Sea City Connections

Network analyses of shipwreck amphorae from Alexandria and the North-Western coastline of Egypt

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Thesis
Submitted to Flinders University
for the degree of

Doctor of Philosophy

College of Humanities, Arts and Social Science

January 2020

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SUMMARY

Alexandria is the second largest city in Egypt and one of the largest seaports in the Mediterranean. It was an important maritime base for the imperial powers that ruled Egypt since its founding; and a centre of political, economic and cultural power, with influence that continues to this day. Alexandria's maritime heritage has been underrepresented by archaeological finds from or related to the sea—especially shipwrecks. Most shipwreck sites are identified by their prominent amphorae mounds which have proven to be invaluable archaeological objects for dating shipwreck and other sites and their associated materials, illuminating trading connections, whether direct or indirect, and possible route itineraries of the wrecked ships that were transporting them. This thesis investigates the amphorae remains from the Alexandrian and the north-western Egyptian coastline sites using the network analysis approach to investigate the region's changing commercial ties and trade networks from the Hellenistic period until the late Roman period.

The shipwreck sites examined in this thesis date from the fourth century BC., when Alexander founded the city (ca. 331 BC), to the fifth century AD, when the city enjoyed great prosperity and an extensive maritime trade network. Furthermore, this thesis focuses on amphorae recovered from terrestrial sites adjacent to the aforementioned coastline because most of them are imported and were en-route to Alexandria from different regions around the Mediterranean. The thesis applies network analyses to the data generated from amphorae finds in order to evaluate their contribution to the country's ancient past, to understand how the economy of Alexandria was integrated within the broader Mediterranean world, and to quantify the economic implications of these interactions and other commercial connectivity.

DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed.....

Date.....20/11/2019.....

DEDICATION

For my parents

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

RIEC	Russian Institute of Egyptology in Cairo
INA-Egypt	Institute of Nautical Archaeology in Egypt
SCA	Supreme Council of Antiquities
GDUA	General Department of Underwater Antiquities
CDUA	Central Department of Underwater Antiquities[1]
CMAUCH	Centre for Maritime Archaeology and Underwater Cultural Heritage
CEAlex	Centre d'Études Alexandrines
HIAMAS	Hellenic Institute of Ancient and Mediaeval Alexandrian Studies
IEASM	Institute Européen d'Archéologie Sous-Marine
PCMA UW	Polish Centre of Mediterranean Archaeology, University of Warsaw
GAIC	German Archaeological Institute in Cairo
LR	Late Roman
DR	Dressel
MC	Mons Claudianus
AE	Amphore Égyptienne
GIS	Geographic Information System
US	University of Southampton

[1] Note that the SCA, GDUA, and CDUA are titles for the same organization but the official name changed at times over the last 30 years.

CHAPTER 1. INTRODUCTION

Alexandria is one of the largest seaports on the Mediterranean. It is situated at the western edge of the Nile Delta and boasts a coastline that stretches almost 40 kilometres (Figure 1.1). It was the capital and principal port of Hellenistic, Roman and Byzantine Egypt for almost a millennium (Khalil 2002:1–2), an important maritime base for the various imperial powers that ruled Egypt, and a centre of political, economic and cultural power, the influence of which continues to this day.

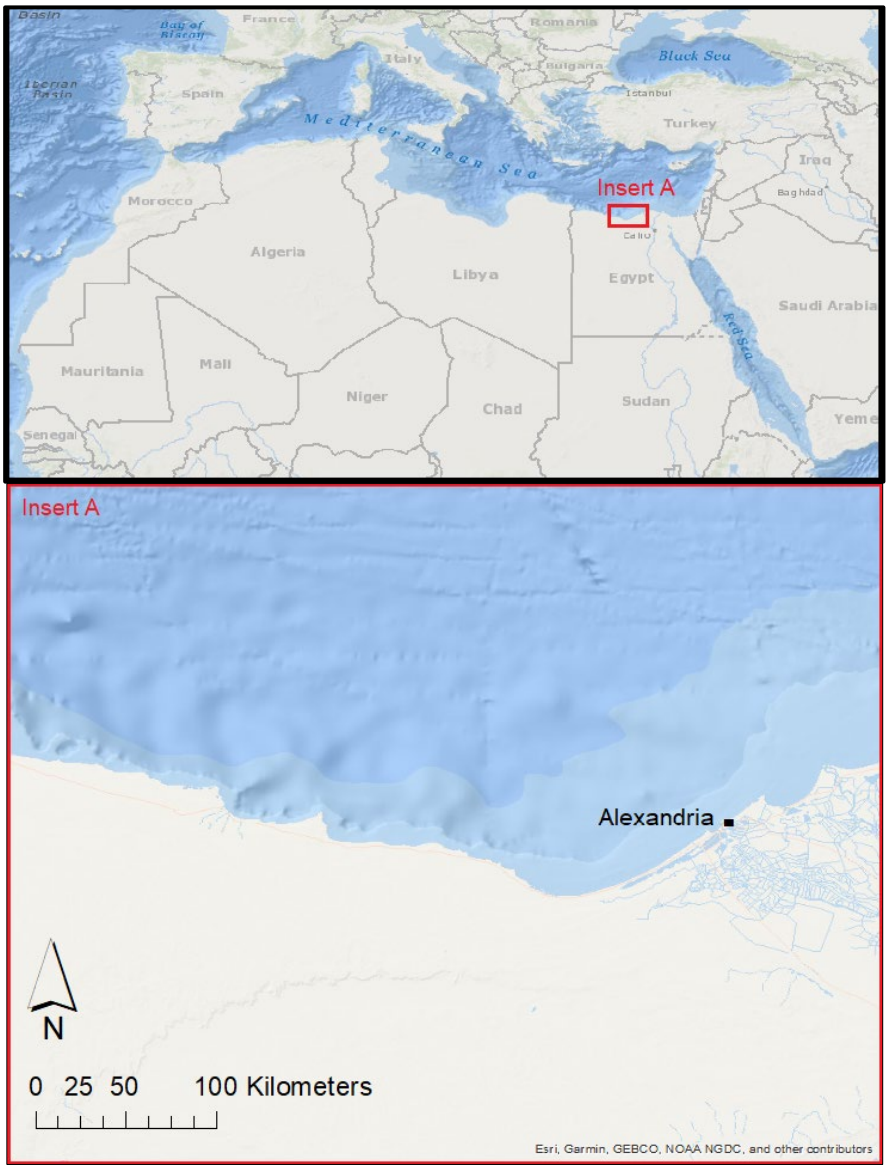


Figure 1.1 Location of Alexandria. Maps produced using ArcGIS® software by Esri.

Alexandria's maritime heritage in general has been underrepresented by archaeological finds from, or related to, the sea—especially shipwrecks. Among Parker's compilation of some 1189 shipwrecks found throughout the Mediterranean and surrounding waters (1992a:5), only two sites were related to Alexandria (Vailati and Curto 1980:53), or the entirety of Egypt, for that matter. Since Parker's publication, archaeologists and members of the public have steadily added to the corpus of Mediterranean shipwreck sites and in the waters off Alexandria alone up to 70 shipwrecks are now known (Abd-el-Maguid 2015; Belova et al. 2015; Empereur 2000a; Goddio 2000, 2007; Tzalas 2012, 2013, 2015).

Most shipwreck sites are identified by their prominent amphorae mounds, a consequence of the ubiquitous use of these ceramic cargo containers in antiquity, their durability and excellent preservation in the underwater environment, and the pronounced visibility they provide on most seafloor terrains (Parker 1992a:16, 19, 31, 1992b:89). For these same reasons, as well as their distinct stylistic and decorative characteristics, which can be tracked chronologically, amphorae have proven to be invaluable archaeological objects for dating shipwreck and other sites and their associated materials. They also represent direct and indirect trading connections and possible itineraries of the ships that transported them.

Most shipwreck sites in the Mediterranean Sea have historically been located visually by divers or snorkellers (Bass 1961:267–276) or via remote-sensing surveys (Papatheodorou et al. 2011:100–115), and this remains the case today. What has changed drastically are ethical approaches and interactions to best-practice applications and methods in the field of underwater archaeology. The United Nations Educational, Scientific and Cultural Organization 2001 *Convention on the Protection of the Underwater Cultural Heritage* (UNESCO 2001 Convention) strongly recommends non-intrusive techniques over excavation. Article 2, no. 5 of the convention specifically states that 'the preservation *in-situ* of underwater cultural heritage shall be considered as the first option before allowing or engaging in any activities directed at this heritage.' This stance is partially reflective of the reality that there is limited funding available for the excavation, conservation and long-term storage of archaeological materials from underwater sites. Moving forward, therefore, it is likely that shipwreck sites will be studied primarily by non- (or minimally-) intrusive survey, with minimal material retrieval only for dating and identification purposes. This approach is particularly appropriate for the underwater cultural heritage in Egypt, where the government has allocated nominal funds for underwater excavation and subsequently has limited resources for conserving and curating artefactual material. Considering these circumstances, amphorae studies may prove to be the preferred means of studying shipwreck sites and the country's past, especially in terms of its ancient economy and maritime connectivity.

This dissertation sets out to study amphorae remains located along the Alexandria coastline and its extent to the North-Western Coast using a network analysis approach to investigate temporally the region's changing commercial ties and trade networks (see Figure 1.2, 1.3, 1.4 and Table 1.1). The shipwreck sites to be examined date from the fourth century BC, when Alexander founded the city (c. 331 BC.), to the fifth century AD (Table 1.2), when the city enjoyed great prosperity and was a node in an extensive maritime trade network. The application of a network analyses framework generated from amphorae finds will enable the study of the broader economic history of Alexandria.

1.1 The Gap in Knowledge

Existing reports on the archaeological projects, shipwreck surveys and amphorae sites along the Alexandrian coastline are mostly preliminary in nature and are not easing accessible. The interpretation of amphorae from terrestrial or underwater excavations in Alexandria is still limited to single sites or areas of research. Additionally, many types remain unidentified or unclassified. The amphorae finds recovered from the underwater and land sites provide a broad range of material, both geographical and chronological, that is well suited for network analysis and examining temporal changes. Therefore, a comparative study and network analysis of these archaeological remains can fill an important research gap, which will provide a better understanding of the country's ancient past, its economic integration within the broader Mediterranean world, other commercial connectivity, and the economic implications of these interactions.

1.2 Research Question

The research question for this research project is:
What do transport amphorae recovered from underwater and terrestrial sites along the Alexandrian coast tell us about trade networks, connectivity and the economic history of the region from Alexandria's foundation in the fourth century BC to the fifth century AD?

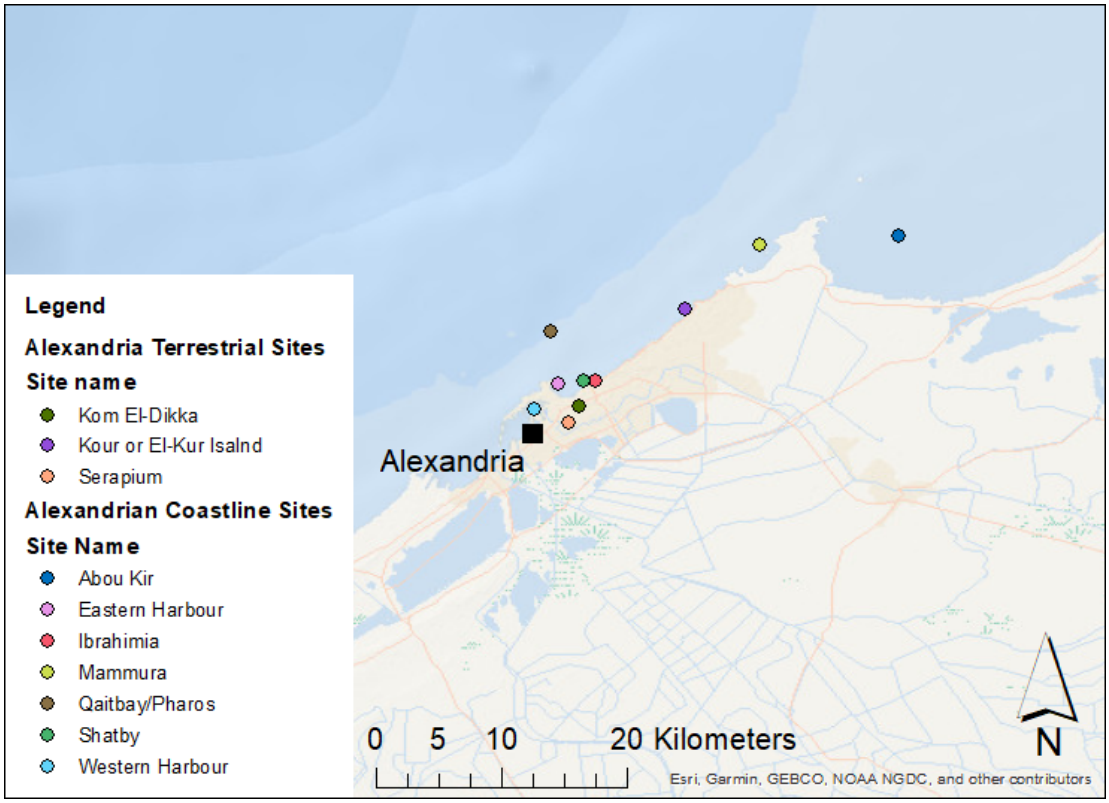


Figure 1.2 Locations of underwater and terrestrial amphorae sites within Alexandria. Map produced using ArcGIS® software by Esri.

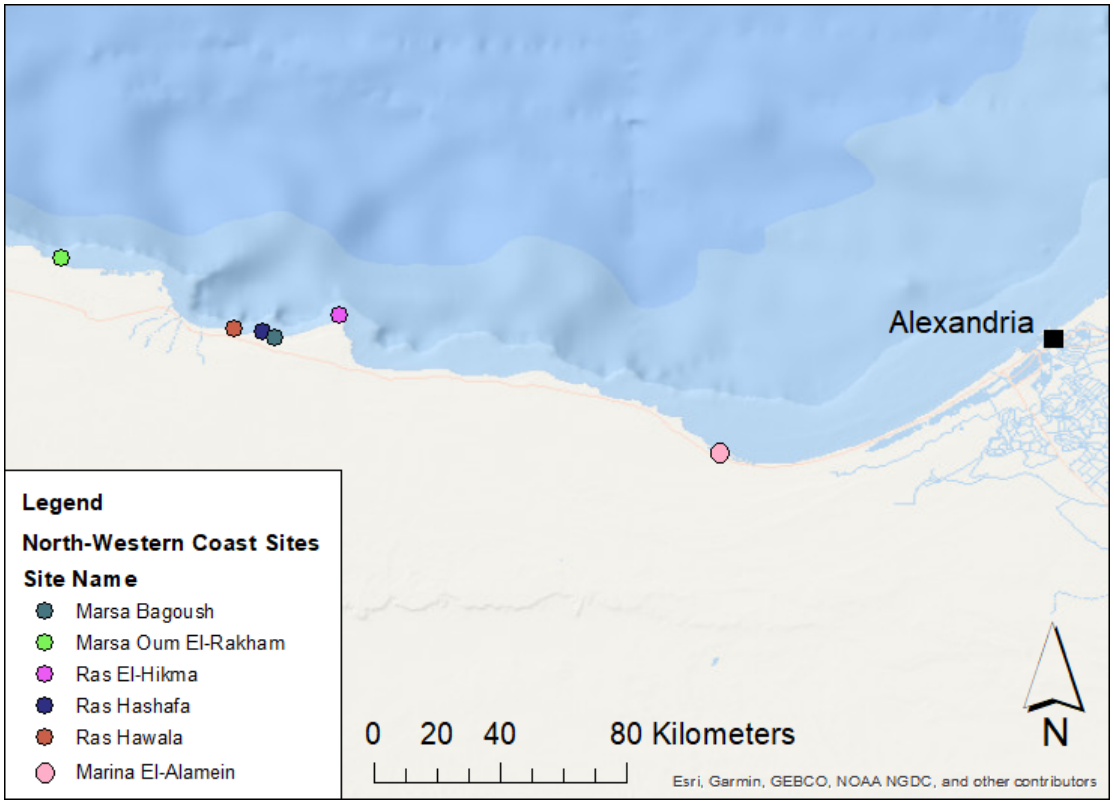


Figure 1.3 Locations of underwater and terrestrial amphorae sites at the North-Western Coast. Map produced using ArcGIS® software by Esri.

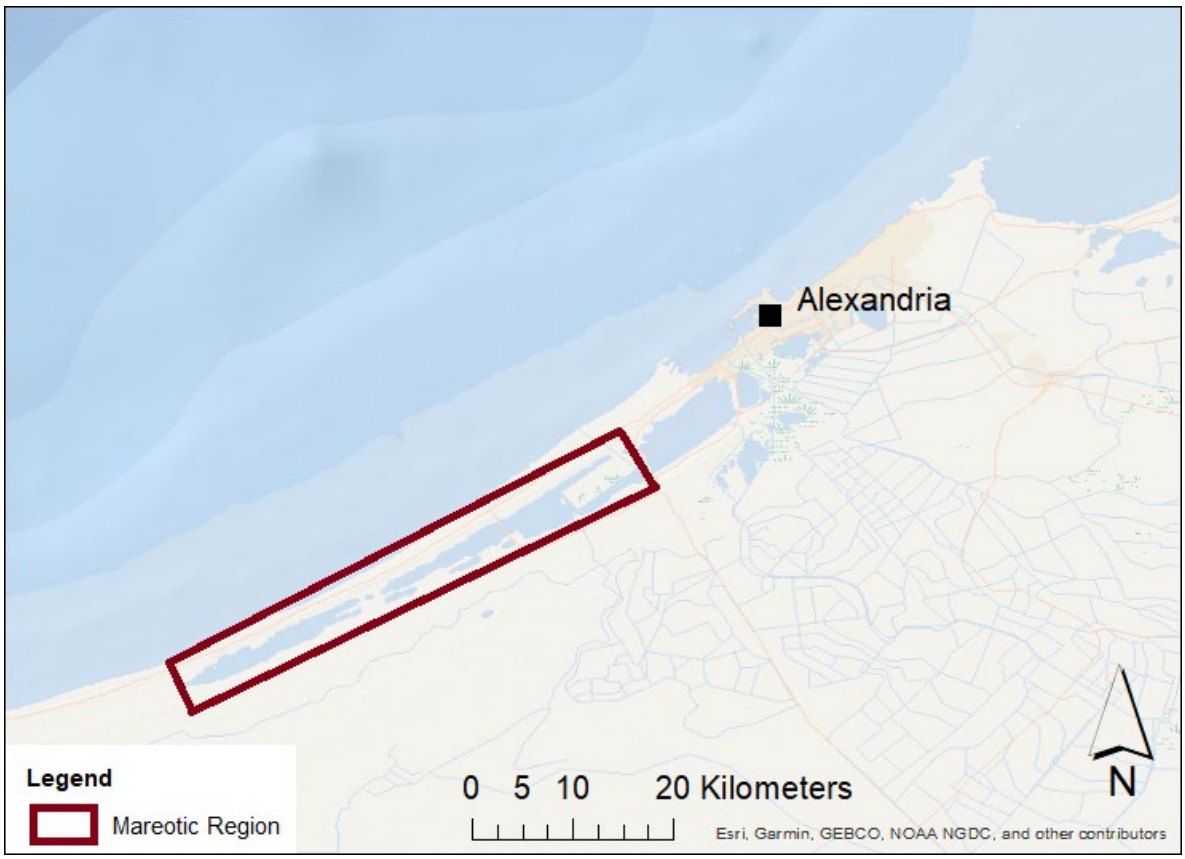


Figure 1.4 Location of Mareotic Region (the hinterland of Alexandria). Map produced using ArcGIS® software by Esri.

Table 1.1 Amphorae sites in Alexandria and adjacent coastal and countryside regions.

Region	Underwater Site(s)	Terrestrial Site(s)
Alexandrian Coastline	Eastern Harbour	Kour Island
	Aboukir	Rescue excavations
	Ibrahimia	Kom El-Dikka
	Shatby	Serapium
	Western Harbour	
	Mammura	
	Qaitbay/Pharos	
Countryside/Hinterland		Mareotic Region
North-Western Coast	Ras El-Hikma	Marina el-Alamein
	Tannum Reef	
	Ras Hashafa	
	Ras Hawala	
	Marsa Oum El-Rakham	
	Marsa Bagoush	

Table 1.2 The dissertation chronological sequence

Periods	Date range
Pre-Hellenistic period	From the fifth to the fourth century BC
Hellenistic period	From 323 BC to 31 BC (The end of the fourth to the end of the first century BC)
Early Roman period	From the first to the second century AD
Mid Roman period	From the third to the fourth century AD
Late Roman period (Byzantine)	From the fifth to the sixth century AD
Islamic period (Arab conquest)	From the seventh to the tenth century AD

Alexandria holds a significant concentration of archaeological sites, with a massive number of underwater and terrestrial archaeological examples containing transport amphorae remains. These transport amphorae were en-route to or arrived in Alexandria from different regions around the Mediterranean. Part of the amphorae remains recovered from 95% of the terrestrial sites, except Kour or El-Kur Island, have been studied separately and are published (Cankardeş-Senol 2001:397–408, 2003:213–260, 2017:321–368, 2007a:33–56, 2011:387, 2007b:85–90, 2012:97–104, 2013:387–401, 2015a; 2015b, 2015c; 2015, 2015e:169–192; Cankardeş-Senol and Şenol 2013:55–82; Empereur and Picon 1992:145–152; Pichot and Şenol 2014:225–239; Senol 2008:109–132, 2013:403–408, 2000:369–396, 2002a:191–215, 2002b:467–484, Senol 2007:57–75; Senol and Cankardeş-Senol 2003:119–146).

In contrast, unidentified amphorae located at the underwater sites in Shatby, Ibrahimia, the Eastern and Western Harbour, Aboukir Bay, Mammura and along the North-Western Coast have yet to be studied, except in Qaitbay which is still under investigation by a team of researchers working for the Centre d'Etudes Alexandrine (CEAlex). Therefore, this project investigates the transport amphorae remains from the latter sites along with the amphorae recovered from the North-Western Coast, especially from Mersa Bagoush—a significant anchorage that was used from the Hellenistic period until late Antiquity. It also incorporates and expands upon the amphoric evidence from the sites studied previously, with a focus on the maritime connectivity and trade networks of ancient Alexandria.

1.3 Background

1.3.1 History: Alexandria through the Eyes of Ancient Historians

Ancient writers and historians, such as Strabo (1903:17.1.7), provide detailed descriptions and valuable contemporary accounts of ancient Alexandria. Prominent among these is the city's

advantageous location between the Mediterranean Sea and Lake Mareotis, with access to the River Nile via numerous canals and distributaries (Casson 1994:257–258; Hamdan 1980:189–206; McKenzie 2007:174–176).

Alexandria's harbour was well laid out and took full advantage of its natural and artificial features, as confirmed by a recent geophysical survey (Papathedorou et al. 2013). The natural harbour comprised two large basins—the deeper eastern basin called Portus Magnus, meaning 'the Great Harbour', and the western basin called *Ευνόστος* (Eunostos), meaning 'good return' (Strabo 1903:17.1.6)—protected by the offshore island of Pharos. Separating them was the Heptastadion, a causeway joining Pharos to the mainland, and so named for its length of seven stadia, which is equivalent to about 1,300 metres. It had two bridges that provided passage between the basins (McKenzie 2007:45). Slowly over time, the Heptastadion accumulated silt until, by the city's Ottoman period, Pharos Island had become part of mainland Alexandria (McKenzie 2007:45; Morcos 2000:40–41).

The city's harbour was connected to the Nile by Lake Mareotis. The western harbour was connected to Lake Mareotis through a small artificial harbour called Kibotos, meaning 'box' or 'chest' (Strabo 1903:17.1.10], and a canal that cut southward across the isthmus of the city to the lake. Various channels along the lake's eastern and southern sides joined it to the Canopic Branch, which in turn linked it to the Nile. The Canopic Branch was the widest and most important distributary of the Nile. It reached the Mediterranean at Canopus (modern-day Abukir), just east of Alexandria, where it emptied into a broad bay.

In the third century BC, Egypt's Ptolemaic Rulers equipped the harbour with the famed Pharos of Alexandria. This lighthouse was the largest structure of its kind and standing more than 100 metres tall, its light was visible as far as 112 kilometres from the coast. This remarkable structure, one of the Seven Wonders of the Ancient World, played an important role in the development of the city throughout its history, and captures the imagination of the world to this day (Casson 1994:257–258; El-Fakharani 1963; Hamdan 1980:189–206; Said 1990; 1993; 2002).

Because of Egypt's central location between two continents and two waterways, and Alexandria's connecting channels, the city became a crucial nexus for maritime trade between Asia and the Mediterranean. Great volumes of trade were transported by ship to Egypt from the Indian Ocean via the Red Sea, then by caravan across the Eastern Desert to the Nile, and from there by boat to Alexandria through the Canopic Branch and Schedia Canal or Lake Mareotis. The latter route was used frequently, with many cargoes then transhipped from Alexandria to Rome or other Mediterranean destinations (Blackman 1982:186; Casson 1989:13; El-Zouka 1979:75; Said 2002).

These harbours and the waterways connecting them facilitated Alexandria's prosperity during the Hellenistic, Ptolemaic and Roman periods (fourth century BC to fifth century AD); they played a critical role in the city's establishment as an important commercial centre and provided an essential junction for maritime trade routes between Asia and the Mediterranean, and from there to North Africa, southern Europe and into the Black Sea (Abd-el-Maguid 2012:197; Ángel Mateo 2009:5; Tzalas 2000a:23; 2015:361; Williams, K. 2004:xi, 121, 131and 173; UNESCO 2001). In the second century AD, Alexandria was at the height of its trading activity and prosperity; it had become one of the most influential and thriving commercial centres in the ancient world, second only to Rome itself. Large consignments of grain left the Eastern Harbour on ships bound for Rome. Stone from Egyptian quarries was in high demand across the Mediterranean world and travelled from Egypt's Eastern Desert to Alexandria on the Nile, from where it was loaded onto purpose-built ships for transport to other seaports. The harbour city also played a key-role in Roman trade with Eastern Africa, the Arabian Gulf, and the Indian Ocean—virtually all sea trade with these regions passed through Alexandria. The city remained the capital of Hellenistic, Roman and Byzantine Egypt for almost a millennium. It started to decline after the Muslim conquest of Egypt in AD 641, when a new capital was founded at Fustat, part of present-day Cairo (Casson 1984:96–105; Conermann 2004:115–139; Rickman 1980:18–19).

The extensive maritime activity in and around Alexandria, coupled with rather treacherous seaward entrances to the East and West Harbours, led to many ships being wrecked along this coast (Figure 1.5). Many such events resulted from dangerous sailing conditions in autumn and winter, as well as unexpected strong winds that have a tendency to rise suddenly, often taking ships by surprise (Opdebeeck 2005:7; Parker 1992a:3).

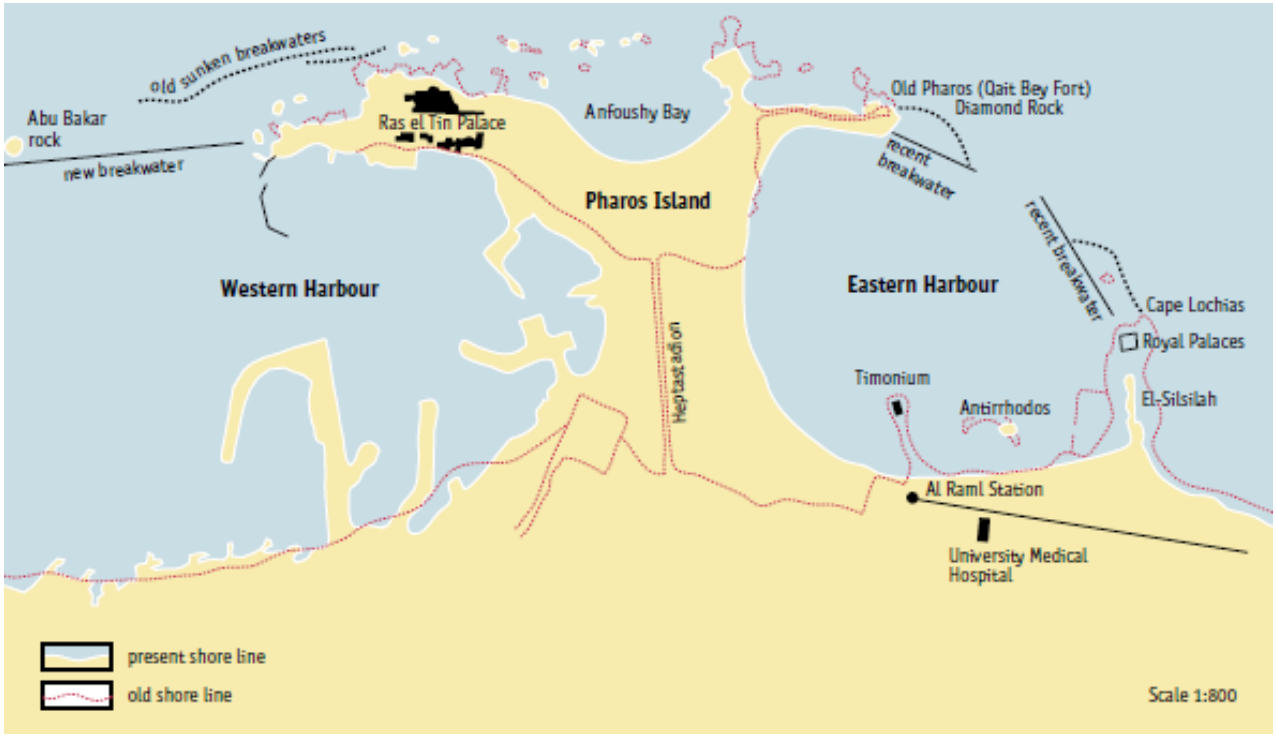


Figure 1.5 Map shows the location of the Eastern and Eastern harbours along the Alexandrian coastline (from Morcos et al. 2003:14, fig. 1 by M. Turner after Morcos 2000) © Copyright 2020, with permission from Hellenic Institute for Ancient and Mediaeval Alexandrian Studies.

1.3.2 Amphorae

Parker refers to transport amphorae as the 'jerry-cans of antiquity' (1992a:31), and they were indeed the staple transport containers and storage jars of the ancient world. They were used for a myriad of products, but especially agricultural produce, such as wine and olive oil. Foodstuffs can be considered their most typical content. Transport amphorae are associated particularly with ancient shipwrecks. Being the primary cargo container for bulk goods and numbering typically in the hundreds or thousands, the amphora mound typically is the most conspicuous feature visible on underwater shipwreck sites.

Amphorae survive well in the underwater environment and can retain at least traces of their organic contents for thousands of years in such conditions. Items such as grape seeds, fruit pits, nuts, honey, resins and pitch have been recovered from amphorae from numerous sites, such as that of the Late Bronze Age (late fourteenth century BC) shipwreck at Uluburun (Bass 1986:369–296; 1987:696–733; 1998:49–53; Pulak 1994:8–16; 1998:188–224) and the eleventh-century AD shipwreck at Serçe Limanı in Turkey (Bass et al. 2004; Ward 2004). Many amphorae from Mediterranean sites survive completely intact and retain stamps, inscriptions or other external markings, and some still even have their stoppers in place. Archaeologists classify amphorae according to style, shape, size and material to establish their use and date and place of manufacture (Göransson 2007:9; Opdebeeck 2005:14; Parker 1992a:16, 19, 31, 1992b:89).

In the last two decades, archaeologists have located and identified several shipwreck and amphorae sites along the Alexandria coast (Abd-el-Maguid 2015; Belova et al. 2015; Empereur 2000a; Goddio 2000; 2007; Tzalas 2012; 2013; 2015). The amphorae remains recovered from these sites include complete examples and fragmentary remains of both Egyptian and non-Egyptian amphorae, some carrying cargoes to distant ports, others holding bulk goods destined for Egypt as imports or for transhipment elsewhere (Blue 2010; Blue and Khalil 2011; De Cosson 1935; Empereur 1994, 1996, 1997, 1998, 2000, 2001, 2002; Empereur et al. 1994; Khalil 2004; Senol 2000, 2003). Egyptian amphorae also have been found in numerous regions around the Mediterranean basin, providing important information on trade connections and export destinations for Egyptian products (Empereur and Picon 1992; Senol 2000, 2008, 2013).

1.4 Shipwrecks and Amphorae

Maritime archaeology is the scientific study of the materials of interactions between human beings and the sea, and ships were the most direct means of that interaction (Gibbins 1987:154). Studying such sites is considered a correlated endeavour with amphorae studies. In another words, this type of study, in conjunction with amphorae evidence from the same context, can potentially provide researchers with indicators, information and a better understanding of maritime trade in ancient times. Even if the amphorae evidence is limited to a few fragments, it can still aid in interpretation of the ship, its cargo and other economic aspects (Gibbins 1990:376–382; Gibbins and Adams 2001:279–281).

Different theories exist and can be applied as an interpretation to shipwrecks. Some scholars define a shipwreck as the destruction of a ship or the ruins of a vessel destroyed by storm activity, impact with the seabed or shore, or by collision with a navigational hazard at or below the water surface (Delgado 2001:260; Muckelroy 1978:169). Others consider shipwrecks as representative agents of closed communities at sea whose beliefs, rules, rhythms of life, and tools make up a particular social system (Olsson 2009:48– 49; Pomey 2011:26). All shipwrecks and their on-board communities have their own story to tell. They provide unique sources of data for reconstructing lifestyles, trade routes, shipbuilding techniques and evidence of daily life (Manders 2012:3). Whilst Manguin (1986:187–213) notes that shipwrecks are ‘fundamental metaphors’, he recognises that each watercraft is its own specific entity.

Shipwreck sites are often called ‘time capsules’, but Muckelroy warns that multiple shipwrecks must always be considered, especially their anchorage sites and harbours (1978:157–182). Examples of multiple wrecking events in a confined area include Aboukir Bay in Alexandria, where some sixty shipwreck sites have been identified and intermixing of artefactual material has

obviously occurred. This makes it challenging—sometimes even impossible—to distinguish and assign materials to a specific shipwreck. In addition, there remains the possibility of drifting artefacts that represent intrusive material when deposited on another site. In these cases, the term 'time capsule' is problematic.

Leidwanger (2013:3–4) raised the question of whether 'a ship can be viewed as a "mobile node" in a broader network system or perhaps as a self-contained network of its own'. Whilst such considerations are intriguing, and can provide different ways of interpretation, all the amphorae remains included in this study are localised in Alexandria, which represents the node. The amphorae provide evidence for the connections, as well as directional indicators, during different times. This thesis project does not examine shipwrecks specifically; rather, it analyses in detail specific archaeological data from shipwreck sites—in this case, transport amphorae —as indicators of maritime connectivity. Evidence for maritime transportation is obvious, but the evidence for production still needs to be considered. Thus, amphorae studies that focus on production and consumption could be the keys to identifying the origin of amphorae fragments and their dating. Comprehensive knowledge of the production, consumption and use of specific amphorae types is an ideal base from which to define the economic aspects of a specific time (Gibbins 2001a:330). Furthermore, amphorae materials are integral to investigating strategies of distribution and redistribution, as well as changes and fluctuations in ancient economies (Gibbins 1987:155).

Furthermore, Parker (1990:345) stresses the deficiency of the data provided by underwater excavations in the Mediterranean. He notes that comparative studies between unstudied and well published materials are significant for addressing gaps in our knowledge and for a more complete the picture of maritime history in the Mediterranean, especially in the Hellenistic and Roman periods. By comparing new amphorae evidence with research results from the sites selected in this study with that from other known sites and material, a broader image of the maritime trade and connectivity between Alexandria and other parts of the Mediterranean, from the fourth century BC to the fifth century AD, can be drawn.

If a specific type of amphorae can be linked to known production sites, and has been located in another region, then a connection can be created. The possible types of connections for amphorae finds examined in this research are as follows:

1. Foreign amphorae found at an Alexandrian site: (1) imported goods (local consumption), (2) imported goods for transhipment, or (3) secondary use (reuse) of import amphorae for local use or for export of local goods;

2. Egyptian amphorae found at an Alexandrian site: (1) local goods for export (local production), (2) amphorae production site/factory (look for supporting evidence, such as kilns);
3. Egyptian amphorae found at a foreign site: (1) Egyptian exports/production (foreign imports/consumption).

1.5 Network Analysis

The theoretical framework employed in this research is a network analyses approach to identify connectivity—in this case, maritime connectivity by using amphora remains. Brughmans (2010, 2012) and Gjesfjeld (2015) both have demonstrated the applicability of this approach for evaluating connectivity between different regions and for visualising the types of relationship. In much the same way, Seland (2016:191–205) acknowledges that network analysis was crucial to his efforts in ascertaining interactions of places and commodities in his study of the Periplus of the Erythraean Sea. A network analyses framework allows for the creation of a comprehensive and informative background for a specific location or region, and a temporal view of its trade networks and connectivity. More importantly, it provides data for studying the underlying causes and consequences of this changing connectivity. Using network analysis, one can investigate the reasons behind the decline or success of specific networks, and corresponding changes in social, environmental and economic conditions (Leidwanger et al. 2013:3–6; Rivers et al. 2013:2–3).

This thesis applies a network approach incorporating production and consumption for defining the similarities in material cultural found on sites located along the Alexandrian coastline and the North-Western Coast, which will be determined by archaeological examination (style, applications, markings and other features) of the amphorae remains as outlined by Graham and Weingart (2015). Additionally, this research will use un-directional ties for connecting nodes in order to depict material cultural movement. This network expresses the domination and emergence of connected edges through ancient times due to the political and the economic situations. In doing so, finding appropriate software for data analyses is crucial. This thesis uses UCINET/NetDraw software which is a package designed for analysis of social network data in order to produce a dynamic network analysis (Bastian et al. 2009:361–362; Leidwanger et al. 2013:5; Moody et al. 2005:1206–1241). UCIENT provides the centrality degree which indicates prominent and the most important nodes which have the highest number of ties (Hawe, Webster and Shiell 2004:974; Kosorukoff and Passmore 2011: 43). Then, NetDraw is used for data visualisation and it demonstrates the strength between each node and the number of nodes and ties in each network. Brughmans (2017) stresses the importance of using a suitable network analyses model to generate a better understanding of the

interactions and connectivity between the nodes. Following Collar and his co-authors (2015), Manolova (2011) and Östborn and Gerding (2014), the network for this thesis will comprise:

- nodes representing the locations where the amphorae were found, which point to ancient sites; and
- ties or links (connections) represented by the transport amphorae examined in this study. The ships transporting amphorae are the actual connectors of the nodes (sites), but it is the amphorae that provide the evidence for the routes of these ships.

Further, geographic information systems (GIS) are used to facilitate this research by processing existing and new data and generating a baseline map of transport amphorae scatter sites along the Alexandria coastline. This approach is new to the study of this region, as no previous works of the area created georeferenced maps, or no such sites were known or included in similar maps of the eastern or entire Mediterranean. The closest such map is Parker's distribution plot of shipwrecks in the Mediterranean Sea (1992a:548), but it provides only rough densities of shipwreck sites in particular areas, is not georeferenced and lacks detailed information on individual sites, such as date, cargo materials and amounts (Figure 1.6).

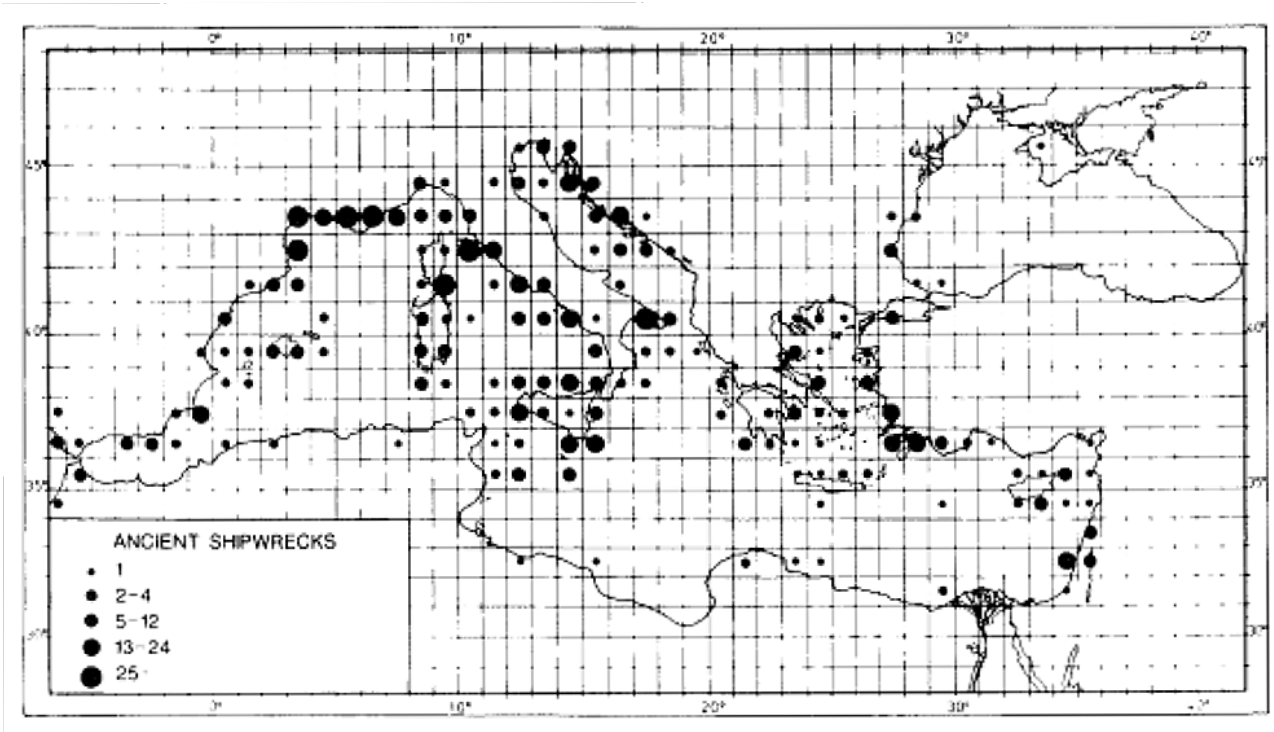


Figure 1.6 The shipwrecks distribution in the Mediterranean Sea (from Parker 1992a:548, fig. 2). © Copyright 2020, with permission from BAR.

1.6 Amphorae Sites

This study examines the amphorae remains from the following sites[2] (See Figures 1.2, 1.3 and 1.4):

1.6.1 The Eastern Harbour

A shipwreck was located in the middle of the eastern harbour. Designated as the Antirhodos shipwreck, the site is dated to the Roman period, between the first century BC and first century AD (Abd-el-Maguid 2012:200–197; Sandrin, Belov and Fabre 2013:45; Williams, K. 2004:172–173). A site catalogue (Goddio and Clauss 2006), including material from Abukir Bay, was published and contains photographs and dimensions for some of the amphorae. Recently three more shipwrecks have been located in the harbour basin (Rogers 2017).

1.6.2 Qaitbay Fort/Pharos Shipwrecks

Two shipwreck sites were found to the north of the Eastern Harbour and Qaitbay Fort, which was built over the ruins of the Alexandria lighthouse, and dated between the fourth century BC and seventh century AD. Although none of the wooden fabric of the ships themselves survived, their cargoes and other contents did. According to preliminary reports, this material includes possible wine amphorae imported from Greece, northern Turkey, Italy, Spain and North Africa, oil lamps, bronze vases, common utensils and lead and stone anchor stocks (Abd-el-Maguid 2012:200–198; Williams, K. 2004:142–143). The amphorae remains are currently undergoing petrographic and archaeological studies and a detailed publication is expected.

1.6.3 Aboukir Bay

Aboukir Bay is a remarkable archaeological site, located thirty kilometres east of Alexandria, that contains more than sixty shipwrecks dateable from the sixth to the second century BC. Finds mainly include stone anchors and amphorae remains dating to the fifth and sixth centuries BC (Abd-el-Maguid 2012:197; Belov 2014b:3, 2014c:314, 2015a:195, 210, 2015b; Fabre 2015:175 and 194; Fabre and Belov 2011:108; Robinson and Goddio 2015:211 and 225). Some amphorae fragments and stamps have been recovered from this site and minimally published in the site catalogue (Goddio and Clauss 2006), but so far detailed analyses have been limited to bowls and other ceramic vessels (Grataloup 2010:151–159; 2015:137–160).

1.6.4 Ibrahimia Shipwreck

Unidentified amphorae fragments were found on this site, located north-east of the Eastern Harbour at a depth of 13 m. An iron anchor of Late Roman/Early Byzantine date and a stone anchor from the

[2] More details about the amphorae collections (types, amounts, characteristics, features, chronology, statistics, figures, illustrations) provided in Chapter 3 and extensively in Appendix 1.

Islamic period also were recovered (Abd-el-Maguid 2012:198; Tzalas 2012:326–331; 2013:2–3; 2015:348–360).

1.6.5 Shatby

A site located just outside the Eastern Harbour contains a small amount of pottery sherds, most unidentified but some dated preliminarily to the fifth and sixth centuries AD (Tzalas 2012:326). Several stone anchors also were recovered, but their association with the amphorae materials is uncertain. There is as yet no detailed or further study of these remains.

1.6.6 Western Harbour

The remains of a shipwreck, designated El Fara, were located in 8–10 m of water inside the Western Harbour. Among the remains are four amphorae fragments (Belova et al. 2015:3). Although these pieces remain *in situ* and diving in this area is prohibited, the GPS coordinates for the site and some photographs were made available to the author.

1.6.7 Mammura Amphorae Scatter

A considerable number of amphorae scattered at a shallow depth (seven metres) off the suburb of Mammura, located some 15 km east of Alexandria's Eastern Harbour. The Central Department of Underwater Antiquities has been investigating the site since 2009, and department staff regularly undertakes site inspection surveys (Abd-el-Maguid 2012:200; 2015:115–117; Khalil 2002:17–18). The Mammura site has yielded remains of a copper-sheathed ship and a substantial number of transport amphorae.

The transport containers reportedly date from the fourth century BC to the seventh centuries AD, and therefore cannot be material from a single wrecking event, but instead represent an accumulation of material deposited over time. Identified amphorae include Kabitan type II, Rhodian production and a mixture of unidentified types. The site remains under-reported. To date, only one article has been published on the site specifically (Abd-el-Maguid 2015), while another mentions it briefly in terms of protecting underwater cultural heritage (Abd-el-Maguid 2012). Khalil (2001:17–18) mentions in his MA thesis that the site needs research beyond the visual site inspection surveys.

1.6.8 North-Western Coast Sites

Some scattered and a modest number of complete amphorae have been located along the North-West Coast which is an extension to the coastline of Alexandria. The sites are Ras El-Hekma, Ras Abu Hashafa and Ras Hawala, except Mersa Bagoush due to the considerable number of amphorae fragments located there in various types. Mersa Bagoush is located 260 km west of Alexandria and it was an active, ancient yet small port in use during the Hellenistic and Roman period; it served as

a shelter as it was located between two headlands (Abdel Aleem 1996: 140). Several surveys and excavations were conducted there by the Supreme Council of Antiquities (SCA) and the Centre for Maritime Archaeology and Underwater Cultural Heritage (CMAUCH) from 2015 and 2017 and further excavations are planned. The excavations revealed a number of amphorae fragments, such as handles, rims and neck and parts of the bodies and shoulders. An archaeological study of these fragments has yet to be undertaken.

1.6.9 Kour Island

Located nearby, around 10 km east of Alexandria's Eastern Harbour, in front of Miami Beach, lays Kour Island. In 1996, the Department of Underwater Archaeology (DUA) investigated the island and recovered a handful of amphorae pieces from a possible Roman cistern, which in later times may have become a rubbish dump; these included neck, handle, base and body fragments (Ragheb 2010:414–416), although they remain unstudied.

1.6.10 Rescue Terrestrial Excavations

Enormous numbers of amphorae, estimated at some 160,000 pieces, were recovered during rescue excavations at numerous building sites in the vicinity of the so-called Royal Quarter of Alexandria, most located close to the Eastern Harbour (Figure 1.7). The pieces date to the Hellenistic, Roman and Byzantine periods of the city. These building sites include the Majestic Cinema (Empereur 1994:524 and 507; 1998a:27–33), Billiard Palace (Empereur 1994:508–512), Shatby Necropolis (Gankardes-Senol 2012:97–104), Diana Theatre (Empereur 1996:959–963; 1997:837–838; 1998a:27– 33;1998b:617), British Consulate (Empereur 1997:838–841; 1998b:619), Cricket Land (Empereur 1997:841–842; 1998:619, 621) and Gabbari necropolis. The Gabbari necropolis dates to the second half of the third century BC and remained in use until the Byzantine Period. Excavations there yielded a substantial number of wine amphorae (Empereur 1998a:175, 211; 1998b:622–630, 1999:549–559, 2000b:604–614, 2001:686–689, Şenol 2000; 2003). The excavators made a detailed study of all of the amphorae stamps, and also conducted petrographic and archaeological studies of the amphorae materials (Cankardeş-Senol and Şenol 2013; Cankardeş-Şenol 2003, 2007, 2013, 2015a, 2015b, 2015c, 2015d).

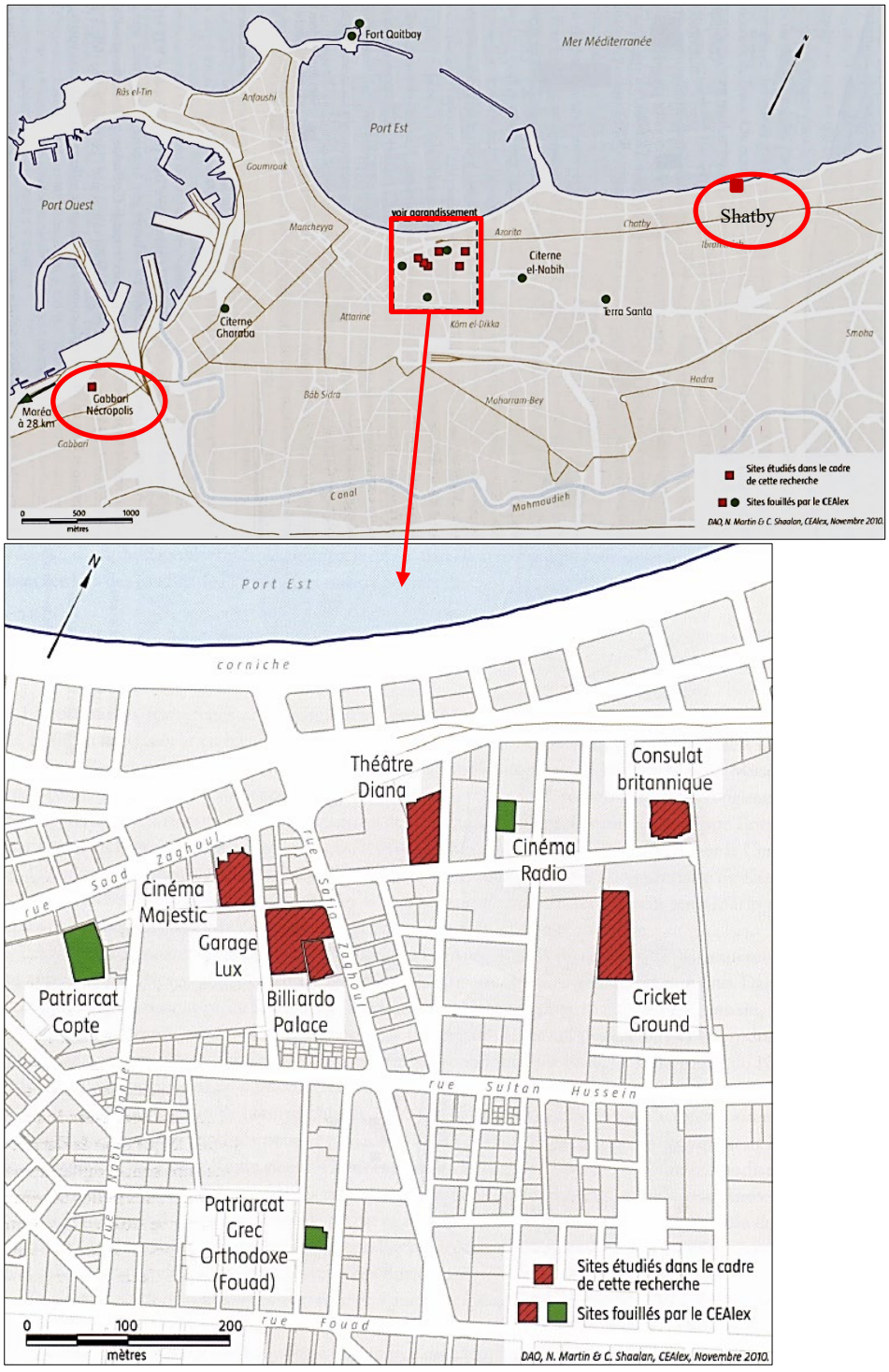


Figure 1.7 Terrestrial amphorae sites (after Dixneuf 2011:45–46, fig. 5 and 6). © Copyright 2020, with permission from Centre for Alexandria Studies.

1.6.11 Kom El-Dikka and Serapium Suburbs

From 1960 to 2012, the Polish Centre of Mediterranean Archaeology of the University of Warsaw (PCMA) excavated the ancient theatre site at Kom El-Dikka, located in the centre of ancient Alexandria. Their work uncovered numerous complete and broken ceramic pieces, all dating to the Late Roman period (Majcherek 2007a:41). The Serapium, however, was a Greek temple dating to the Hellenistic period located near the Western Harbour (Empereur 2002:39–84).

1.6.12 Mareotis Region

From 1970 to 1998, the Centre d'Étude Alexandrin (CEAlex) excavated at Mareotis, an archaeological site located on the shore of Lake Mareotis, that includes domestic dwellings, wine presses, amphorae kilns and a basilica (Cosson 1935). Amphora material is mentioned superficially in the various campaign reports (Empereur 1998a:213, 239; Empereur, Hesse and Picard 1994; Empereur and Picon 1986, 1989, 1992; Khalil 2004), yet no detailed study has been published to date.

From 2007 to 2008, SCA in collaboration with the University of Southampton (US), conducted two seasons of excavations at the site. These works recovered various amphorae remains, including Egyptian, Knidian, Rhodian, Thasian, Italian, Cypriot, Koan, North African and Levantine types (Blue 2010; Blue and Khalil 2011). All of the SCA/US materials have been photographed, drawn and studied, but their work still lacks any research into fabric clay analysis, in particular petrography (Blue 2010; Blue and Khalil 2011).

1.6.13 Marina el-Alamein

Marina el-Alamein was a town and harbour during the Hellenistic period (first century BC) and located at 107 Kilometres to the west of Alexandria (Majcherek and Zych 2011:357–378). The imported amphorae are the main artefacts located at this terrestrial site (Czerner, Bąkowska-Czerner and Majcherek 2015:30–31; Daszewski et al. 1990:15–17; Daszewski 1992:26, 1997:71, 2003:56–58; Daszewski et al. 2004:79–92; Majcherek 1993:215–220, 2007:9–31; Majcherek and Zych 2011:361; Medeksza 2006:79–80). Chapter 3 expands on these details.

All aforementioned sites and amphorae remains give an indication of the geographical scope and reach of maritime trade between Alexandria and points across the Mediterranean and beyond in ancient times and provide a chronological scale that will also enable this trade to be studied temporally. These sites can reveal much about maritime trading networks in the region and contribute to the broader socio-economic history of this and connected regions in the Mediterranean, making them ideal sites for addressing the research question of this thesis.

1.7 Research Aims

The research aims of this thesis are to:

1. study the transport amphorae remains from underwater and terrestrial sites along the Alexandria littoral to draw meaningful conclusions about the region's maritime trade networks using a network analysis approach;

2. undertake a typological study, i.e. chronological sequence and classification for transport amphorae remains recovered from AbouKir, Mammura, Ibrahimia, Shatby, Eastern Harbour, Qaitbay/Pharos, Western Harbour and North-Western Coast sites to:

    a) identify the most common amphorae type used at each time period,
    b) identify the most common transported amphora product/content at each time period, and
    c) identify the most common production areas/regions at each time period;

3. evaluate what the analysis of amphorae evidence can contribute to the economic history of Alexandria;

4. track the changes overtime in the maritime trade network between Alexandria and the rest of the Mediterranean Basin;

5. track the movement of the cultural materials via amphorae; and

6. examine the size and the strength of the interactions and the relationships between Alexandria and the rest of the Mediterranean Basin.

1.8 Project Significance

This thesis provides a comprehensive study of transport amphorae recovered from underwater and terrestrial sites in the Alexandria region of Egypt. Furthermore, employing a network analysis approach as an interpretive framework, the temporal, spatial and cultural data extracted from the various assemblages included in this investigation is used to draw conclusions on maritime trade and its impact on ancient Alexandria. This is the first time that such study has been attempted, and it addresses the gap in the archaeological and historical records of this important Mediterranean city. The results of this research, therefore, provide an original perspective on using amphoric evidence (dating, place of manufacture, commodity transported, reuse, etc.) to study maritime trade and connectivity and their embedded socio-economic conditions. This research also provides a model for future studies of amphorae remains from other shipwreck sites or regions, and of other cargo assemblages from shipwrecks. These aspects are considered within the context of the recommended practices of the UNESCO 2001 Convention. Long term, the combined results of such studies can be used to construct a more holistic picture of maritime commerce in the ancient Mediterranean and its socio-economic consequences, as well as greater understanding of the geopolitical factors and other correlates of the connectivity that such trade engendered.

1.9 Limitations

Amphorae were not cargo items themselves, but simply the containers used to transport tradable commodities. Unfortunately, none of the sediments from recovered amphorae in the previous studies were sieved for archaeobotanical identification in order to determine evidence of possible contents, such as grape seeds, olive pits, etc. (Haldane 1993b; Ramsay 2010; Ward 2004a, 2004b), nor was it so for pollen, which could have provided critical evidence of provenance, at least for the contents (Gorham and Bryant 2001). Such studies are no longer possible, except for new amphorae that are recovered, from underwater sites. The only indication of original contents is the resin coating on the interior of some jars, which is a strong indicator that they carried wine. One possibility for future study is DNA analysis of contents, traces of which can be swabbed from the interior surfaces of amphorae and successfully analysed (Foley et al. 2012; Hansson and Foley 2008). Further, due to the lack of direct investigation to the transported products carried in each amphora type recovered from the underwater and terrestrial sites in Alexandria and North-Western Coast, previous amphorae studies and classifications were used only for providing initial or possible identifications to the transported products carried into the amphorae types along with their production regions.

Most importantly, the network analysis model used in this study is dependent upon the quality of its input data. Comparative data will be limited to the type and quality available from relevant studies, which can vary widely (Bilde and Lawell 2014; Diler, Şenol and Aydinoğlu 2015; Eiring and Lund 2002; Grace 1979; Lafli and Pataci 2015; Lawall and Lund 2013; Öniz 2016; Peacock and Williams 1986). In some cases, no direct access was granted to the amphorae collections recovered from the underwater and terrestrial sites. Consequently, previous publications and preliminary reports are used instead as a secondary resource. Nevertheless, the model and case studies remain valid for future applications and can be improved as new or better data becomes available. Also, while not all amphorae finds necessarily represent cargo containers and evidence ancient trade, those used for shipboard or other purposes, such as storage of water and victuals for the crew for example, typically represent a very small percentage of the overall number of amphorae carried aboard trading ships, and so should not skew the results in any meaningful way.

1.10 Thesis Structure

This thesis covers a range of topics like maritime trade in the Mediterranean in general and Alexandria in particular, trade networks, navigation, amphorae studies, amphorae production regions, amphorae types and statistics alongside the transported products. A summary of the content of each chapter is presented below.

Chapter One—Introduction

This chapter covers general introduction about Alexandria as a coastal and commercial city in the Mediterranean Sea. It also discusses the gap in knowledge, research question, aims and project significance and limitations. Further, Chapter One provides an overview about network analysis as a research method.

Chapter Two—Alexandria and maritime trade in the ancient Mediterranean

Chapter Two introduces an overview of Alexandria's location among the Mediterranean Sea and discusses Alexandria as a cosmopolitan and consumer city. This chapter tackles the maritime history of Alexandria, the maritime trade in the Mediterranean, the trade routes and navigation in the Mediterranean. Further, Chapter Two addresses the harbours of Alexandria: namely, the Eastern and Western harbours, Canopus and Lake Mareotis harbours. Additionally, this chapter highlights the role of amphorae in ancient times as a backbone of the maritime trade in antiquity along with their usage and significance. In addition, this chapter discusses the production regions of amphorae and the transported products across the Mediterranean like the Eastern and Western Mediterranean, Aegean, North Africa and Egypt. Also, it focuses on the transported products like wine, olive oil, fish products. Finally, it discusses the debate regarding the procedure used for transporting grain in antiquity.

Chapter Three—Archaeological sites and amphorae evidence

Chapter Three introduces the amphorae sites in Alexandria and along the North-Western Coast and the amphorae evidence; in addition to reviewing amphorae production/kiln sites in the vicinity of Alexandria. Further, this chapter describes the amphorae collections for each site, along with providing detailed data regarding the amphorae type production origin, region, date, the type of product the amphorae carried and if it was produced locally in Egypt or imported from other places around the Mediterranean.

Chapter Four—Amphorae and shipwreck studies

Chapter Four presents a review of previous shipwreck and amphorae studies conducted in Alexandria in particular. This chapter highlights the significance behind undertaking a shipwreck and amphora study and how it such studies are contribute to knowledge through filling gaps in ancient history. Chapter Three shows the differences and limitations of the Alexandrian amphorae studies and how these are incorporated into the dataset of this thesis.

Chapter Five—Network analysis

Chapter Five provides an introduction about how social network analysis (SNA) as a methodological approach is applied in this study and the reasons behind it. It investigates network

analysis as a theoretical and interpretive approach used in this research. This chapter presents network theory, structure and types along with their terminology and significance. Also, Chapter Five introduces network analysis in archaeology while reviewing the archaeological studies that have used the network analysis approach.

Chapter Six—Methods and datasets

This chapter presents the permits and permission granted to access to the amphorae collections selected to study. Chapter Six discusses the methods used in this research in terms of identifying the amphora collection selected for study and network data analysis. Also, it introduces in detail how the archaeological data is transformed into network analysis data, along with the SNA software selected for processing the data. Additionally, this chapter points out the level of analysis applied to the archaeological data.

Chapter Seven—Results

This chapter contains the results of the data processed through the social network analysis software. It provides a visualisation of the connectivity between Alexandria and the rest of the Mediterranean in terms of the amphorae production regions, types and transported products. The results show the fluctuations and changes between these aspects across time periods, starting from the pre-Hellenistic period until the Arab conquest. This will reflect the strength and the size of the connecting ties between Alexandria and the ancient Mediterranean world.

Chapter Eight—Discussion

Chapter Eight offers an interpretation of the social network analysis results presented at the previous chapter. It provides a discussion in the light of the previous Mediterranean amphorae studies. Also, this chapter compares the results of the network analysis with the previous Alexandrian amphorae studies conducted based on the terrestrial excavation sites. This gives a better understanding and a detailed image of the movement and connectivity between Alexandria and the rest of the Mediterranean Sea in antiquity.

Chapter Nine—Conclusion

Chapter Nine provides a conclusion of this research by answering the research questions and addressing the research aims. It highlights the significance of applying network analysis to archaeological remains and shows how this approach is promising in providing a new perspective and interpretation of the archaeological evidence. Also, this chapter presents considerations regarding future recommendations and possibilities for further research.

Appendix 1—Amphorae collections information sheets

Appendix 1 contains the amphorae sheets prepared by the author for the transport amphorae found along the Alexandria coastline and the North-Western Coast, as well as those recovered from Kour Island terrestrial site. The appendix covers detailed description for each amphora, features, colour, visual characterisation, type, origin and date, as well as photographs and illustrations where available for each piece.

Appendix 2—Network analysis datasets

Appendix 2 is dedicated to the Excel sheets that contain the network analysis dataset. The dataset introduces the detailed information regarding the amount of each amphora type located at the archaeological sites selected for study, along with site ID, name and GPS coordinates. These data were prepared for processing using UCINET which is the social network analysis software used in this thesis.

Appendix 3—Permissions

Appendix 3 provides the permissions granted to access to several amphorae collections.

Appendix 4—The amphorae types located at the underwater sites record.

Appendix 4 provides a combined record for the amphorae types located at the underwater sites.

CHAPTER 2. ALEXANDRIA AND THE MARITIME TRADE IN THE MEDITERRANEAN

This chapter presents an overview of the maritime trade activities in ancient Alexandria since the pre-Hellenistic (the fifth to the fourth century BC) until the late Roman period (the fifth to the sixth century AD) and Arab conquest. It provides a historical review of the main events effecting the maritime trade activities in the Mediterranean and the trade routes across the historical periods. Further, this chapter highlights Alexandria's location and how significant this location was for trade activities, not only across the Mediterranean but also as far as India and China, as well as an overview on the configurations and features of the Mediterranean coastline. This chapter also discusses how Alexandria was a cosmopolitan, consumer city during the Hellenistic and Roman periods, rather than an industrial or productive city. On one hand, Alexandria facilitated the transhipment of products to Rome and other Mediterranean harbours, and on the other played a critical role in transporting the products down to the Nile, then to India and China through the Red Sea harbours. More about the trade routes will be discussed in this chapter. Finally, this chapter discusses and describes the Eastern and Western harbours, Aboukir harbours and Lake Mareotis harbours which were the main harbours of ancient Alexandria. It also highlights the amphorae as the transport containers of antiquity and their usage in the ancient commercial activities, along with their archaeological significance.

2.1 Alexandria's Location within the Mediterranean Basin

The Egyptian coast along the Mediterranean Sea is 965 kilometres long, starting from the far west at Al-Salum to the far east at the border of Palestine. This coastline is distinguished by its low shoreline with 'bays and headlands' that provided shelter or anchorage to commercial vessels (Abu El-Atta 1994:418). Alexandria is located to the north-west of the Nile Delta and extends from Aboukir in the east to Al-Agami to the west for 40 kilometres along the Mediterranean Sea (Abu El-Atta 1994:418; Gouda 1994:77). It surrounded by the Mediterranean Sea to the north and Lake Mareotis to the south, in addition to the Nile River branches (Figure 2.1). This location privileged Alexandria over any other Egyptian coastal city, as Strabo mentions: 'The advantages of the city are of various kinds. The site is washed by two seas; on the north, by what is called the Egyptian Sea, and on the south, by the sea of the lake Marea, which is also called Mareotis' (1903:17.1.7).

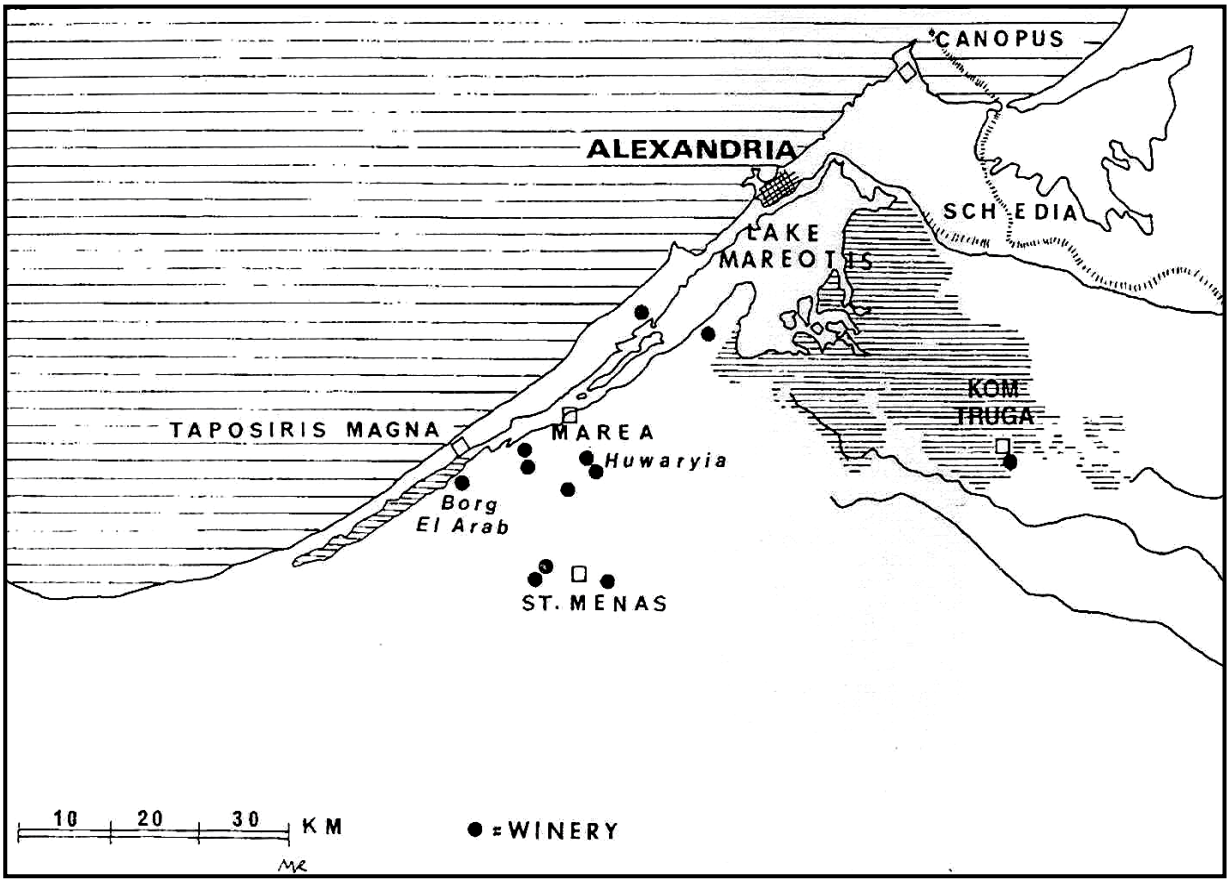


Figure 2.1 Lake Mareotis (After Rodziewicz 1998b:28, fig. 1).

2.2 Alexandrian Maritime Trade

The Mediterranean Sea was witness to the earliest connections between ancient communities as it made connections with far off lands faster and more efficient though the sea rather than via overland routes (Horden and Purcell 2000:10–11). Further, transporting goods to and from far or remote destinations was always more affordable if it was by the sea. As for the land roads, they were used only for distributing the goods to other parts of the empire (Peacock and Williams 1986:63–64). The Mediterranean Sea was the main source of economic life for the populations on its shores. It is worth noting that people preferred to be located close to the sea because it provided a means of connection and trade with other countries (Rauh 2003:17). Regarding the significance of the Mediterranean Sea during the Hellenistic and Roman periods, Rauh states that it was 'the great highway to the Graeco-Roman world, its lifeblood, its interior lake' (2003:17). Parker (1990:335–336) asserts that early evidence of the beginnings of trade in the Mediterranean are still unclear. However, an early ship cargo that has been located is the Helladic II wreck along the coastline of Greece and it is datable to the Bronze Age. It is worth noting that transporting goods in the Mediterranean Sea was always risky due to the storms and rough seas, especially in the winter season as it was unpredictable (Peacock and Williams 1986:63–64).

Of Alexandria in particular, Cankardeş-Şenol (2011:387) notes that the unique location and the stable political and economic situation during the Hellenistic and Roman period qualifies it be a commercial capital and centre point of the maritime trade in the Mediterranean. As mentioned before, Alexandria was transhipping the goods from the west to the east and vice versa, as well as transporting these goods to the south in Africa and through the Red Sea Harbours to India. It is worth noting that this maritime trade was the reason behind Alexandria's prosperity and wealth (Elsayed 2012:72). It is striking also to note that the first sailors in the Mediterranean Sea were the Egyptian and Phoenicians (Alpözen, Berkaya and Özdaş 1995:10).

Khalil (2005:22) examines the economic role of Alexandria as a centre point of the maritime trade in the Mediterranean Sea from the beginning of the Roman empire until the mid-Roman period. This study addresses the role of Alexandria's harbours and the hinterland in the Roman economy based on written sources and archaeological evidence. Further, Alexandria was involved in two patterns of maritime trade during the Roman period. These patterns are described by Khalil (2005:27) as the Roman trade vessels in the Indian Ocean seeking exotic and unique products from India, East Africa and Arabia, a trade only for the wealthy, and the grain trade route from Alexandria to Rome to cover local needs in Rome.

According to Strabo (1903:16.4.24.), the vessels travelled from Alexandria down to the south using the Egyptian Red Sea harbours of Myos Hormos and Berenike. Some of the vessels continued on to India and the others transhipped cargoes to the Eastern Desert using animals like camels or donkeys, then to the Nile to distribute the products to Upper Egypt (Coptos) for local consumption (Figure 2.2). The same route was used the other way, north to Alexandria through the Nile and its branches to Lake Mareotis and then to the Western Harbour, to transport goods to different destinations around the Mediterranean Basin (Alpözen, Berkaya and Özdaş 1995:59; Casson 1980:21–36; Cobb 2015:185–203; Dixneuf 2011:218; Dzierzbicka 2015:204; Pollard 2014:457–474; Schoff 1912:16–32, 103–104; Thorley 1969:209–210). It is interesting to note that the trade routes to India variously passed the Yemeni Coast, the Arabian Gulf and the Horn of Africa as well as the Red Sea (Dixneuf 2011:233–234).

Figure 2.2 Trade routes from Egypt into the Mediterranean, Red Sea, and Arabian Sea in the Hellenistic and Roman Periods (from El-Abbadi 2000:21, fig. 1).

2.2.1 Navigation in the Mediterranean Sea

The Mediterranean Sea has different features along its coastline (Figure 2.3). The northern coastline is distinguished by its huge landmarks which can be seen from far out to sea. Further, its bays that provide shelter for vessels during rough and stormy weather. Also, the deep water close to the coastline provided easy and safe navigation, along with the islands located along the coast. These islands served as stopovers for vessels and an option for sailing close to the land rather than in open water (Rauh 2003:21–22). On the contrary, the southern coastline is distinguished by its flat shore with few bays or islands like the northern one. Moreover, the southern coast has 'hidden sandbanks' that might extend up to 19 km into the sea, which is dangerous for navigation, as well as hidden rocks that cannot be seen until the last minute before grounding. Despite this, the lighthouse functioned to provide a guide to sailors within sight of the coast to help vessels entering the harbour, although it did not provide an appropriate light to the sailors to see the rocks or the coast, especially during storms and rough conditions (Empereur 2000a:59; Rauh 2003:22). This makes the northern coastline the preferable one for traders and navigators (Rauh 2003:22).

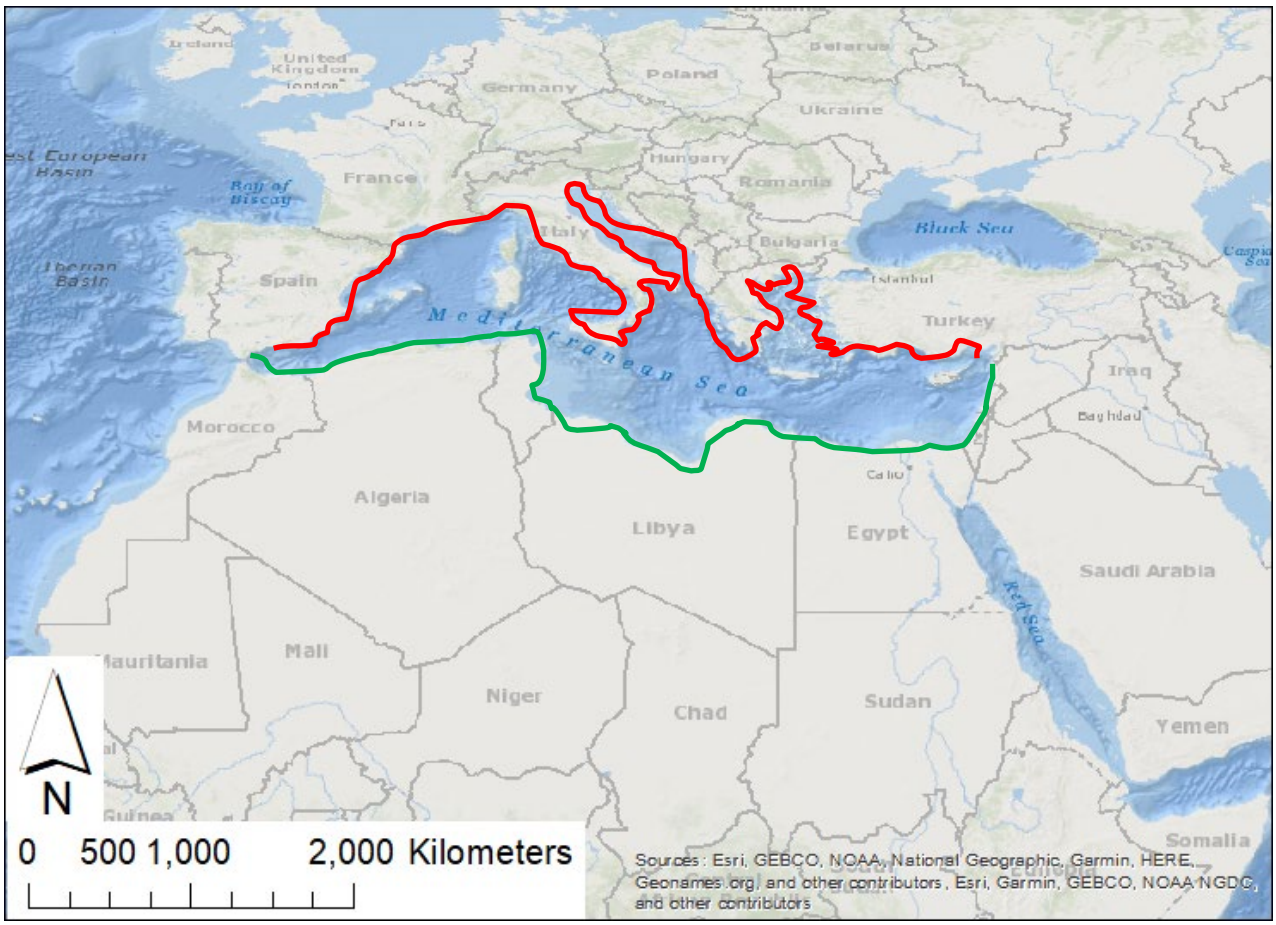


Figure 2.3 The disparity between the northern and southern Mediterranean Coastline. Map produced using ArcGIS® software by Esri.

Further, entering harbours along the southern and eastern Mediterranean coast during rough and stormy conditions carries with it considerable risk; as it is difficult for the sailor to see submerged rocks and shoals. It is worth stressing that hidden rocks, reefs and shoals extended along the Levantine and Egyptian coastline. This might explain the considerable number of shipwrecks at the mouth of the Eastern Harbour and along the Alexandrian coast (Dixneuf 2011:216–217; Empereur 2000a:59; Frost 2000:65–66). Hence, navigating into Alexandria harbour was tricky and risky due to the hidden underwater rocks and reefs (Empereur 1998a:244; Rauh 2003:75–76).

It is also worth stressing that sailors preferred to travel in summer and during the day, while avoiding traveling at night. But unexpected conditions like changes in wind direction, sudden storms, fog and low visibility off the coast could arise suddenly. This might cause delays and oblige the sailor to travel at night. which is a real risk and could cause the loss of vessel if it grounded on hidden rocks or reefs (Empereur 2000a:59; Frost 2000:64–65). Because of the risk of sailing and the unexpected sea conditions, many numbers of vessels wrecked along the coasts of the Mediterranean basin, leaving significant evidence of ancient maritime trade (Parker 1992a:1–5).

What is more, Khalil (2005:125–126) addressed the two main navigation routes used in the Mediterranean and both were against the wind. The first one is towards the east along the Egyptian coast passing through the Levantine then up to Cyprus. After that, vessels navigate towards Asia Minor, Rhodes, Crete, Malta, Sicily and finally Ostia or Portus. The second one is the western one towards Libya and Tunisia, then north to Italy. These voyages might take around one to two months (Casson 1995:289–290; Rougé 1981:189–190). The return route is a direct one which starts at Ostia then to Alexandria. Because vessels navigate with the wind while using this route, the voyage takes from 10 days to three weeks (Horden and Purcell 2002:138–139).

2.2.2 Nile River and Waterways

One of the main reasons behind the success of Alexandria as an important commercial centre in antiquity is the diversity and availability of navigable waterways and branches that linked the Nile with Lake Mareotis with the Mediterranean Sea (Figure 2.4). This facilitated the transportation of products to different destinations in the south as far as India and to the north to Rome and beyond. Connecting Alexandria's sea with the Nile river gave the city another advantage: the Nile River acts as a link to connect the south together with the north through its navigable waterways used for transporting and distributing products to remote areas (Dixneuf 2011:216–217; El-Abbadi 2000:17–18).

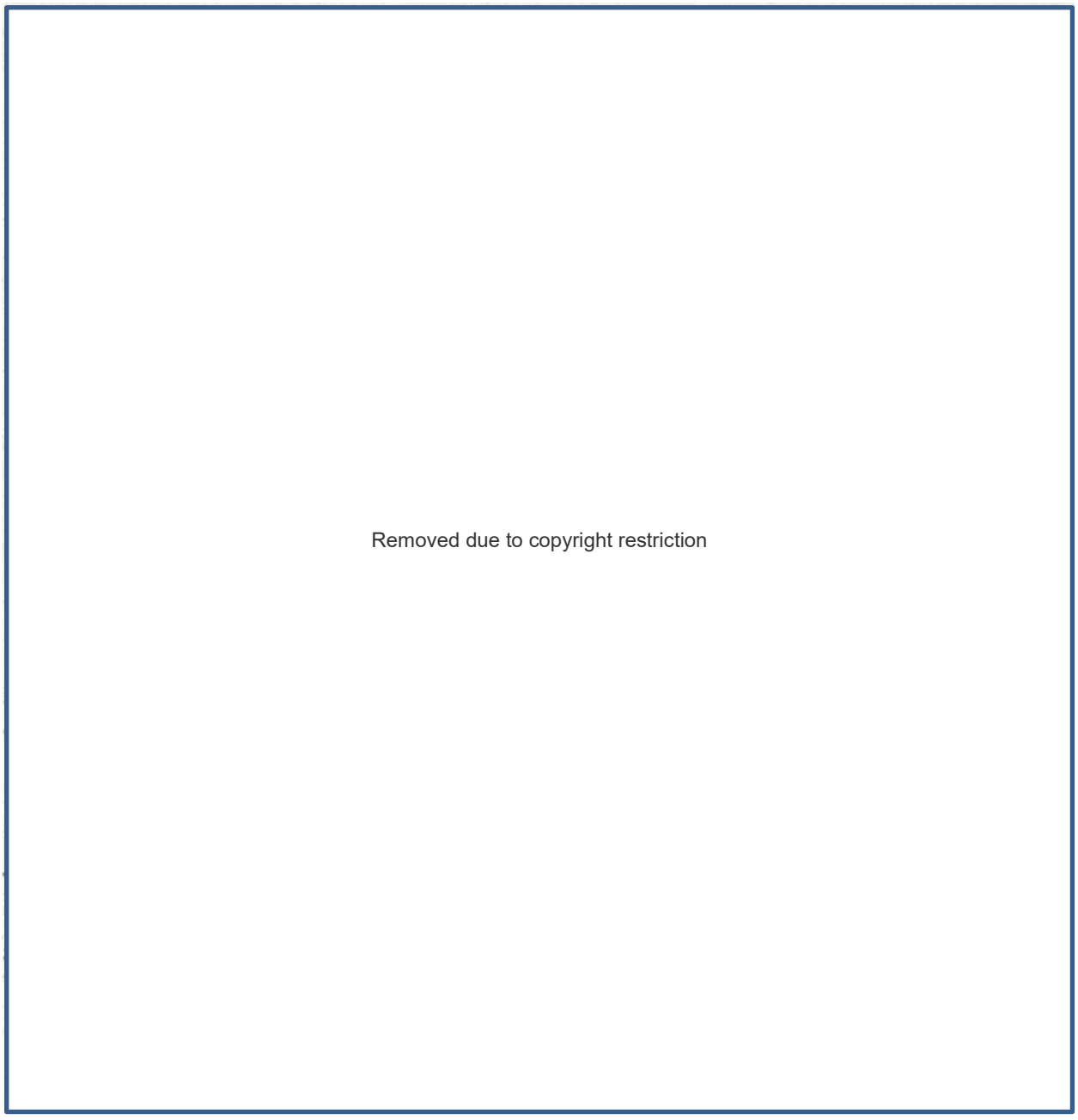


Figure 2.4 Waterways linking the Nile, Lake Mareotis and the sea to Alexandria during the Hellenistic and Roman periods (from Grimm 1998, fig. 30).

Khalil (2010a:33–34) articulates the water bodies in Alexandria and how they influenced maritime trade and the movement of products. The Nile River had a number of navigable branches running from the south to the north. The most important branch was the Canopic Branch located to the east of the Nile Delta that ends in Canopus Bay (Aboukir Bay) (see Figure 2.5) (Blackman 1982:186; Casson 1989:13; El-Zouka 1979:75; Said 2002). The Canopic Branch divided into two smaller branches: one to the west, which is Schedia Canal, and one to the east towards Aboukir Bay (Strabo 1903:17.1.16).

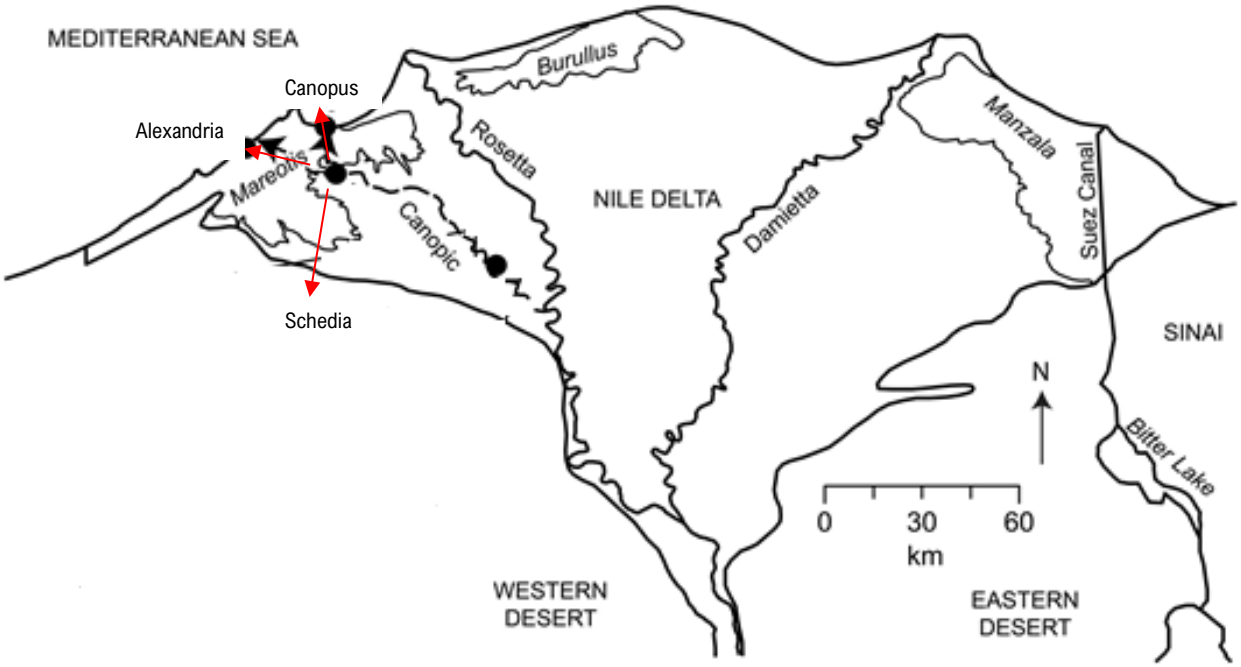


Figure 2.5 The Location of Canopic Branch and the Nile River branches (After Pennington and Thomas 2016:181, Fig. 1).

The Canopic Branch was Egypt's main gate to the Mediterranean for vessels before the establishment of Alexandria. By the establishment of Alexandria, Aboukir Bay and the Canopic Branch declined due to the frequent sedimentation process at the mouth of the Canopic Branch every year during the Nile flood, and sediments also come from the east due to the eastward long-shore drift. This was one of the reasons behind the success of the other harbours along the Alexandrian coastline. As for Schedia Canal, it was used extensively to transport products since the foundation of Alexandria until the late Roman period. It declined by the late Roman period (fifth century AD) and was abandoned around the seventh century AD (El-Abbadi 2000:17–18).

In short, Alexandria was the main gate of Egypt to the Mediterranean basin and beyond (Majcherek 2004:229). According to Rauh, Alexandria was:

> 'the greatest international city of its day. Its sweeping harbours, broad avenues and magnificent public monuments withstood all comparison. Its centres of science and learning set the pace for the entire world. As a centre an international trade it was the world's greatest emporium. Its wharves dazzled with goods arriving from four continents, its marketplace was awash with a diverse array of language and racial features.' (2003:11)

2.3 Alexandria Across Time

Alexandria established by the end of the third century BC (332–331 BC) by Alexander the Great who built a massive empire extending from Alexander's home in Macedonia/Greece to Asia and India and this period is called the Hellenistic period which refers to the Greek identity (El-Abbadi

2000:17–18). Nevertheless, the relationships between Egypt and the Greek people back to the seventh century BC (Manning 2011:299–300; Pfeiffer 2010:15–23). The Greeks settled at a delta town called Naucratis by that time, which led to the establishment of an import trade network from Greece to Egypt to cover their needs (Manning 2011:299–300). After the death of Alexander in 323 BC, power moved to the Ptolemies who inherited this massive empire. Under the Ptolemies, the trade relationships increased between Alexandria and the foreign traders around the Mediterranean and beyond due to the increasing immigration rate from all around the Mediterranean Sea to Alexandria, as will be discussed in the next section of this chapter (Blackman 1982:186; Casson 1989:13; El-Abbadi 2000:17–18; El-Zouka 1979:75; Said 2002). By the end of the Hellenistic period, the commercial trade in Alexandria was effected by the continuous conflict between the Ptolemies' family members which in turn emasculated the Hellenistic rule in Egypt and put an end to this period. As by the end of the first century BC (30 BC) Egypt became a Roman province (Aneni 2016:146–169).

It worth noting that piracy was one of the biggest threats to maritime trading activities, especially long-distance trade, since the pre-Hellenistic period (Gabbert 1986:156–163; Semple 1916:134–151; Souza 1992:180–200). By the beginning of Roman rule in Egypt, the Romans succeeded in abolishing the piracy in the Mediterranean Sea which was one of the main reasons behind the prosperity of the maritime trade by this time period. Further, the stability of the political and economic situation in the Roman Empire played a critical role in expanding the maritime trade patterns within the Empire during the first and second centuries AD (Souza 1992:211–213). By the third and fourth centuries AD, natural disasters like the massive earthquake and tsunami waves that hit the city in AD 365 had caused extensive damage to the city and its buildings. This impacted the trade activities between Alexandria and the rest of the Mediterranean. This earthquake in particular extensively affected the Eastern Mediterranean coastline alongside the Libyan and Tunisian coasts (EL-Sayed, Korrat and Hussein 2004:1003–1019; Pararas-Carayannis 2011:274–275).

During the late Roman period (the fifth to the sixth century AD), trade activities continued but in a modest scale due to the instability of the political situation and religious conflicts between the Hellenes, Jews and Christians that started by the end of the fourth century AD and lasted across the fifth century AD (Kaplow 2005:2–4; Kristensen 2010:158–175; North 2017:1–32). In addition, piracy returned to the Mediterranean Sea (Souza 1992:217–220). During the Islamic period (the seventh to the tenth century AD), Alexandria started to decline as a commercial city and approximately by the end of the eighth century AD was diminished due to the decision to decrease foreign trade by Ahmed Ibn Touloum, who ruled Egypt by AD 868 (Conermann 2004:115–139). It is worth noting that despite the continuous decline from the late Roman period until the Islamic

period, Alexandria remained the main commercial city in Egypt, as it is today.

2.4 Alexandria as a Cosmopolitan City

Cankardeş-Şenol (2011:387) highlights the diversity of nationalities in Alexandria, which acts as another factor in the prosperity of Alexandria during the Hellenistic and Roman periods. Alexandria was an open city to people from the Eastern and Western Mediterranean and from India across these time periods. It is worth stressing that Alexandria was occupied by a mixture of different nationalities (Dio Chrysostom 1940:36). The population of Alexandria was around one million consisting of Greeks, Egyptians, Jews and Levantines, along with people from Libya, Carthage, Italy, Marseille and India (Fraser 1972:38–39; Cankardeş-Şenol 2013:387). For almost a thousand years the Greek language was the official spoken language in Alexandria. Further, the Greek culture was widespread across Alexander's Empire (Tzalas 2013:321). This diversity was a result of the vastness of Alexander's empire, which extended to include Libya, the Levant and the Aegean regions. Further, migrations between the Empire's parts increased during the rule of the Ptolemies, which led to the rise of Alexandria as a cosmopolitan city. Consequently, trade activities and exchange across the empire flourished, especially with the Greek parts as the majority of immigrants to Alexandria originated from Greece (Fraser 1972:38–39; Williams, K. 2004:44, 46–49).

2.5 Alexandria as a Consumer City

According to Lund (2000:88) and Majcherek (2004:229), Alexandria was the biggest consumer city in the country. Furthermore, Khalil (2010a:34–35) stresses that Alexandria is a poor city in terms of agriculture and industry in general. Neither industry or production centres nor any agricultural lands were located in Alexandria itself. The countryside, the Mareotic region, was the main place of production and agricultural activities and the main supplier of products for Alexandria since the Hellenistic period and through the Roman and late Roman periods (El-Zouka 1979:75; Empereur 1998a:225–226). The significance of Alexandria resides in its location and harbours, which served as a main supporter to maritime trade to and from Alexandria. Alexandria was a 'crossroads and a transshipping point' to the south to Arabia, India and China through the Red Sea, and the north to Rome and beyond (Alpözen, Berkaya and Özdaş 1995:59; Rickman 1980:231–235). As Strabo outlines:

> 'The greatest advantage which the city possesses arises from its being the only place in all Egypt well situated by nature for communication with the sea by its excellent harbour, and with the land by the river, by means of which everything is easily transported and collected together into this city, which is the greatest mart in the habitable world.' (Strabo 1903:17.1.13)

2.6 Alexandria Harbours

The location of Pharos Island opposite the Alexandrian coast played a role in providing shelter to trading vessels before the establishment of Alexandria (Khalil 2002:2). As mentioned in the previous chapter, a causeway was built to connect Pharos Island to the mainland, which was called Rakotis. This led to the establishment of two harbours; one to the east called Portus Magnus (Eastern Harbour) and one to the west called Eunostos (Western Harbour) (Dixneuf 2011:216–217; El-Abbadi 2000:17–18; Morcos 2000:40–41; Marcos et.al 2003:14–15). The following section provides a general review of Alexandrian harbours (Figure 2.3).

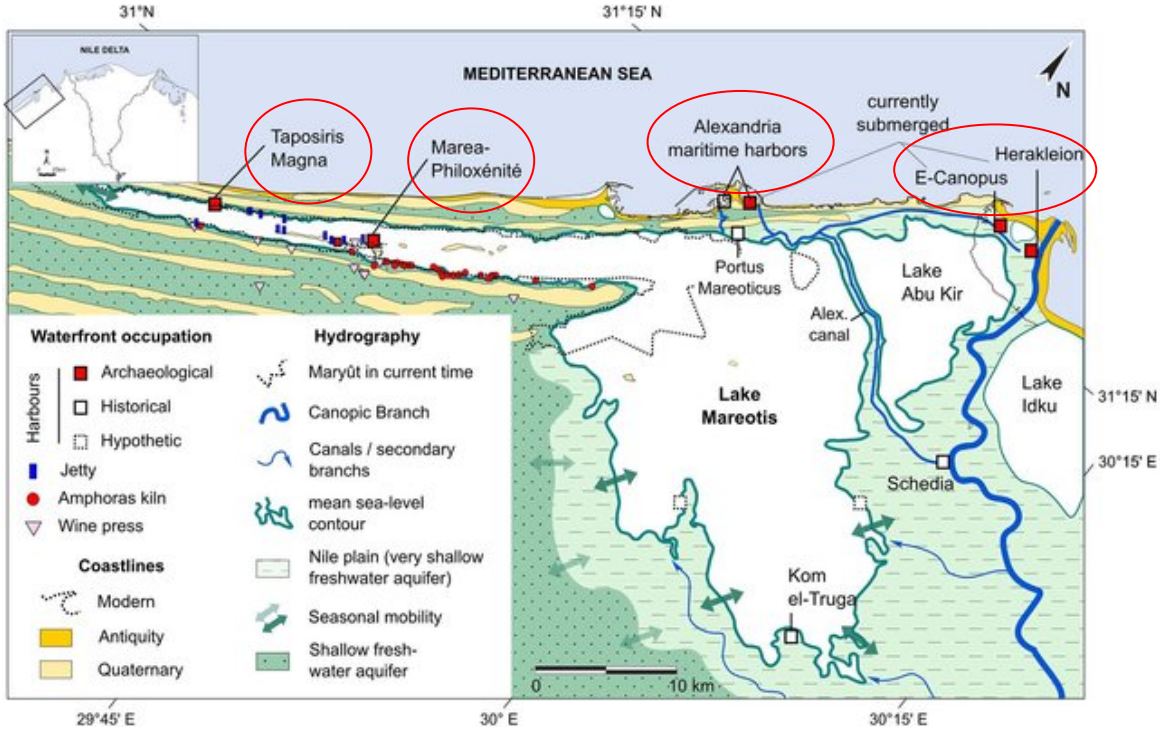


Figure 2.6 Alexandrian Harbours (from Flaux et al. 2017:670, fig. 1) © Copyright 2020, with permission from Elsevier.

2.6.1 Eastern Harbour

The Eastern Harbour was the main harbour in Alexandria during the Hellenistic and Roman periods (Khalil 2005:128). Morcos (2000:37) highlights how huge the Eastern Harbour was at around six kilometres long, with four kilometres occupied by the harbour facilities. It is worth commenting that the harbour structure and its design lasted without change, along with their role in the commercial trade, during the Hellenistic and Roman periods (Khalil 2002:35).

Khalil (2002:30–31) highlights the trade patterns undertaken during the Hellenistic period and the Roman period. The Eastern Harbour controlled the import and export operations along with the transhipment of goods. As for the import operations, the harbour was receiving vessels full of products like olive oil and wine. It is interesting to note that most of the imported products were not

for the general public, it was only for the wealthy, especially the Greeks. This is because local productions fulfilled the local needs (Casson 1984:72–73, 1991:157–169).

The Eastern Harbour received exotic products coming from East Africa, Arabia and India through the Eastern Desert and the Red Sea harbours. Then the products were transferred down to the Nile, Lake Mareotis and finally to Alexandria Harbour to be distributed to different destinations across the Mediterranean Sea. The products ranged from silk to spices, pearls and ivory. The Eastern Harbour is distinguished by its unique location in adjacent to the marketplace. Consequently, the Eastern Harbour was the most convenient harbour for import operations and provided easy and rapid distribution of the products into the marketplace (Casson 1984:72–73, 1991:157–169). Also, increasing the population of the rich communities led to increasing the demand for exotic imports like spices, perfumes, etc. to cover their needs (Johnson 1951:139). During the Hellenistic period, the Eastern Harbour was exporting local products along with products received from the East. During the Roman period, trade activities expanded due to the elimination of piracy, which provided peace and stability to the Mediterranean Sea. Also, the Indian Ocean trade flourished in conjunction with improving navigation in the Red Sea. It is worth noting that up to 120 vessels sailed from Myos Hormos to India on an annual basis (Casson 1989:10–12).

2.6.2 Western Harbour

The Western Harbour is located west of the Eastern Harbour and according to the evidence of remaining structures, this harbour was active during the Hellenistic period and demolished during the Roman period. It has now became a huge commercial harbour in charge of 80% of the trade from different destinations around the world (Fraser 1972:26). The Western Harbour is distinguished by its link with Lake Mareotis through a small man-made lake called *Κιβωτος* (Kibotos), which means a box, and a navigable canal branched from it (Dixneuf 2011:216–217; El-Abbadi 2000:17–18; Morcos 2000:40–41; Morcos et al. 2003:14–15). As Strabo states: ‘Next after the Heptastadium is the harbour of Eunostus, and above this the artificial harbour, called Cibotus (or the Ark), which also has docks. At the bottom of this harbour is a navigable canal, extending to the lake Mareotis’ (1903: 17.1.10).

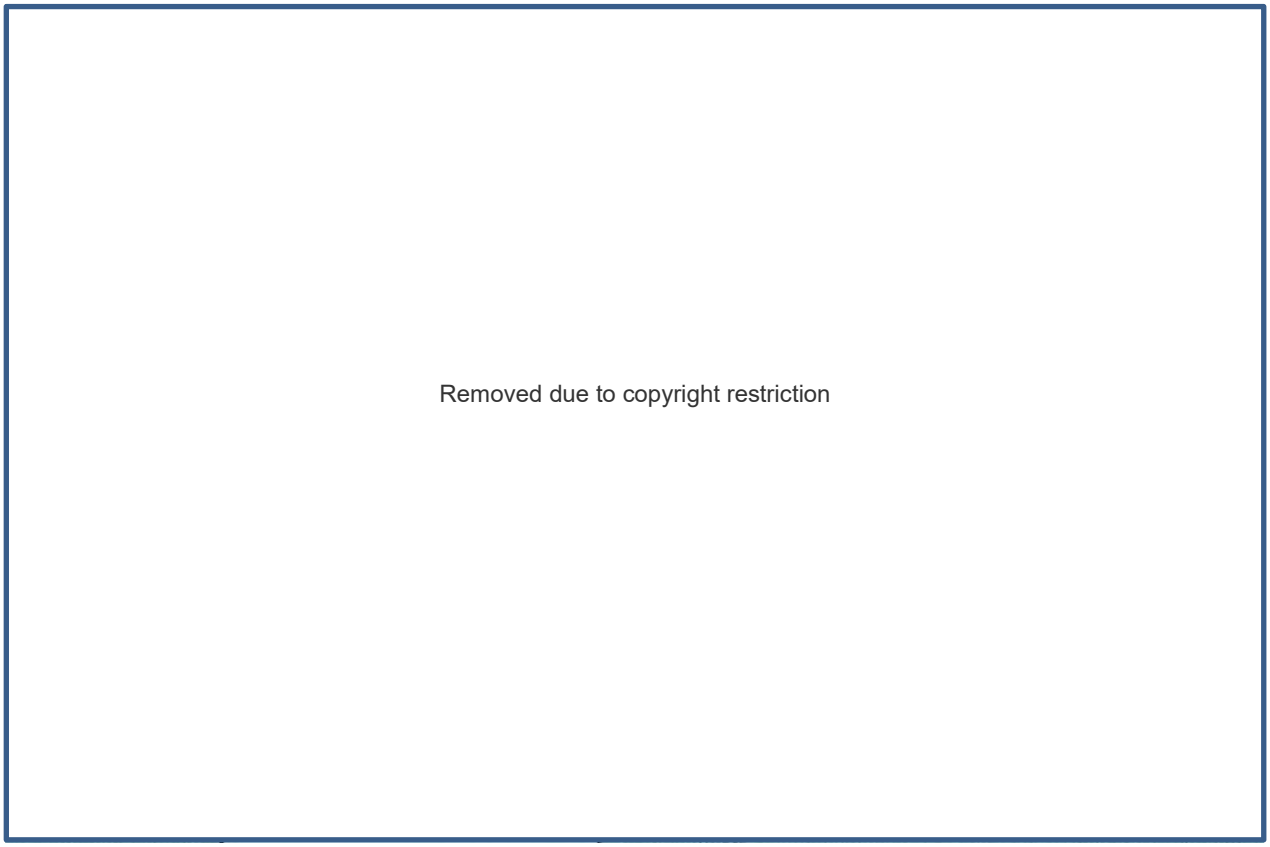


Figure 2.7 Map of Alexandria's harbours and the Kibotos canal (from artstor slide gallery).

The Western Harbour oversaw reception of the imported products and transhipping the exported ones. The products that arrived at the Eastern Harbour were transfered through a passage in the causeway to the Western Harbour, then to Kibotos and Lake Maretois down to the Nile (Figure 2.7). Therefore, the Western Harbour was suitable for export operations as the products come through the Nile and Lake Mareoties to Kibotos (Casson 1991:160). Further, the increase of the scale of trade led to the requirement to dig the Neapolis canal, which was constructed to link Schedia Canal with the Eastern harbour (Rickman 1971:299–302). The reason behind this was to provide a fast connection with Lake Mareotis and the Nile. Consequently, this connection led to the decline of the Western Harbour during the Roman period (Khalil 2002:25–28).

2.6.3 Aboukir Harbours

Aboukir is a town located to the east of the Eastern Harbour and contains three other ancient towns—Canopus, Heraclium and Menouthis. Two of these towns, Canopus and Heraclium, are distinguished by their harbours. Canopus Harbour for example linked with the Nile River through the Canopic branch which was used to transport products during the fifth century BC (Morcos 2000:33–34; Strabo 1903:17.1.17; 17.1.18). Morcos mentions that the Canopic Branch was the main branch used to transport the products to Canopus Harbour and continued as late as the Islamic

period (2000:34). It is worth noting that Canopus Harbour is considered one of the oldest harbours in the Mediterranean Sea.

As for Heraclium Harbour, Goddio and Clauss (2006:288) state that Heraclium oversaw the trade activities with the Greek world during the Saiten, the Persian, the Pharaonic and the Hellenistic periods. Up to 700 anchors and 60 shipwrecks ranging in date between the sixth century BC to the second century BC have been located at Aboukir Bay (Goddio and Clauss 2006:296; Robinson and Wilson 2010:18–19). Hence, Aboukir Harbour is not considered amongst the Alexandrian ancient harbours as it was established before the city of Alexandria by Alexander the Great, although the Aboukir harbours continued in use during the Hellenistic until the early and mid Roman periods, as will be discussed in the following chapter.

2.6.4 Lake Mareotis Harbours

Lake Mareotis played a significant role during the Hellenistic and Roman period as a production centre and as a harbour. It linked the south to India and China with the north to the Western Harbour, then to the other harbours around the Mediterranean Sea. Lake Mareotis controlled the movement and transport of products and goods to Alexandria and beyond (Fraser 1972:143–148). Additionally, the harbours and other maritime infrastructure along the lake shore served as 'point to point' transhipping facilities for distribution of products directly from the production area (Khalil 2010a:34–35). As mentioned before, the Canopic Branch was vital for connecting the Nile River with Lake Mareotis and the Schedia canal, which connected the lake with the Western Harbour alongside more canals extended to reach Aboukir Harbour. The products transferred through the Nile, once they arrived at Lake Mareotis, were transported to the Western Harbour and Aboukir Harbour (Blue and Khalil 2011:9–12).

Strabo states that the lake branches were much more active much 'busier than' than the sea harbour during the Hellenistic and Roman periods (Dixneuf 2011:98, 216–217; Fraser 1972:144–148; Strabo 1903:17.1.7). It is interesting to note that the scale of export in Alexandria was not the same as that of the import trade. Exports was much more extensive than imports and this is supported by Strabo who mentions that:

> 'This lake is filled by many canals from the Nile, both by those above and those at the sides, through which a greater quantity of merchandise is imported than by those communicating with the sea. Hence the harbour on the lake is richer than the maritime harbour. The exports by sea from Alexandria exceed the imports. This any person may ascertain, either at Alexandria or Dicæarchia, by watching the arrival and departure of the merchant vessels and observing how much heavier or lighter their cargoes are when they depart or when they return.' (1903:17.1.7)

Further, Lake Maroties has more than one harbour, as several harbours dating to the Hellenistic, Roman and Byzantine periods have been located along the lake shores, especially at the western arm, such as Taposiris Magna and Marea (Figure 2.8) (Rodziewicz 1990:72–74). These harbours are detailed below.

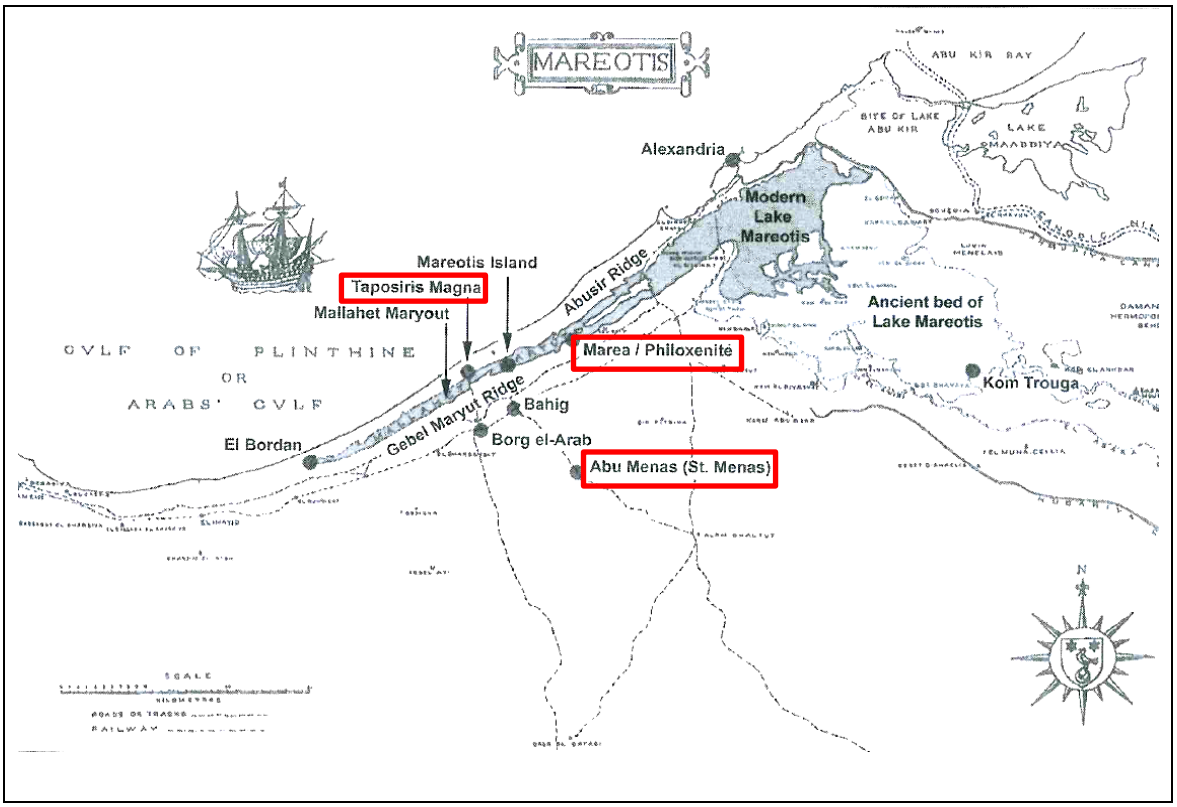


Figure 2.8 Harbours along the western arm of Lake Mareotis (from Blue and Khalil 2011:3, fig.1.4). © Copyright 2020, with permission from BAR.

2.6.4.1 Taposiris Magna

According to De Cosson (1935), this site was the main harbour of the entire area. It was located to the west of the north coast of Lake Mareotis, currently Bourg El-Arab. This harbour was active during the Hellenistic period until the late Roman period (Boussac and El Amouri 2010:87–105; Dixneuf 2011:105). Khalil notes that Taposiris Magna was the most significant at the western arm of the Lake as it oversaw the transfer of products between the lake and other destinations during the Hellenistic and Roman periods (2005:117–119). It was a 'customs station' to oversee the reception of products from Cyrenaica (Libya) in the west using the overland routes and the vessels coming from the south and the east and vice versa (Al-Falaki 1872:97–98; Blue and Khalil 2011:23; Empereur 1998a:225–227).

2.6.4.2 Marea

Marea is located 45 km southwest of Alexandria on the south coast of Lake Mareotis and 15 km to the east of Taposiris Magna (See Figure 2.8). This town was in use during the Hellenistic and early

Roman periods as a capital of the Mareotic region (Babraj, Drzymuchowska and Willburger 2014:45; El-Falaki 1872:81–97). According to Khalil (2010b:137), Marea was a trade centre during the Hellenistic and the Roman periods; however, it become a stopover for Christians pilgrims during the Byzantine period on their way to Abu Mina and the 'holy Byzantine shrine of St. Menas', which is located to the south of the Lake (See Figure 2.5) (Al-Falaki 1872:97–98).

2.6.4.3 Schedia

Schedia located 30 km to the south east of Alexandria (Figure 2.2 and 2.3). Schedia canal had a significant role in the movement of products from the north to the south and vice versa during the Hellenistic and Roman periods, and until the late Roman period. Then it was abandoned during the Islamic period. Schedia was a customs house for both the import and export trades (Blue and Khalil 2011:26–27). Further, Strabo provides a description of Schedia as:

> 'Schedia … is a suburb of the city, and has a station for the vessels with cabins, which convey the governors when they visit the upper parts of the country. Here is collected the duty on merchandise, as it is transported up or down the river. For this purpose, a bridge of boats is laid across the river, and from this kind of bridge the place has the name of Schedia.' (1903:17.1.16)

Along with these harbours mentioned above, several small harbours were located along the lake shore dating from the pre-Hellenistic period until the Islamic period. These harbours facilitated the transport of products from the industrial and agricultural area located along the lake shore to the larger main harbours across the lake (Empereur and Picon 1986:103–106). The loocation of these harbours is an indication of how busy the lake was across the historical periods. Altogether, it is striking to note that Alexandria's harbours operated for almost 2,300 years, particularly with Eastern Mediterranean trade (Morcos 2000:33). Moreover, the harbours of Alexandria prospered during the Hellenistic and Roman periods until the fourth century AD and continued to be active during the Islamic period (Tzalas 2000a:23). In the same time, a series of gradual declines to Alexandria and its harbours started from the late Roman period. The most significant was in the fifteenth century AD with the launching of the new maritime route around Africa via the Cape of Good Hope, although commercial activities continued on a more modest scale (Tzalas 2000a:31–32).

2.7 Amphorae: The Backbone of Maritime Trade

Ceramics in general are the most famous and common artifacts located at almost every archaeological site (Finkelstein et al. 2011:249; Kaldeli 2013:39; Sinopoli 1991a:2). Amphorae are the marine shipping containers in the ancient world. They were containers par excellence of sea transportation. They were used during the second millennium BC in Syria-Palestine and continued

in use for many centuries, to be replaced during the late medieval era by other types of containers, such as wooden barrels (Sibella 2002:4).

The term amphora is Greek in origin, *amphoreus* (ἀμφορεύς) being a reduction of *amphiphoreus*. *Amphiphoreus* consists of two words: *amphi* which means from both sides and *phoreus* which means bearer, soa*Amphiphoreus* means the 'vessel carried from both sides' (Alpözen, Berkaya and Özdaş 1995:13; Göransson 2007:9; Öniz 2016:1; Will 1977:264–265; Zemer 1977:1). According to Peacock and Williams (1986:21, 63), the primary use of the amphora was for maritime trade. The shape of the amphora served to meet the needs of the traders and crew in that it could take large amounts of goods and was able to be carried by only one person. Gibbins (1990:383–384) states that amphorae are not only transport containers used in maritime trade but were simultaneously used onboard by the vessel's crew for subsistence during their long journey. That is to say, the main function of amphorae was for transporting products, which ranged from liquids like wine, olive oil, sesame oil, and fish sauce, to seeds like sesame seeds, to solid foodstuffs like dried food, dried fruit, fish products, olives and salted meat (Dixneuf 2011:9; Göransson 2007:9; Sibella 2002:4; Whitbread 1995:43). at the same time, amphorae were reused for other functions like preserving and storing food at houses and funeral places (Moore 2000:52–53). This usage is discussed further in the following chapter.

As only very few amphorae types have a flat base (Figure 2.9), the pointed base amphorae were stacked in the vessel in a specific technique. The ships hulls of some Roman shipwrecks like that at Madrague des Giens (France) indicate the ways that amphorae were stacked in the vessel (Figure 2.10). There were slots or empty spaces in the decks of the ship, into which the crew used to put the pointed base, while using straw between each one to avoid damage during transport. As for the flat ones, they were covered by straw as well (Keay and Williams 2005). It is worth noting that a pointed base acted as a third handle to provide easy control while pouring amphora contents (Denker and Öniz 2015:85; Gibbins 1990:376; Peacock and Williams 1986:2).

Figure 2.9 Amphorae parts, Lamboglia II amphora (after Sciallano and Sibella 1994:35).

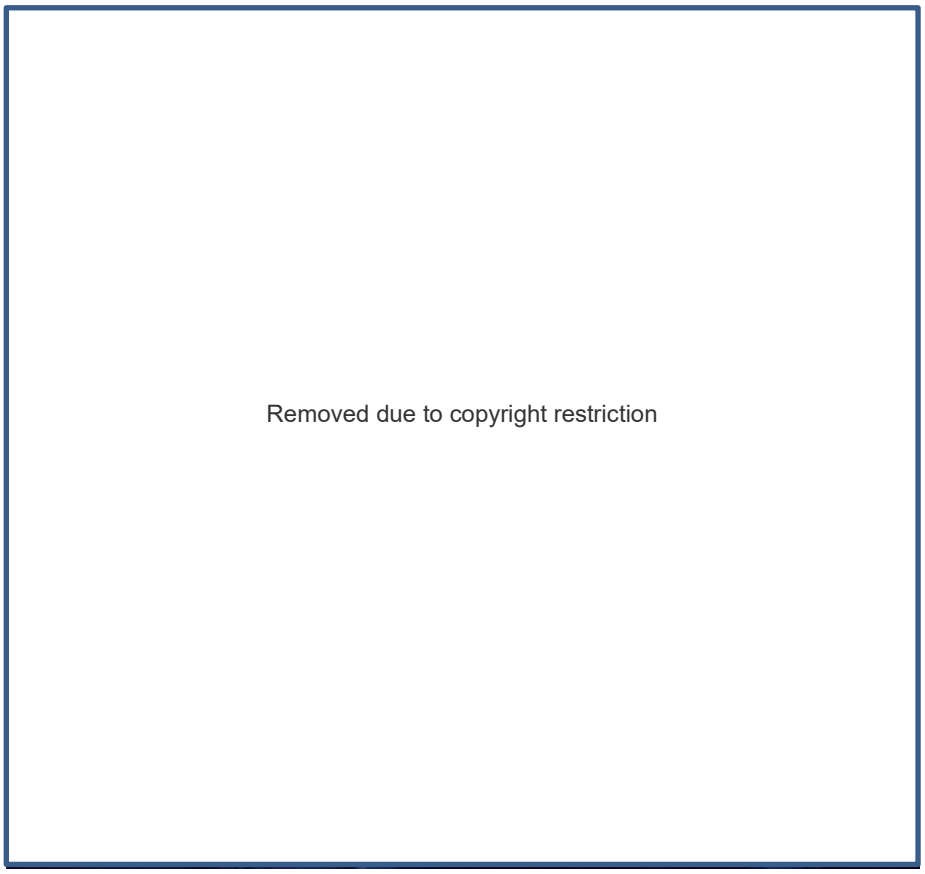


Figure 2.10 Madrague des Giens shipwreck, France (Image by A. Chéné 2018, Centre Camille Jullian).

Turning to the archaeological significance of the amphorae, they were key elements of trade during the Roman period; they were used for transporting goods by the sea and in long distance trade. Keay and Williams (2005) believe that amphorae represent a massive source of data about maritime trade, connectivity, production and consumption areas. Further, identifying the origin of the amphorae fragments in a wreck site could provide us with information about the ways trading regions were connected (Denker and Öniz 2015:85). It is worth highlighting that most of the wreck sites have been located by their amphorae fragments due to their excellent preservation in the underwater sites, as highlighted at chapter one (Parker 1990:342). Hence, amphorae fragments are considered a sign of the wrecks buried below the seabed and act as a paved road or a trail to the maritime trade connectivity (Denker and Öniz 2015:85; Gibbins 1990:383–384).

Moreover, Ashley (2010:136) acknowledges that ceramics are considered a massive source of archaeological data that could play a major role in providing the solutions to debates about trade connectivity, in addition to the social and economic aspects. Further, Empereur states that amphorae provide information about many aspects of the commercial patterns and maritime trade networks (1998a:244). Besides, Peacock and Williams (1986:2) assert that amphorae fragments have a great potential in providing us with not only the maritime network and connectivity between ancient entities, but also with the type of the goods transported within these containers. They give a reflection of the economic situation in a specific period of time between the connected entities (Finkelstein et al. 2011:249; Öniz 2016:2). Also, the dispersal of the amphorae fragments is a tool to connect the entities with each other (Peacock and Williams 1986:2). Notably, Williams, D.F. (2004:443) mentions that amphorae are a trail to investigate the transportation of the goods between ancient entities and to identify the economic situation at certain periods of time.

As mentioned before, amphorae provide us with direct evidence for some key aspects of ancient trade; namely the movement of certain commodities from their places of origin to the sites where they have been found (Grace 1979; Peacock and Williams 1991:2; Will 1987:71–77). Moreover, quantitative studies of amphorae shed light on the geographical and chronological shifts in trade between different regions (Panella and Tchernia 2002:173; Woolf 1992:284). Also, Khalil (2005:152–153) emphasises the significance of the amphorae evidence as a direct trail to define and confirm the connections between ancient entities based on these transport containers.

2.8 Summary

This chapter draws attention to Alexandria as an important city in the Mediterranean throughout ancient history. It highlighted the commercial role that Alexandria played since the Pre-Hellenistic period until the Islamic period. Investigating maritime trade in the Mediterranean along with the trade routes provides a detailed overview of the connectivity and exchanges between the Mediterranean regions. Also, shedding light on the local waterways and the navigable canals, along with the Alexandrian harbours, provides a more complete image of the maritime trade activities centred at Alexandria and products transported as far as India, China, Arabia, Rome and beyond. As this thesis is mainly about Alexandria and its amphorae sites, the following chapter discusses the underwater and terrestrial amphorae sites and their archaeological remains in detail.

CHAPTER 3. ARCHAEOLOGICAL SITES AND AMPHORAE EVIDENCE

Present-day Alexandria is constructed on the ancient ruins of the Hellenistic, Roman, Byzantine, and Islamic settlements of the same name. This is evinced by the artefacts recovered from excavations conducted underwater and on land. Archaeological exploration and excavations were started in 1906 by Maspero and Fouratau along the North-Western Coast of Egypt and continued through the years and remains an ongoing process. With every new excavation, new aspects of Alexandria's history appear to fill in the missing parts.

This chapter outlines the amphorae sites located both underwater and on land along the Alexandrian coastline, hinterland and along the North-Western Coast. Additionally, this chapter details the amphorae fragments located at each site in terms of the types, origin, and region, date, local or imported and content[3]. The chapter is divided into two parts: part one dedicated to the seven underwater sites along the North-Western Coast and the seven underwater sites located along the Alexandrian coastline, and part two that covers the six land sites located in Alexandria, countryside and the North-Western Coast, as well as highlighting the amphorae collections stored in the Greco-Roman Museum in Alexandria. Moreover, detailed descriptions for each amphora piece, colour, dimensions, features, visual and fabric characteristics, along with a picture and drawing if available, are provided in appendix 1.[4]

3.1 The Underwater Sites

3.1.1 North-Western Coast

The archaeological evidence indicates that the North-Western Coast was one of the most significant maritime trade routes since the Pharaonic era. It continued in use, reaching its prosperity during the Hellenistic and Roman period (White and White 1996:11–26). Haldane (2000) pointed out that all the amphorae located along the North-Western Coast reflect seafaring along this coast from the Hellenistic period until the Islamic period. However, evidence also dates to earlier times due to the discovery of Canaanite amphorae, which are datable to the Bronze Age (fourteenth century BC) at Oum El Rakham (Haldane 1996; Khalil and Moustafa 2002:527–528; Snape 2002:17–22). Consequently, a number of ports and cities along the north coast have been used to serve that trade. Marsa Bagoush (Zygris in Greek), Marsa Oum El Rakham (Catabathmus Maior in Greek), Ras El

3 The information related to the origin, date and content is based on previous published amphorae studies.
4 The appendix covers all the underwater sites except Qaitbay/Pharos site due to the shortage of quantity data and archaeological photography or illustrations for the amphorae. Also, Appendix 1 covers one terrestrial site which is Kour Island. This is because the underwater sites are the main concern of this thesis; 98 % of amphorae recovered from these sites have yet to be studied. Kour Island amphorae remain unstudied to date.

Hikma (Leuce Acte in Greek), Marsa Hawala (Calamaeum in Greek), Ras Abu Hashaifa (Leodamantium or Ladamantia in Greek), and Ras Gibeisa (Derrhis in Greek) have been mentioned as anchorages that were in use in Antiquity (Figure 3.1). This evidence resulted from of a survey undertaken in 1906 by Gaston Maspero and M. R. Fouratau, along the Egyptian North-Western Coast (White and White 1996:11–26), and the survey was continued by the Institute of Nautical Archaeology in Egypt (INA) Egypt, Supreme Council of Antiquities (SCA) and lately by the Centre for Maritime Archaeology and Underwater Cultural Heritage (CMAUCH) in Alexandria University.

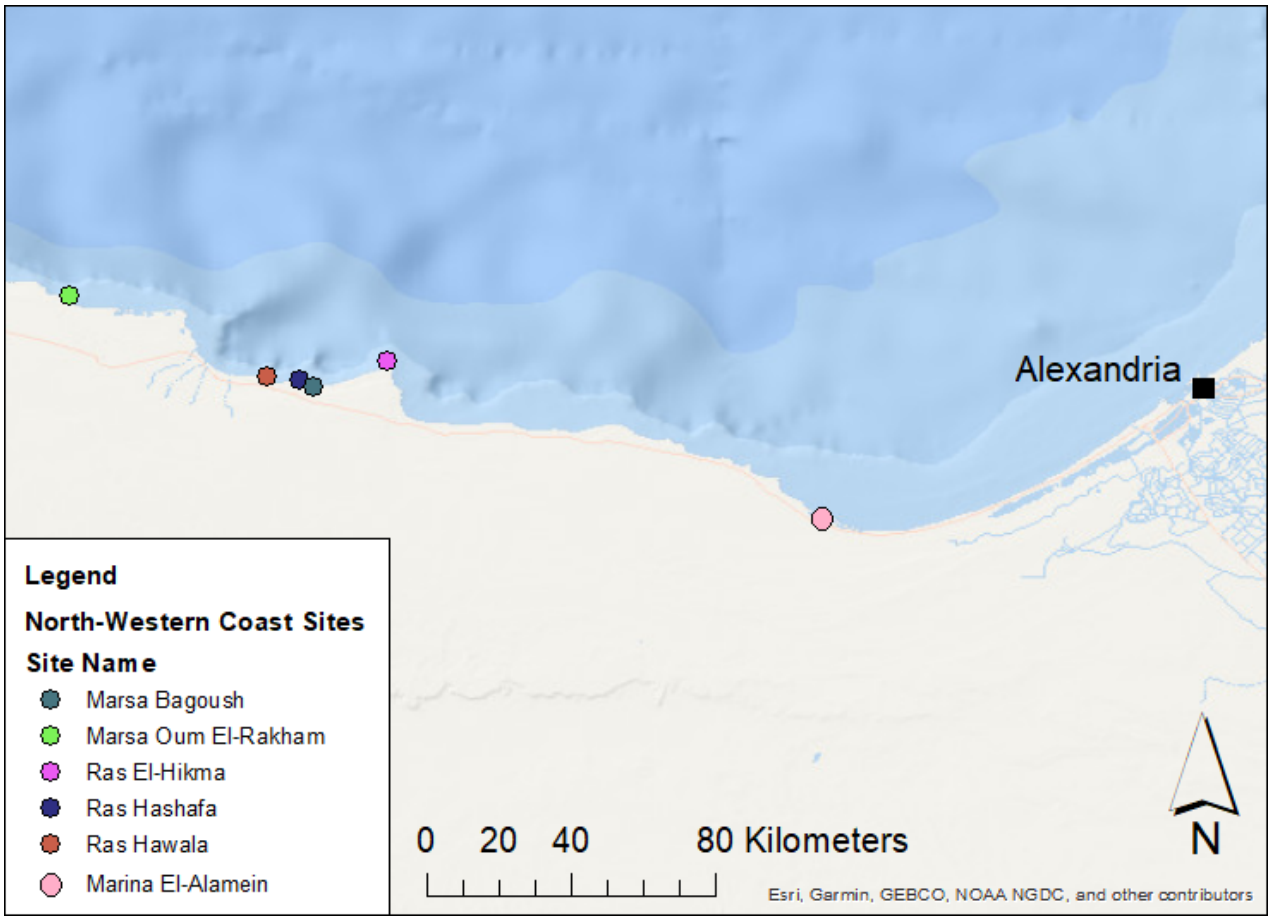


Figure 3.1 North-Western Coast amphorae sites. Map produced using ArcGIS® software by Esri.

The North-Western Coast is distinguished by its sandy and rocky seabed, while silt is the main feature to the east due to the sedimentation from the Nile branches and Delta. In contrast, the coastal waters of the northern Mediterranean are deep providing good conditions for the preservation of shipwrecks and providing protection for hundreds of years. The Egyptian Mediterranean coastline is distinguished by its shallow water, which creates a rough environment for shipwrecks and makes them vulnerable to waves, currents and looting. Locating wooden remains is therefore not likely, but amphorae remains are much more common (Haldane 2000).

The main aim of the INA-Egypt survey was to identify the location of the amphorae fragments as an indication of shipwrecks' cargoes and of the shipwreck itself. All the sites surveyed are considered sheltered harbours, as all of them are located in bays protected by reef or natural frontiers. The report covered what has been done, which sites have been surveyed, the archaeological remains located at each area, the surveying methods/devices and some minor details about the dimensions of some amphorae remains, along with scaled photographs for some of the amphorae located. Preliminary typology for a minor number of amphorae has been provided in that report. What exactly was been done, and the methods or devices used for that survey are outside the scope of this research. This thesis concentrated on the amphorae remains located and the areas/sites where they were located. Due to the limited amphorae types located at six of seven sites, the author produced one chart for all the amphorae located at the underwater sites along the North-Western Coast (Figure 3.2), excluded Marsa Bagoush which has a separate chart due to the unique variety of the types located. The amphorae types located at each site are provided below and more details are provided at Appendix 1, section 11.1.1.

3.1.1.1 Ras El-Hikma

The INA-Egypt survey recovered several amphorae (see Appendix 1, section 11.1.1.1). The preliminary report provided general information, along with photographs which the author used to identify their types as shown in Table 3.1. Due to the different dates of the amphorae, it seems like that they belong to different ships that have been wrecked at this spot (Haldane 1996).

Table 3.1 The amphorae types located at Ras El-Hikma.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Spatheia	Tunisia	Central Med.	4th AD to 5th AD	Late Roman	Imported	Uncertain, suggestion of olives	1
Beltrán 72	Spain	Western Med.	Mid 3rd AD to 5th AD	Late Roman	Imported	Fish sauce	1
Dressel 9	Spain	Western Med.	1st AD	Early Roman	Imported	Fish sauce	1
LR7/ AE7	Egypt	Egypt	Late 4th AD to 7th AD	Late Roman	Local	Wine	1

3.1.1.2 Tannum Reef

Fragments and intact amphorae have been located here, but again with no indication of the exact number. The INA-Egypt team have provided a preliminary uncertain typology for some of the amphorae including Egyptian amphorae (no identification of a specific type) and amphorae from southern Spain (end of the first century BC to the first century AD) (Haldane 1996). Table 3.2 shows the amphorae types located.

Table 3.2 The amphorae types located at Tannum Reef.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Rhodian Middle	Rhodes	Aegean	2nd BC to 1st BC	Hellenistic	Imported	Wine	1
Knidian Middle	Knidos	Aegean	1st BC	Hellenistic	Imported	Wine	1
Koan	Kos	Aegean	End 3rd BC to 2nd BC	Hellenistic	Imported	Wine	1

3.1.1.3 Ras Hashafa

According to Haldane (1996), Koan amphora, datable to the third to second centuries BC have been located here as well as Tyrrhenian Sea amphora fragments (third century BC to second century BC) and North Aegean amphora (fourth century BC to third BC). Further, Amphora Egyptian 2-3 (AE2-3) have been located at this site (CDUA Archive 1996; Dixneuf 2011:93). See Appendix 1, section 11.1.1.2.

3.1.1.4 Ras Hawala

According to Haldane (1996), Koan amphora have been located at Ras Hawala and are datable to third century BC to second century BC, as well as Italian Tyrhennian amphorae fragments (third century BC to second century BC) and North Aegean amphorae (fourth century BC to third century BC). See appendix 1, section 11.1.1.3.

3.1.1.5 Marsa Oum El-Rakham

Located 320 km west of Alexandria, Oum El-Rakham was the site of a survey conducted by INA-Egypt and SCA which revealed several different amphorae types (Haldane 1998; Khalil 2002:17–18; Knapp and Demesticha 2017:17–18). No photography has been undertaken of the amphorae located there, but some representative images of the types located were recorded in their preliminary report (Haldane 1998). Most of the amphorae types are imported, except one local type as shown at (Table 3.3). What is a more, Canaanite amphora datable to fourteenth century BC from Syria and Palestine have been located at the adjacent land area (Alpözen, Berkaya and Özdaş 1995:63; Haldane 1996; Khalil and Moustafa 2002:527–528; Snape 2002:17–22).

Table 3.3 The amphorae types located at Marsa Oum El-Rakham.

Type	Origin	Region	Date	Period	Supply	Content	Amount
AE3 Late/ AE3T-2, variant B	Egypt	Egypt	4th AD to 5th AD	Late Roman	Local	Wine	1
LR 4	Gaza	Eastern Med.	3rd to 4th AD	Late Roman	Imported	Wine	1
Greco-Italic / Will form A2	Sicily	Central Med.	Mid-4th BC to 3rd BC	Hellenistic	Imported	Wine	1
LR 2	Chios/Knidos	Aegean	4th AD to 6th AD	Late Roman	Imported	Wine	1
LR 1	Cilicia	Eastern Med.	early 5th AD to late 7th AD	Late Roman	Imported	Wine	1
LR4	Palestine	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine	1
Agora K 114	Italy	Central Med.	1st BC to 3rd AD	Early Roman	Imported	Wine	1
Agora G 199	Cilicia	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine and olive oil	1
Chios	Chios	Aegean	4th BC	Hellenistic	Imported	Wine	1
Chain	Chios	Aegean	5th BC to 3rd BC	Pre-Hellenistic	Imported	Wine	1
Dressel 5	Kos	Aegean	1st BC to 2nd AD	Early Roman	Imported	Wine	1

3.1.1.6 Marsa Bagoush

Bagoush Bay is located 260 km west of Alexandria. Abdel Aleem (1996:100) first investigated this site in 1968 and found a number of complete and fragmentary amphorae covered with concretion, encrustation and coral. That area consists of a number of bays, the largest of which is Bagoush Bay, which extends 900 metres from east to west, and 300 metres from north to south and reaches a maximum depth of 12 metres. Bagoush Bay was mentioned by Claudius Ptolemy in his work *Geography*, under the name of Zygris (Abdel Aleem 1996:100). It serves as a shelter due to its location between two headlands that are a series of surface and underwater rocks. These headlands serve as a shelter and safe anchorage for trading vessels, but at the same time, represent a significant hazard to sailing vessels while entering the port during storms and heavy seas.

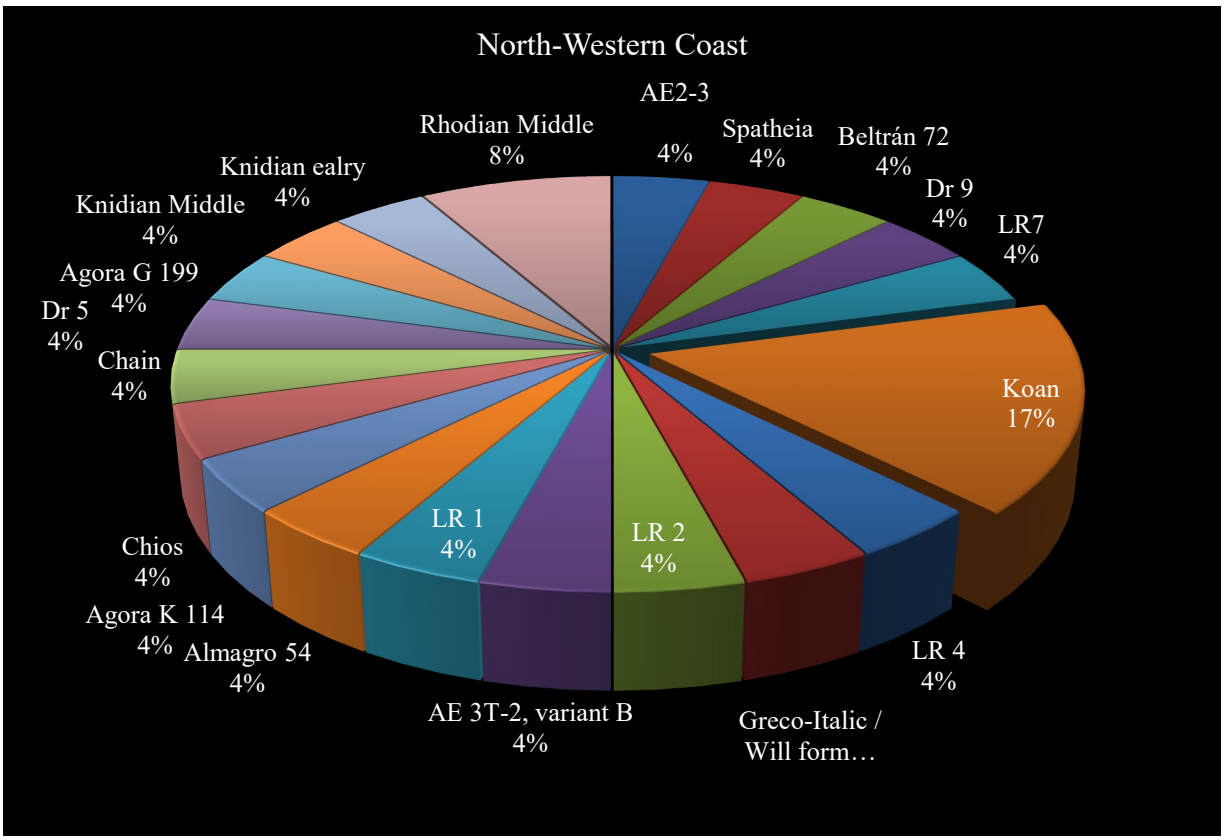


Figure 3.2 The percentage of amphorae types located along the North-Western coastline (excluded Marsa Bagoush).

Marsa Bagoush was a small, ancient but active port in use during the Hellenistic and Roman period; it served as a shelter as it is located between two headlands (Abdel Aleem 1996:140). Abdel Aleem noted that the north coast was used as agricultural land for producing grain and grapes during the Roman period. He particularly mentioned that there were cisterns excavated in the bedrock along the coastline, used to save water for that purpose.

In 1996, a limited survey was undertaken by INA-Egypt and SCA, revealing a number of Egyptian amphorae datable to the first to fourth centuries AD and a Knidian amphorae dating to the end of the second century BC (see Appendix 1). In 2015, CMAUCH in collaboration with the Central Department of Underwater Antiquities (CDUA), started a survey in that bay that included a detailed 3D recording. They located two groups of broken amphorae, as follows:

- One group was in the north of the bay (spot no. B), datable to early Roman period. The initial typology for this group of amphorae is AE3 and AE4. According to Khalil (2016), around 100 amphorae datable to the early Roman period have been located at Bagoush, ranging between AE3 and AE4, which is the Egyptian imitation of the Italian Dressel 2-4. Those types were made at the Mareotis region during the first century AD. The vessel transporting them probably left Alexandria to one of the Mediterranean harbours.

Alternatively, the vessel was on its return voyage to Alexandria with refilled or even empty amphorae.

- The other group is located outside the bay to the north-east (area no. E), and datable to the Hellenistic period. The type of amphora in that area was AE2 and datable to the end of the second century BC.

Haldane (1996) stresses that the location of the amphorae remains in shallow water was the main reason they were under threat from waves, swell and currents, which mix and scatter the remains. This is elucidated by the existence of different types of amphorae belonging to different periods of time. Also, Douglas (1996) suggests that the individual pieces might be discarded in a cleaning process while waiting for the next voyage in the harbour. Khalil (2016) agrees with this suggestion and noted that Marsa Bagoush in particular contains remains from more than one single shipwreck. Furthermore, he claimed that the different unique fragments, which were located separately, are probably jetsam from ships, which indicates the use of this harbour by vessels passing along the coast in ancient times. Furthermore, the amphorae remains indicate that Bagoush Bay was in use for trading vessels during the Hellenistic and Roman periods.

In 2017, CMAUCH and CDUA recovered the amphorae fragments for onsite study, consisting of cleaning, photographing and taking initial measurements, before returning them to a safe and protected spot underwater. Emad Khalil (the director of CMAUCH) provided the author with the photographs, measurements and detailed maps of the site. A detailed study has been undertaken by the author in order to identify the amphora typology, date, origin, distribution areas and contents. See Appendix 1, section 11.1.1.4. The results showed 29 different types of amphorae have been located (Figure 3.3), 12 of which are local production as shown in Table 3.4.

Table 3.4 The Egyptian amphorae types located at Marsa Bagoush.

Type	Origin	Region	Date	Period	Supply	Content	Amount
AE2	Egypt	Egypt	2nd BC	Hellenistic	Local	Wine	1
AE2-3 [5]	Egypt	Egypt	Late 2st BC	Hellenistic	Local	Wine	5
AE 3-1.5 Variant B	Egypt	Egypt	2nd AD – 3th AD	Mid. Roman	Local	Wine	3
AE 3-2, Variant A	Egypt	Egypt	1st AD to 2nd AD	Early Roman	Local	Wine	2
AE3-I.4	Egypt	Egypt	1st AD to 3rd AD	Early Roman	Local	Wine	1
AE3 Late/ AE3T-2, Variant B	Egypt	Egypt	4th AD to 5th AD	Late Roman	Local	Wine	1

[5] AE2-3 is the transition type between AE2 and AE3 (Dixneuf 2011:93).

Type	Origin	Region	Date	Period	Supply	Content	Amount
AE3 Late/ AE 3T-3.2, Variant B	Egypt	Egypt	7th AD to 8th AD	Islamic	Local	Wine	2
AE 5/6	Egypt	Egypt	5th AD	Late Roman	Local	Wine	1
AE8-2 [6]	Egypt	Egypt	7th AD to 8th AD	Islamic	Local	Wine	1
Bailey O 17	Egypt	Egypt	9th AD	Islamic	Local	Unknown	1
Bailey V 17-18	Egypt	Egypt	6th AD to 8th AD	Islamic	Local	Wine	1
Bailey W26-8	Egypt	Egypt	9th AD to 10th AD	Islamic	Local	Water- dried food	1

The imported amphorae were sourced widely from the Mediterranean basin, as shown in Table 3.5.

Table 3.5 The imported amphorae types located at Marsa Bagoush.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Dressel 2-4	Pompeii	Central Med.	End of 1st BC to the mid-2nd AD	Early Roman	Imported	Wine	3
Knidian Middle	Knidos	Aegean	1st BC	Hellenistic	Imported	Wine	1
Knidian Late	Knidos	Aegean	1st AD to 3th AD	Early Roman	Imported	Wine	1
Dressel 2-4 Imitated Pompeiian shape	Uncertain	_____	End of 1st BC to the mid-2nd AD	Early Roman	Imported	Wine	1
Agora G 197	Crete	Aegean	1st AD	Early Roman	Imported	Wine	1
Dressel 2-4 Imitated Campanian shape	Uncertain	_____	1st AD to 2nd AD	Early Roman	Imported	Wine	1
Late Roman 4	Gaza	Eastern Med.	4th AD to 6th AD	Late Roman	Imported	Wine	1
Brindisi	Brindisi	Central Med.	2nd BC to 1st BC	Hellenistic	Imported	Olive Oil	1
Greco-Italic / Will Form A1	Sicily	Central Med.	Mid-4th BC to 3rd BC	Hellenistic	Imported	Wine	1
Greco-Italic Will Form A2	Sicily	Central Med.	Mid-4th BC to 3rd BC	Hellenistic	Imported	Wine	2
Rhodian Early	Rhodes	Aegean	Mid-4th BC to 3rd BC	Hellenistic	Imported	Wine	1
Subgroup Late Roman 13 close to Peacock &	Cyprus	Eastern Med.	6th AD to 8th AD	Islamic	Imported	Unknown	1

6 This is an imitation of LR7/AE7 (Dixneuf 2011:174–179).

Type	Origin	Region	Date	Period	Supply	Content	Amount
Williams Class 54							
Günsenin 2	Chalcis	Aegean	10th AD to 11th AD	Islamic	Imported	Unknown	1
Globular	Uncertain	_____	7th-8th AD	Islamic	Imported	Wine	2
Unidentified							3

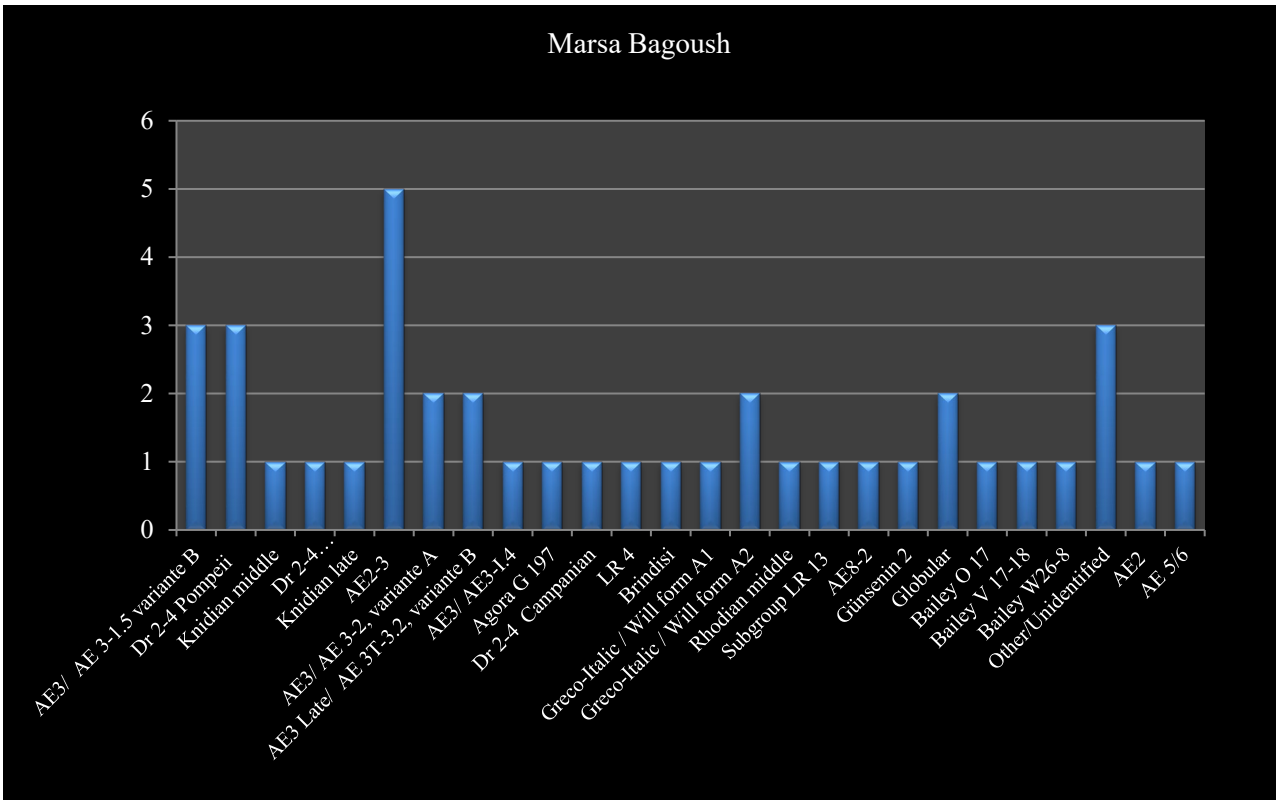


Figure 3.3 The amphorae types located at Marsa Bagoush.

3.1.2 The Alexandrian Coastline

The Alexandrian coastline is rich with shipwrecks and discarded cargo sites, and while no wooden remains have been located at 90% of the following sites, many amphorae fragments have. These sites are discussed from the east, starting with the Aboukir site and ending with Western Harbour in the far west (Figure 3.4).

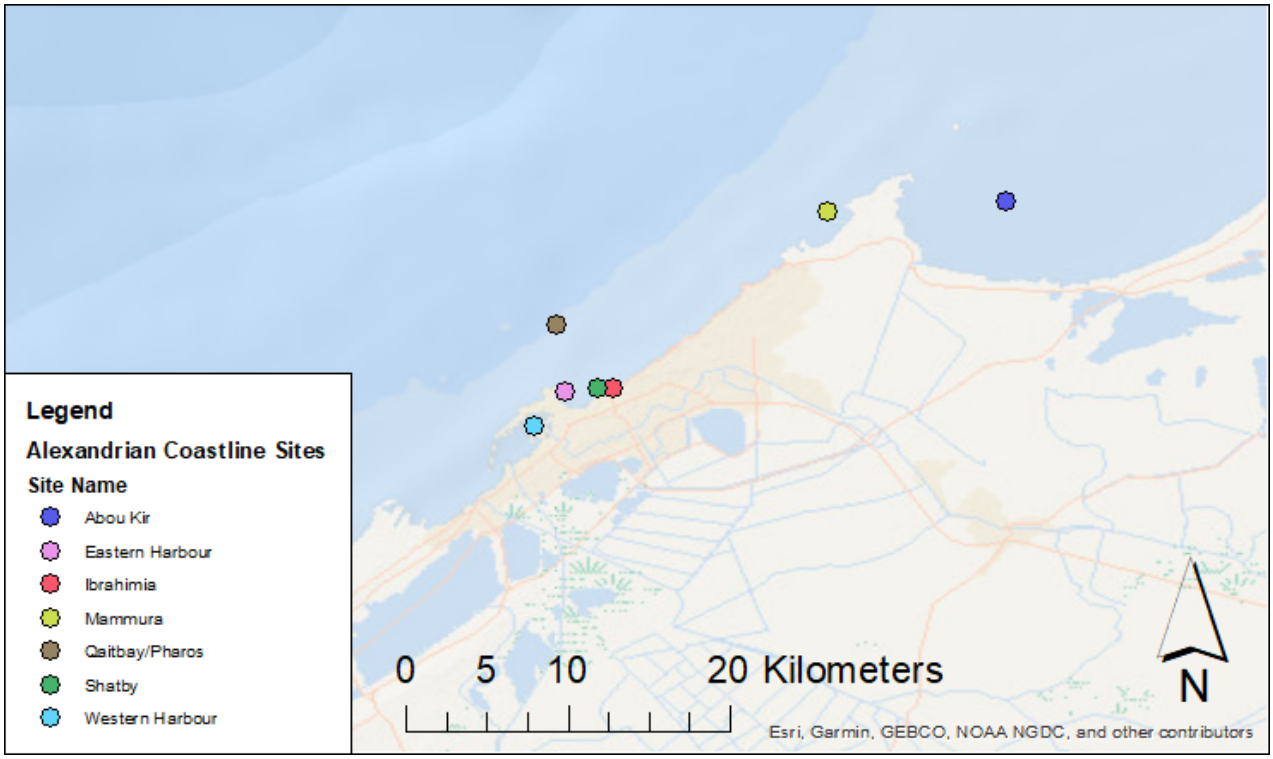


Figure 3.4 Alexandria Coastline amphorae sites. Map produced using ArcGIS® software by Esri.

3.1.2.1 Aboukir

Aboukir is located 30 km from the Eastern Harbour and was occupied by three ancient cites—Canope, Menouthis and Thonis Heracleion—the last of which was one of the main harbours along the coastline, in use since the eighteenth century BC until the eighteenth century AD. Thonis Heracleion was located six km from the coast at a depth ranging between five to seven metres. The harbour and the city were submerged due to the collapse that happened to the Western Delta as a result of the massive earthquake that hit Alexandria at 365 AD (Abd-el-Maguid 2012:197; Elsayed 2012:119; Goddio and Clauss 2006:75; Grataloup 2010:157–158). The Institut Européen d'Archéologie Sous-Marine (IEASM), in collaboration with SCA, have conducted ongoing surveys and excavations since 1992 in the Aboukir area. The main aim was to locate the missing sites using extensive geophysical and topographical surveys. Detailed georeferenced maps have been produced for the entire area which show the location of the different artefacts such as statues, ruins, coins, jewels, anchors, 60 shipwrecks, ceramics, and metal tools from as early as the Pharaonic to the Byzantine period (Elsayed 2012:121–122; Darwish and Abd-el-Maguid 2002:885; Khalil and Moustafa 2002:527).

On the one hand, Goddio (2007; 2010:3–11) concentrated on the topographical survey conducted at the Aboukir site, the results of the geophysical survey, and some maps of the amphorae locations. The ongoing survey and excavation revealed a considerable number of local and imported ceramics, including fine wares, cooking wares and amphorae, datable from the Saite to the Hellenistic and

Roman periods (Grataloup 2010:151; 2014:137–160). On the other hand, publications on several shipwrecks located at Abukir Bay provide only general considerations, but also ignore potential evidence from amphorae remains found in association. Other observations combined with even preliminary studies, provide a more complete picture, and bolster these studies (Belov 2014a, 2014b, 2014c, 2015a, 2015b; Fabre 2015; Fabre and Belov 2011; Sandrin, Belov and Fabre 2013).

Goddio and Clauss (2006:332–348) highlighted the ceramics located in the Aboukir area. Their review deals with the ceramics in general without a close examination of the amphorae in terms of the imported and local fragments. Nevertheless, Grataloup (2010:151–159) contributed her detailed review of the ceramics located at Aboukir. Grataloup divided the entire area and discussed the ceramics located at each spot. The author concentrated only on the amphorae fragments and excluded the fine wares and cooking wares, then the amphorae collected from each spot were considered as located at Aboukir in general to provide a larger view of the amphorae located there (Figure 3.5).

Limited information relating to the amphorae located and their types is provided by Goddio and Clauss (2006:340), Goddio and Fabre (2006:215, 334) and Grataloup (2010:151–159). Further, Table 3.6 shows the amphorae types located at this site. See Appendix 1, section 11.1.2.1 for more information. In addition, some Rhodian stamped amphorae handles have been located by Grataloup (2010:151–159).

Table 3.6 The amphorae types located at Aboukir.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Samian	Samos	Aegean	6th BC	Pre- Hellenistic	Imported	Wine	1
Lesbian	Lesbos	Aegean	4th BC	Hellenistic	Imported	Wine	1
Klozomenai	North Ionian Asia Minor	Aegean	6th BC	Pre- Hellenistic	Imported	Unknown	2
Chios	Chios	Aegean	4th BC	Hellenistic	Imported	Wine	1
Milesian	Miletus	Aegean	6th BC to 5th BC	Pre- Hellenistic	Imported	Wine	1
Chiote	Sicily	Central Med.	6th BC to 5th BC	Pre- Hellenistic	Imported	Olive oil	1
Basket-handle Type 3	Cyprus	Eastern Med.	5th BC to 4th BC	Pre- Hellenistic	Imported	uncertain	1
Thasos	Thasos	Aegean	5th BC 4th BC	Pre- Hellenistic	Imported	Wine	1
Mendean	Mende/France	Western Med.	6th B.C to 4th B.C.	Pre- Hellenistic	Imported	Wine	1
Persian Torpedo	Phoenician coast	Eastern Med.	5th BC to 6th BC	Pre- Hellenistic	Imported	fish	1
Koan	Kos	Aegean	4rd BC to 3rd BC	Hellenistic	Imported	Wine	1

Type	Origin	Region	Date	Period	Supply	Content	Amount
Knidian Early	Knidos	Aegean	3rd BC to 2nd BC	Hellenistic	Imported	Wine	1
Rhodian Middle	Rhodes	Aegean	Late 2nd BC	Hellenistic	Imported	Wine	5
LR4	Palestine	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine/ Olive oil/ Sesame oil	1
AE2	Egypt	Egypt	2nd BC	Hellenistic	Local	Wine	1
Greco-Italic/ Will Form A2	Sicily	Central Med.	2nd half of 4th BC	Hellenistic	Imported	Wine	1

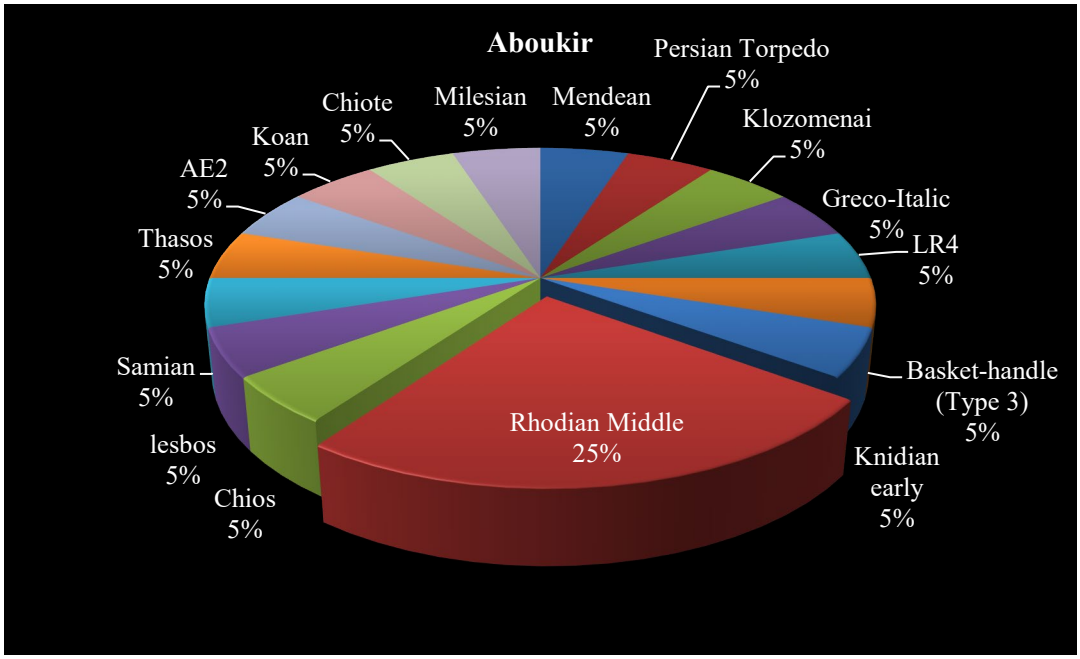


Figure 3.5 The amphorae types located at Aboukir Bay.

It is worth noting that an advanced study conducted by Grataloup (2014:137–160), who reviewed the ceramics located at Aboukir, highlighted the potential connections between Aboukir and other Mediterranean countries. However, Grataloup ignored the amphorae in particular and focused only on the fine and cooking wares. In her discussion she provided charts for all the ceramics located at Aboukir in general, in terms of locality, provenance, age and their specific find spot. One chart mentions the number of amphorae located (20) but fails to include their types. Finally, Belova (2011:107–118) notes that 40% of the shipwrecks located at Aboukir bay are datable to the Hellenistic period and 40% are datable to late Roman and beyond. Hence, further excavations at these unique shipwreck sites would reveal much more amphorae evidence.

3.1.2.2 Mammura

Mammura is located 25 km to the east of the Eastern Harbour and the General Department of Underwater Antiquities in the Ministry of Antiquities (GDUA) has carried out underwater visual surveys there over the years between 1999 and 2002. This site was located by fishermen and was known to recreational divers, who guided the maritime archaeologists to the exact spot and provided them with more information about the site. The area in general contains fish tanks, anchors, a cluster of rocks (mooring points), a wreck 420 metres from the coast in a depth of 7 metres and 94 amphorae located 150 metres from the wreck and 330 metres from the coast. The reports concentrated on recording the structure of the fish tanks and provided detailed measurements of the anchors along with drawings of some of the amphorae. Only two pieces of amphorae were recovered and stored in the ministry's storages and the rest have been drawn underwater and remain *in situ* (Abd-el-Maguid 2002:1, 2012:200, 2015: 115; Elsayed 2012:159; GDUA 1999, 2000, 2001, 2002; Khalil 2002:17–18).

According to the preliminary reports (GDUA 1999, 2000, 2001, 2002), two groups of amphora have been located comprising 60 amphorae and ranging between complete containers and fragments. Some of these amphorae were drawn and an initial typology assigned to some of them. The first group contains 37 amphorae identified as Kapitan II (third century AD to fourth century AD), and a group of various types of imported amphorae datable to the Hellenistic to late Roman periods (Table 3.7, Figure 3.6 and Appendix 1, section 11.1.2.2).

Table 3.7 The amphorae types located at Mammura.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Kapitan II	Asia Minor	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine	37
Africana 2B Grande	Tunisia	Central Med.	3rd AD	Mid. Roman	Imported	Olive oil	1
Africana 2D Grande	Tunisia	Central Med.	End of 3rd AD	Mid. Roman	Imported	Fish sauce	1
Cyrenaican	Libya	Central Med.	4th BC to 3rd BC	Hellenistic	Imported	Wine	1
Agora G 199	Cilicia	Eastern Med.	1st AD to 2th AD	Early Roman	Imported	Wine and olive oil	1
Rhodian Early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Olive oil or wine	3
Rhodian Middle	Rhodes	Aegean	Late 2nd BC	Hellenistic	Imported	Wine	1
Knidian Early	Knidos	Aegean	3rd BC to 2nd BC	Hellenistic	Imported	Wine	2
Late Roman 4	Gaza	Eastern Med.	4th AD to 6th AD	Late Roman	Imported	Wine, olive oil and sesame oil.	1

Type	Origin	Region	Date	Period	Supply	Content	Amount
Late Roman 1	Cilicia	Aegean	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	2
Günsenin 1	Marmara Sea (Turkey)	Aegean	10th AD to 11th AD	Islamic	Imported	Unknown	1
AE3 Late/ AE 3T-2, Variant B	Egypt	Egypt	4th AD to 5th AD	Late Roman	Local	Wine	1

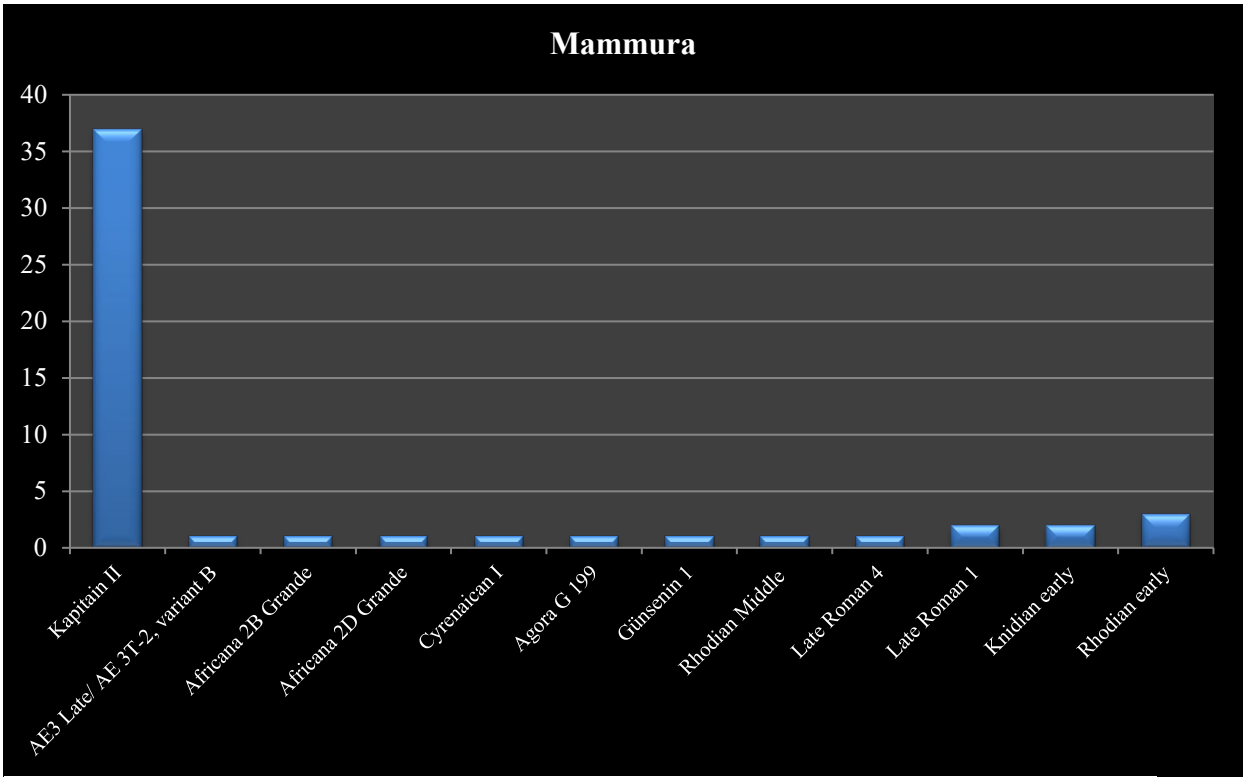


Figure 3.6 The amphorae types located at Mammura amphorae site.

Elsayed (2012:159–162) and Abd-el-Maguid (2015:116) suggest that the Kapitain II amphora belong to the cargo of a wreck located there and the other group might be discards from passing vessels or fell into the water accidentally during the loading and unloading process, particularly the second group of amphorae located close to one of the mooring clusters. In the other hand, Khalil (2002:17–18) proposes that Mammura was used as a 'stop over' and a shelter for the passing vessels coming from the west and going to the south through the Canopic Branch (Nile branch). These vessels were seeking protection from strong winds and rough seas and may also have loaded or discharged cargo. Mammura has also been suggested as a harbour and a fish farm (Abd-el-Maguid 2002:1, 2012:201, 2015:116; Elsayed 2012:162).

3.1.2.3 Ibrahimia

The Ibrahimia site is located 450 metres from the coastline, at a depth ranging between 13 to 15 metres and is comprised of a reef and a sandy area. According to Tzalas (2009:352–356, 2010), up to 60 stone anchors and 34 amphorae fragments have been located at this site, recovered, conserved and stored at the Hellenic storage at CDUA. The initial measurements undertaken for some of these fragments and suggested typology and dates have been mentioned in their preliminary reports. This site is referred to in the HIAMAS preliminary reports as Ibrahimia 3. In general, the HIAMAS preliminary reports about the survey at Shatby and Ibrahimia concentrate on the anchors and other building structure remains, recording the changes in the coast every year, and contain little study or close observation of the amphorae remains. The typology conducted by the author revealed the imported types shown in Table 3.8 and Figure 3.7. See also Appendix 1, section 11.1.2.3.

Table 3.8 The amphorae types located at Ibrahimia.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Dressel 20	Spain	Western Med.	1st AD to 3rd AD	Early Roman	Imported	Olive oil	2
Tripolitanian I	Libya	Central Med.	1st AD to 2nd AD	Early Roman	Imported	Olive oil	2
Tripolitanian III	Libya	Central Med.	3rd AD	Mid. Roman	Imported	Olive oil	1
Greco-Italic Will Form A2	Sicily	Central Med.	4th BC to 2nd BC	Hellenistic	Imported	Wine	1
Dressel 23	Spain	Western Med.	3rd AD to 4th AD	Mid. Roman	Imported	Olive products	1
AE 8-1, Variant B	Egypt	Egypt	Mid 7th to mid-8th AD	Islamic	Local	Uncertain	1
Unidentified							26

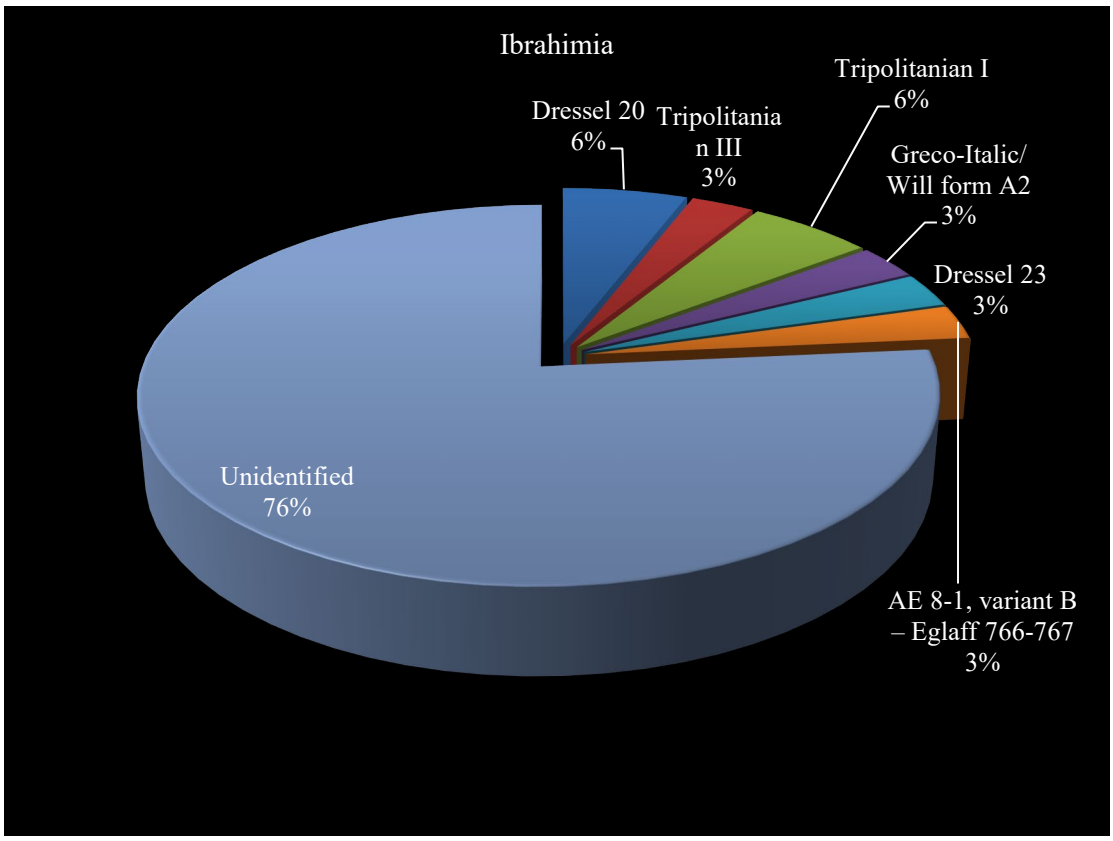


Figure 3.7 The amphorae types at Ibrahimia amphorae site.

3.1.2.4 Shatby

Shatby is located close to the Eastern Harbour, adjacent to the eastern side of it. Two subsites have been located at Shatby by the Hellenic Institute of Ancient and Medieval Alexandrian Studies (HIAMAS) (Shatby 1 and Shatby 2). Some structural artifacts and remains of ancient buildings and Hellenistic temples have been located at Shatby 1; however, the amphorae fragments, some anchors and structural remains of a Christian church have been located at Shatby 2, which is the concern of this thesis. Shatby 2 is located in the area extending to the south of Shatby 1 at a depth ranging between 1 to 5 metres (Tzalas 2006, 2011, 2012a, 2012b). According to Tzalas (2003:74: 2006), the amphorae located there are datable to the Late Roman and Islamic periods, and locating shipwrecks in this area is common due to the proximity to the Eastern Harbour. Further study by the author revealed early period remains, some datable to the Hellenistic period. The diversity of the amphorae types located, which cover a huge time period from the Hellenistic period to the Islamic Period, support the hypothesis that they belonged to more than one shipwreck.

The amphorae fragments were recovered, conserved and stored at the Hellenic storage at CDUA, and preliminary dimensions, typology and dates were suggested for a few fragments by the team of HIAMAS, under the direction of Harry Tzalas (Tzalas 2012a, 2016a). Furthermore, coordinates of

the amphorae fragments have been provided in the (HIAMAS) preliminary reports (Tzalas 2011, 2012, 2016a, 2016b). The typology conducted by the author revealed the following imported and local types shown in Table 3.9. (see Figure 3.8 and Appendix 1, section 11.1.2.4):

Table 3.9 The amphorae types located at Shatby.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Dressel 2-4	Pompeii	Central Med.	End of 1st BC to the mid-2nd AD	Early Roman	Imported	Wine	2
Agora M 54	Cilicia	Eastern Med.	Second half of 1st AD	Early Roman	Imported	Wine	1
Africana I	Tunisia	Central Med.	2nd AD to 4th AD	Mid. Roman	Imported	Olive oil	1
Dressel 20	Spain	Western Med.	1st AD to 3rd AD	Early Roman	Imported	Olive oil	2
Rhodian late	Rhodes	Aegean	Late 1st AD to 2nd AD	Early Roman	Imported	Wine	1
Lamboglia II	Italy	Central Med.	1st BC	Hellenistic	Imported	Olive oil	1
Beltrán 2A	Spain	Western Med.	1st BC to the 2nd AD	Early Roman	Imported	Fish products	1
Rhodian Early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Wine	1
AE3 Late/ AE 3T-3.2, Variant B	Egypt	Egypt	7th AD to 8th AD	Islamic	Local	Wine	1
Unidentified							2

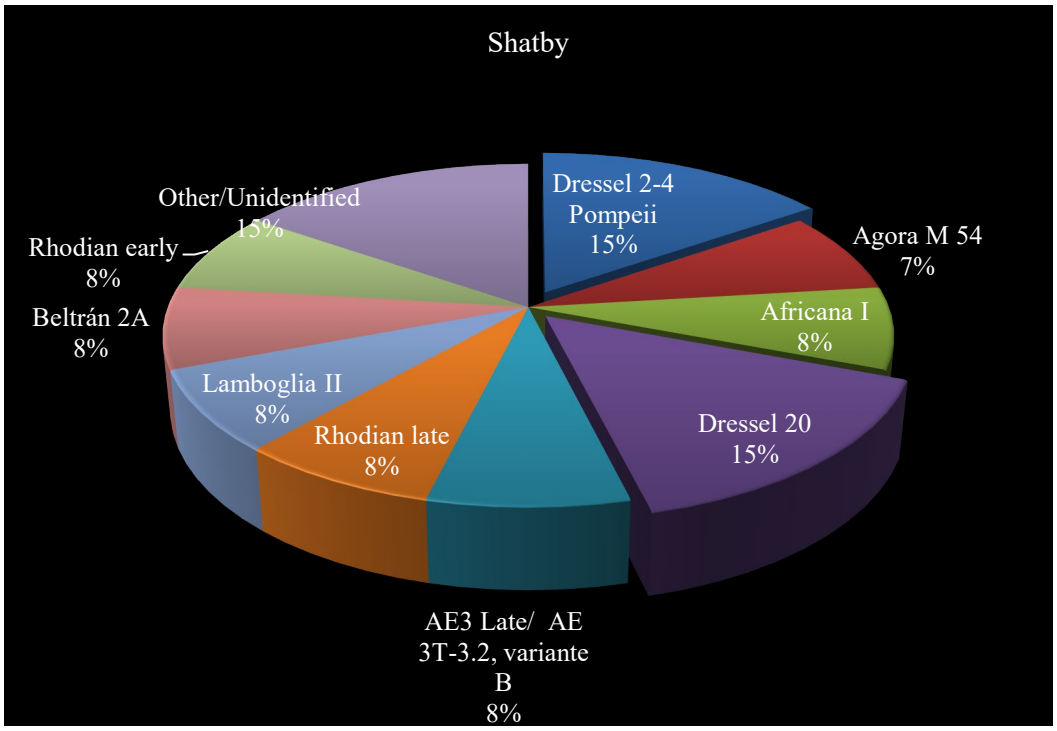


Figure 3.8 The amphorae types located at Shatby amphorae site.

3.1.2.5 Eastern Harbour

IEASM, in collaboration with SCA, conducted a topographical and geophysical survey and excavation of the Eastern Harbour to trace and record the configurations and remains of ancient buildings and marine infrastructure, as well as conducting a stratigraphic study. Ceramic finds have been identified along with statues, huge blocks, remains of buildings and wooden elements (Goddio et al. 1998). Furthermore, an intact shipwreck, called the Antirhodus wreck, has been located in the middle of the harbour. A radio carbon date of this wreck suggests that it dates to the early Roman period (first century BC to first century AD) (Abd-el-Maguid 2012:196–197; Elsayed 2012:101–104; Goddio et al. 1998:41; 2002:60–62; Khalil and Moustafa 2002:525). According to Sandrin, Belov and Fabre (2013), no amphorae remains dating to the early Roman period of the first century BC to the first century AD were located in or close to the Antirhodos wreck. Darwish and Abd-el-Maguid (2002:884) believe the vessel was discharging cargo during or before sinking, or it was already empty when it sank, which may explain the absence of amphorae fragments in this site. Nevertheless, excavations undertaken in the area around Antirhodos Island revealed amphorae datable from the Hellenistic to the late Roman period, although no photos, drawings or recordings of any types have been provided in their publication (Goddio et al. 1998:41).

According to Goddio and his co-authors (1998:51), an enormous number of ceramics ranging from fine wares to table and cooking wares have been located along with amphorae at several parts of the harbour. Their volume contains a study of the located statues and building remains, while the amphorae remains are noticeably absent. In the same token, Goddio and Clauss (2006) concentrate on studying the architecture and ruins, and provide photographs, initial dimensions, descriptions, typology, dates and the current place with an inventory number of a limited number of the amphorae located there. Moreover, maps containing the location of the ceramics and amphorae have been provided. As for the amphorae types, they are reported at Table 3.10. See figure 3.9 and Appendix 1, section 11.1.2.5.

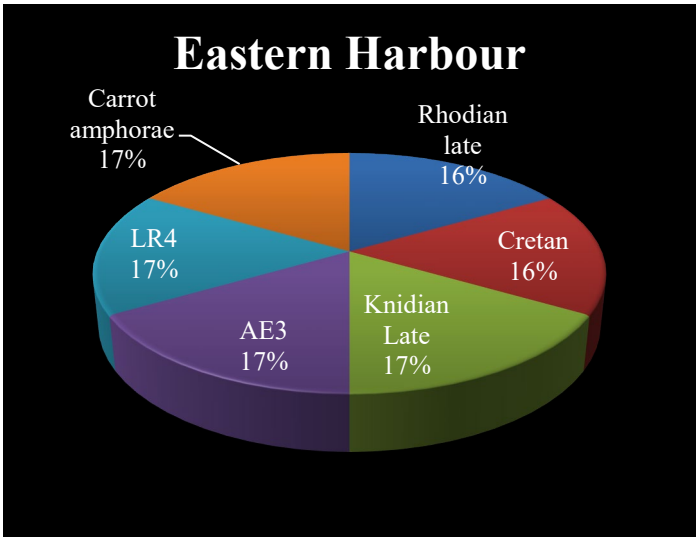


Figure 3.9 The amphorae types located at the Eastern Harbour.

Table 3.10 The amphorae types located at Eastern Harbour

Type	Origin	Region	Date	Period	Supply	Content	Amount
Rhodian Late	Rhodes	Aegean	1st AD to 2nd AD	Early Roman	Imported	Wine	1
Cretan	Crete	Aegean	1st AD to 3rd AD	Early Roman	Imported	Wine	1
Knidian Late	Knidos	Aegean	1st BC	Early Roman	Imported	Wine	
Camulodunum 189 (Carrot)	Beirut/ Palestine	Levant	1st BC to 2nd AD	Early Roman	Imported	Unknown	
AE3	Egypt	Egypt	1st AD to 3rd AD	Early Roman	Local	Wine	
LR4	Gaza	Levant	4th AD to 7th AD	Late Roman	Imported	Wine	

3.1.2.6 Qaitbay/Pharos

The Centre d'Études Alexandrines (CEAlex), in collaboration with SCA, are conducting ongoing excavations of the Qaitbay Fort underwater site. Their mission reports include the diving operations, the methods or devices used to locate the artefacts, recovery operations, etc. As for the amphorae remains located there, an initial typology has been mentioned (Empereur 1997:831–847, 1998b:611–638). In the same manner, La Riche (1997) dedicated a volume to the recovery operations conducted at Qaitbay Fort in 1995 of the statues and massive remains of ancient

buildings in an event attended by the Minister of Culture at that time and other media organisations and the general public. No mention at all was made of the amphorae remains.

Four shipwrecks have been located 350 metres outside the Eastern Harbour, but close to the entrance (Figure 3.10). The majority of the seabed in this area is rocky which does not help to protect the wooden ship hulls. Also, the shallow water played another role in disturbing and destroying these shipwrecks. For these reasons no wooden remains have been located and the main artefacts were amphorae and some anchors and other utensils. Amphorae remains have been located at three sites as discussed below (Figure 3.11) (Abd-el-Maguid 2012:198; Empereur 1998a:244, 2000a:59; Khalil 2002:29).

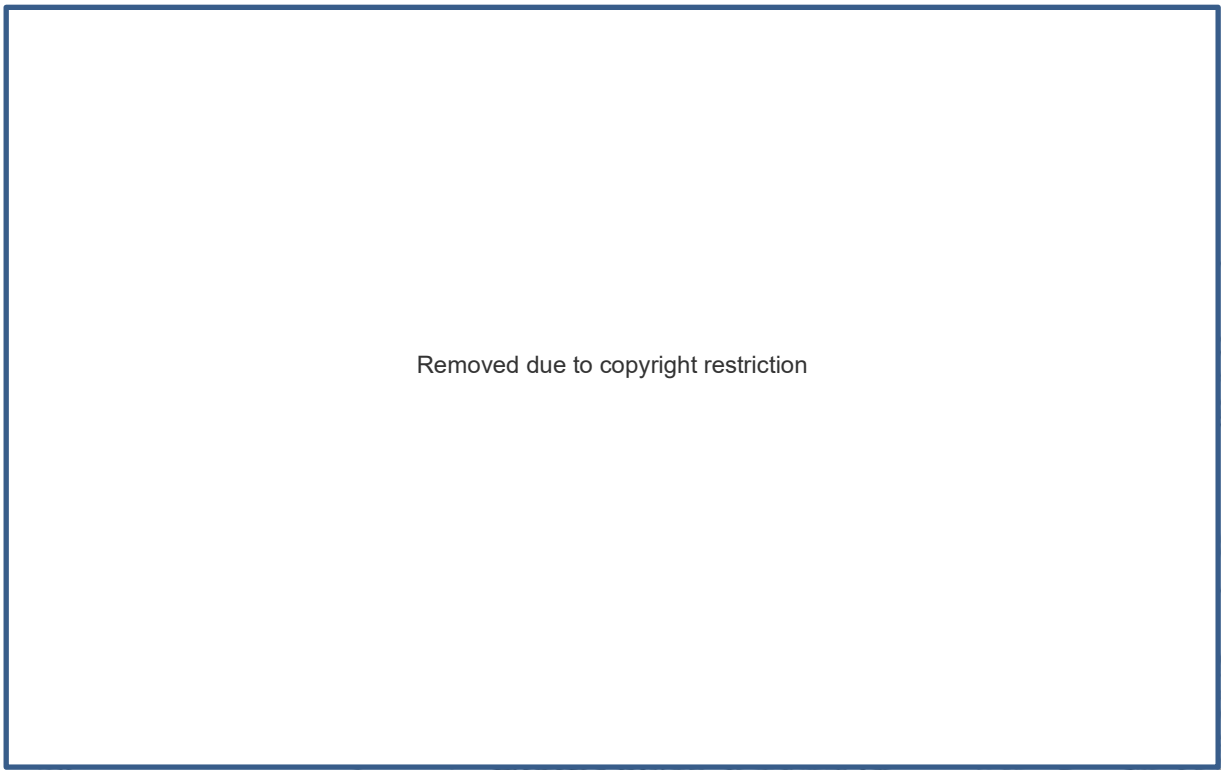


Figure 3.10 Location of Qaitbay shipwrecks (From Elsayed 2012:60, Fig. 125)

Qaitbay 1 shipwreck

This shipwreck is located 100 metres to the north of Qaitbay Fort at 11 metres depth. The cargo is composed mainly of two amphorae types (Table 3.11). This wreck dates to the middle of the 1st century BC. No trace of wood has been found to date and the study of amphorae discovered during excavations on this site is still on-going at the Centre d'Études Alexandrines (CEAlex) (Elsayed 2012:96; Empereur 1998a:244, 1998b:615, 1999:546, 2000b:601, 2002a:619, Nicolas Boichot pers.comm. 2017; Williams, K. 2004:143).

According to Elsayed (2012:97), another wreck located 50 metres east of Qaitbay 1 contains some amphorae and lots of utensils for everyday use by sailors. Khalil and Moustafa (2002:525) suggest that this site might belong to the Qaitbay 1 shipwreck. [7]

Table 3.11 The amphorae types located at Qaitbay 1 shipwreck.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Lamboglia II	Adriatic coast	Central Med.	1st BC	Hellenistic	Imported	Olive oil	495
Dressel 6A	Italy	Central Med.	Late 1st BC to mid-1st AD	Early Roman	Imported	Wine/Olive oil	10

Qaitbay 2 shipwreck

This shipwreck is located 650 metres north-east of Qaitbay Fort at 17 metres depth. The cargo consists of 100 complete Rhodian amphorae (second century BC to first century BC) (Elsayed 2012:97; Empereur 1998b:615–616, 1999:547, 2000b:603, 2001:683, 2002a:619; Khalil and Moustafa 2002:525; Williams, K. 2004:144). Cretan amphorae have been located which are datable to the first century to the third century AD as well as some local and imported types (Majcherek 2007b:9–11) (Table 3.12).

Table 3.12 The amphorae types located at Qaitbay 2 shipwreck

Type	Origin	Region	Date	Period	Supply	Content	Amount
AE2-3	Egypt	Egypt	Last quarter of the 2st BC	Hellenistic	Local	Wine	5
Greco-Italic Will Form A2	Italy	Central Med.	Mid-4th BC to 3rd BC	Hellenistic	Imported	Wine	5
Rhodian Early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Wine	100
Rhodian Middle	Rhodes	Aegean	Late 2nd BC	Hellenistic	Imported	Wine	17
Dressel 2-4 Pompeiian shape	Pompeii	Central Med.	End of 1st BC to the mid-2nd AD	Early Roman	Imported	Wine	5
Sinope	Greece	Aegean	3th AD to 4th AD	Mid. Roman	Imported	Wine	5
LR3	Western Asia Minor	Aegean	4th AD to 6th AD	Late Roman	Imported	Unknown	2

[7] The amphorae located at these four sub-sites have been merged together in Appendix 1 under the main site entitled Qaitbay/Pharos (see chart 8).

Qaitbay 3 shipwreck

This shipwreck is located 450 metres north of Qaitbay Fort at 17–20 metres depth. The cargo consists of a large number of Late Roman 1 type amphorae (Table 3.13). As previously mentioned, no wood remains had survived due to the rocky seabed (Khalil and Moustafa 2002:525).

Table 3.13 The amphorae types located at Qaitbay 3 shipwreck.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Late Roman 1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	50

Qaitbay 4 shipwreck

The fourth shipwreck is located ten km west of Qaitbay Fort and includes a cargo of blocks of limestone, although no wooden or amphorae remains have been recorded there (Abd-el-Maguid 2012:198; Empereur 2000b:603, 2001:683).

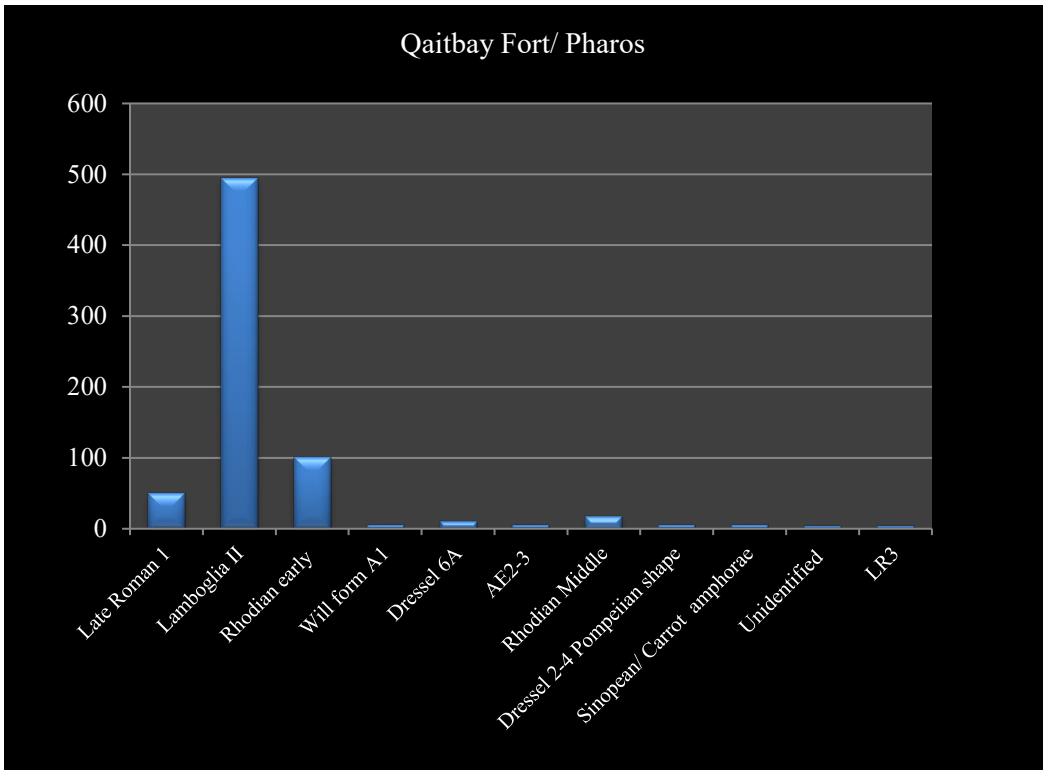


Figure 3.11 The amphorae types located at Qaitbay Fort/Pharos.

3.1.2.7 Western Harbour

A number of surveys have conducted by the Russian Institute of Egyptology in Cairo (RIEC) in collaboration with SCA at Western Harbour since 2003 and progress annually. The survey includes geomorphological and geophysical investigation aimed at identifying the ancient harbour construction and at mapping the entire site. Some amphorae along with other artefacts have been located, indicating the presence of a shipwreck called *El Fara* at eight to ten metres depth. Only

four amphorae fragments have been recovered for photography and measurement and returned to their spot underwater. The RIEC report provides initial typology, dates and descriptions for a few of the fragments (Belova, Ivanov and Belov 2014; Belova et al. 2015; GDUA 2007). The author completed the typology of these fragments and revealed that all of them are imported amphorae from the Aegean region (Table 3.14 and Figure 3.12). Also see Appendix 1, section 11.1.2.6.

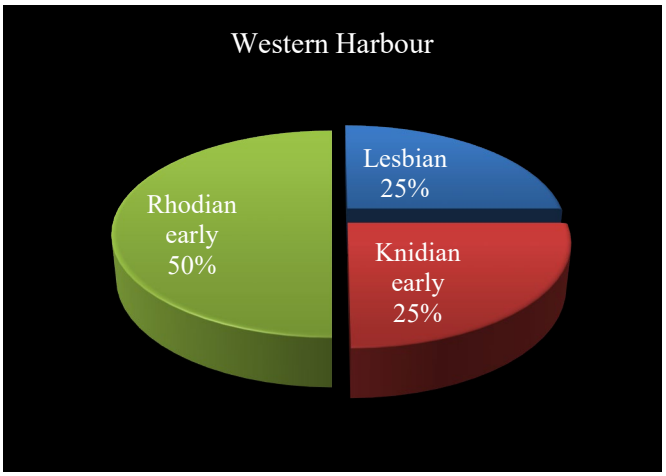


Figure 3.12 The amphorae types located at the Western Harbour.

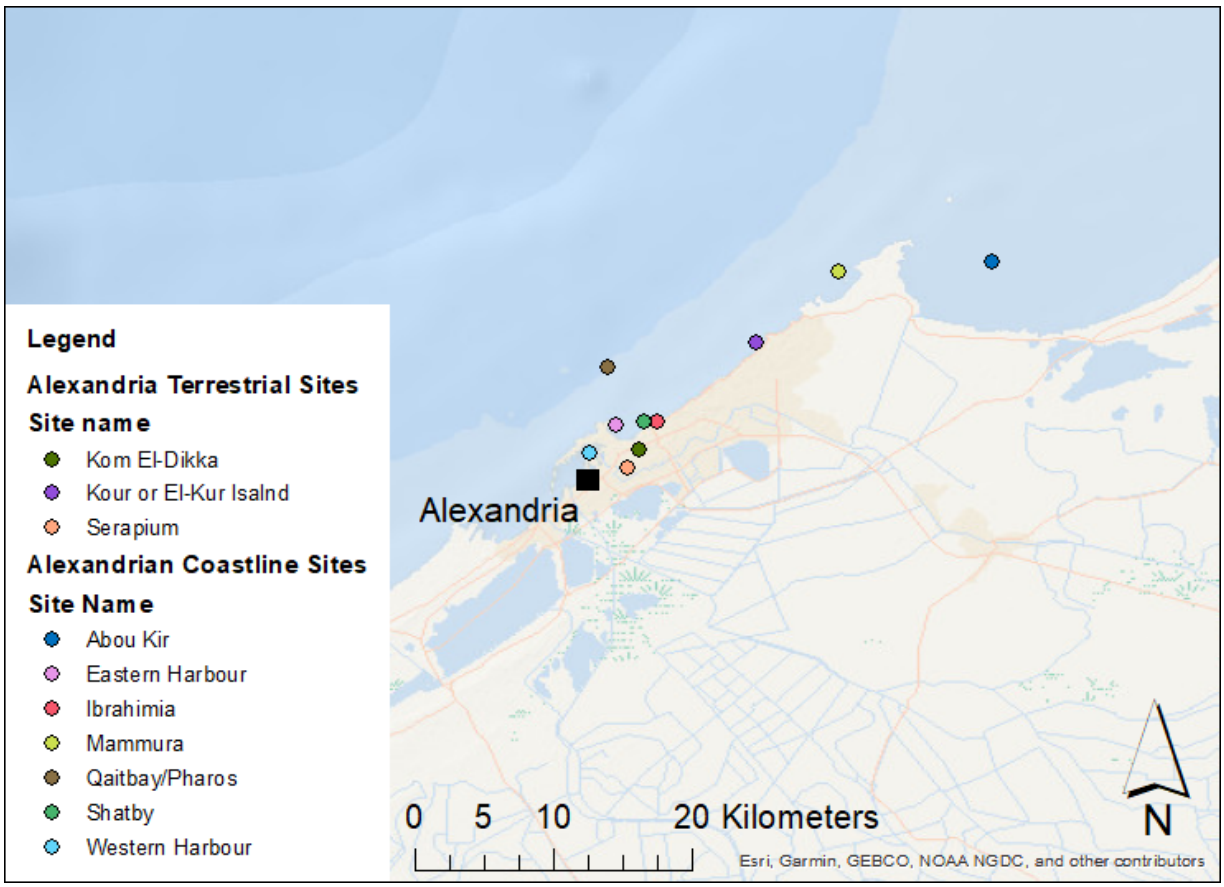
Table 3.14 The amphorae types located at Western Harbour.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Lesbian	Lesbos	Aegean	4th BC	Hellenistic	Imported	Wine	1
Knidian Early	Knidos	Aegean	3rd BC to 2nd BC	Hellenistic	Imported	Wine	1
Rhodian Early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Wine	2

3.2 The Terrestrial Sites[8]

The terrestrial sites where amphorae are found represent a significant quantity of data; each one of the following sites could inform an entire thesis by itself. Hence, the following sections merely highlight the essence of each site and focus on the amphorae located in terms of the types, time periods, origins/sources and content if any (Figure 3.13).

[8] The tables below are not provided with the amount of each type located at the terrestrial sites due to the lack of this type of information except for Serapium, Gabbari Necropolis and Mareotic Region.



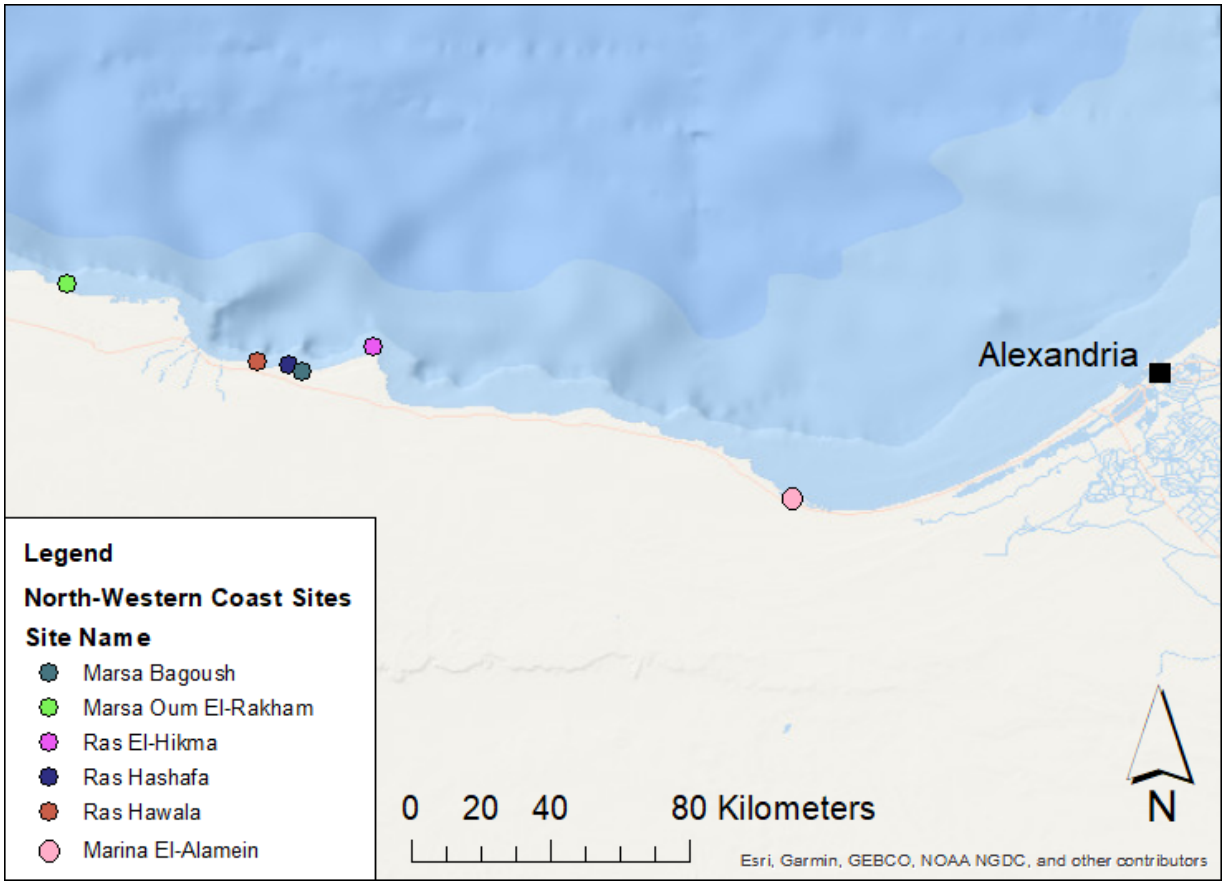


Figure 3.13 The terrestrial amphorae sites locations integrated with the underwater amphorae sites. Maps produced using ArcGIS® software by Esri.

3.2.1 The Terrestrial Sites at Alexandria

3.2.1.1 Kour Island

This island is parallel to and around 150 metres from the coast, and ten km from Eastern Harbour, and extends to 250 metres in length and 55 metres wide. The highest point on the island is around four metres above sea level (Ragheb 2010:413; Tzalas 2009; 2016). It is currently called Miami Island, although it has had other names like Gabal El Kour or Geziret Gabal El Kour. Gabal is an Arabic word meaning mountain, but this island was not even a hill. This is the reason why Tzalas argues the origin of the name and believes that it should be called Gezirat Gabr El Kour and not Gabal el Kour. Regardless of which of these names are correct, the main concern is the amphorae located there. This island was connected to the land during the Roman period and used as a cemetery, fish farm and quarry, but sea water has flooded large parts of the quarries (Elsayed 2012:166; Ragheb 2010:412–418; Tzalas 2010, 2016). Topographical and archaeological surveys have been undertaken by HIAMAS and SCA to investigate and map the structure and record the artefacts and fragments (Elsayed 2012:143–145; Tzalas 2009, 2010, 2014, 2016). SCA separately conducted an advanced survey that concentrated on identifying some submerged quarries and the structural remains of the fish farms and basins. According to Elsayed (2012:165) and Ragheb (2010:412–418), fragments of amphorae have been located (Table 3.15). See Appendix 1, section 11.1.3.2.

Table 3.15 The amphorae types located at Kour Island.

Type	Origin	Region	Date	Period	Supply	Content	Amount
LR1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	
LR3	Western Asia Minor	Eastern Med.	4th AD to 6th AD	Late Roman	Imported	Unknown	
LR7/AE7	Egypt	Egypt	4th AD to 7th AD	Late Roman	Local	Wine	

3.2.1.2 Serapium

According to Empereur (2002:39–84), the Serapium is one of the unique archaeological sites in Alexandria; it was a Greek temple datable to the Hellenistic period constructed by Ptolemy III and lasted until the fourth century AD. Imported, local and previously unidentified amphorae fragments were identified as follows (Table 3.16). See also Figure 3.14.

Table 3.16 The amphorae types located at Serapium.

Type	Origin	Region	Date	Period	Supply	Content	Amount
LR1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	6

Type	Origin	Region	Date	Period	Supply	Content	Amount
LR3	Western Asia Minor	Eastern Med.	4th AD to 6th A.D.	Late Roman	Imported	Unknown	5
LR4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	6
Keay 25	Tunisia	Central Med.	4th AD to 5th AD	Late Roman	Imported	Olive Oil	16
Keay 35	Tunisia	Central Med.	5th AD to 6th AD	Late Roman	Imported	Olive Oil	1
Keay 8B	Tunisia	Central Med.	5th AD	Late Roman	Imported	Olive Oil	6
Keay 36	Tunisia	Central Med.	5th AD to 6th AD	Late Roman	Imported	Olive Oil	1
Keay 45	Tunisia	Central Med.	6th AD	Late Roman	Imported	Olive Oil	1
Africana I	Tunisia	Central Med.	2nd AD to 4th AD	Mid. Roman	Imported	Olive Oil	1
Africana II	Libya/Tunisia	Central Med.	2nd AD to 3rd AD	Mid. Roman	Imported	Wine/Fish sauce	3
AE3	Egypt	Egypt	1st BC to 3rd AD	Early Roman	Local	Wine	5
AE3 Late	Egypt	Egypt	4th AD to 5th AD	Late Roman	Local	Wine	5
LR7-AE7	Egypt	Egypt	4th AD to 7th AD	Late Roman	Local	Wine	6

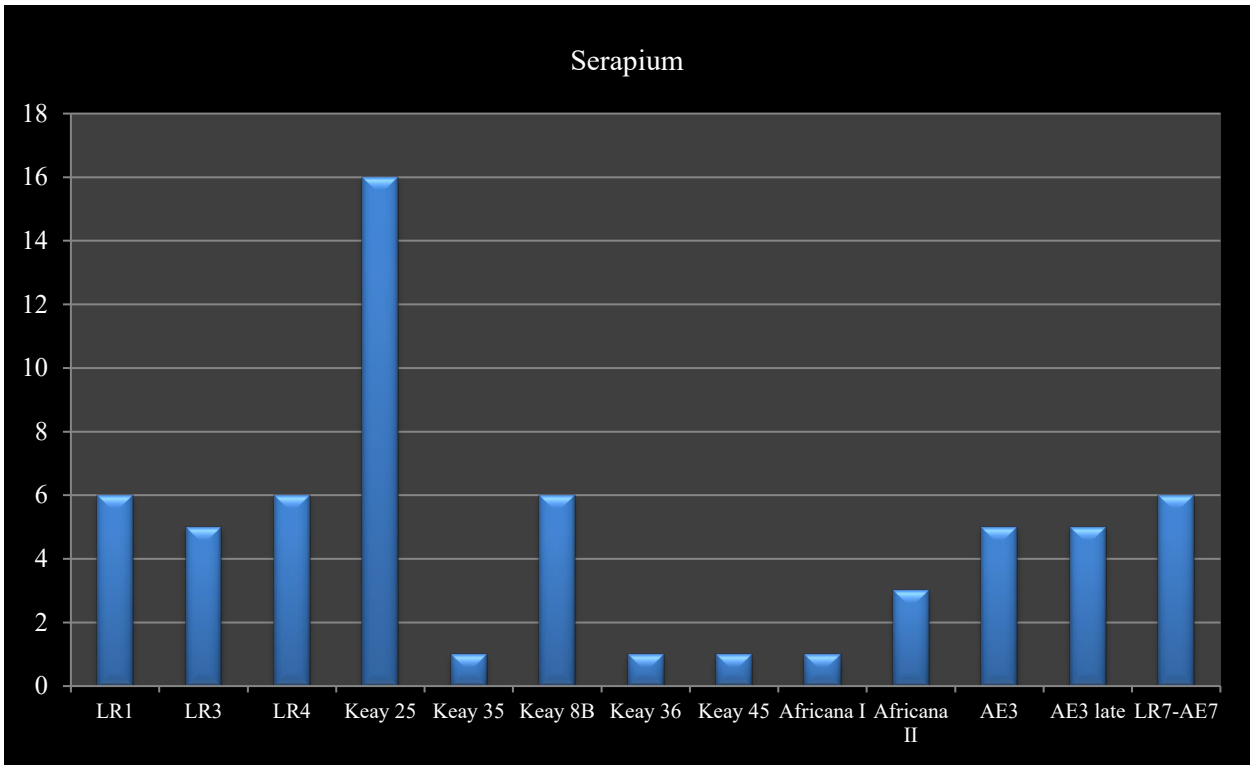


Figure 3.14 The amphorae types located at Serapium site

It is worth noting that the usage of these amphorae was for storing and preserving food as mentioned in the previous chapter.

3.2.2.3 Kom El-Dikka

Kom El-Dikka is one of the richest terrestrial archaeological sites in Alexandria dating to the Roman period (end of the first century BC to the fifth AD) and is located at the current city centre of Alexandria. An extensive continuous excavation was conducted by the Polish Centre of Mediterranean Archaeology, University of Warsaw (PCMA UW) from1988 until 2011. The excavations revealed houses, tombs, baths, cisterns, Roman mosaics, theatre and auditoria, along with local and imported amphorae fragments (Table 3.17) (Majcherek 2004:229–235, 2010:75–89).

Table 3.17 The amphorae types located at Kom El-Dikka

Type	Origin	Region	Date	Period	Supply	Content	Amount
LR1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	
LR2	Chios/Knidos	Aegean	4th AD to 6th AD	Late Roman	Imported	Wine	
LR3	Western Asia Minor	Eastern Med.	4th AD to 6th AD	Late Roman	Imported	Unknown	
LR4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	
Kapitan II	Asia Minor	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine	
Agora M 273	Greece	Aegean	4th AD to 5th AD	Late Roman	Imported	Wine	
Spatheia	Tunisia	Central Med.	4th AD to 5th AD	Late Roman	Imported	Uncertain, possibly olives	
AE5/6-LR5/6	Egypt	Egypt	5th AD to 6th AD	Late Roman	Local	Wine	
LR7-AE7	Egypt	Egypt	4th AD to 7th AD	Late Roman	Local	Wine	
Kellia 172	Egypt	Egypt	7th AD to 8th AD	Islamic	Local	Wine	
Kellia 167	Egypt	Egypt	7th AD to 8th AD	Islamic	Local	Wine	

3.2.2.4 Rescue Terrestrial excavations

CEAlex, under the direction of Jean-Yves Empereur, conducted extensive rescue excavations at construction sites in Alexandria. The excavations were conducted at 8 different sites as follows: Diana Theatre (Empereur 1996:959, 1997:837–838, 1998b:617–618), Garden of the former British Consulate (Empereur 1997:838–841, 1998b:619), Majestic Cinema land (Empereur, Albert and

Olivier 1994:504–507), Radio Cinema land, Billiards land (Empereur, Albert and Olivier 1994:508–519), Cricket land (Empereur 1997:841–842, 1998:619–621), Lux land, Shatby Necropolis (Gankardes-Senol 2012:97–104) and Gabbari Necropolis (Empereur 1998b:622–630, 1999:549–559, 2000b:604–614, 2001:686–689, 2002b:615–626; Gankardes-Senol 2007:33–56; Senol 2003a:191–211, 2003b:467–484).

Based on studies conducted by Gankardes-Senol (2007:33–56) and Senol (2002a:191–211, 2002b:467–484), the imported amphorae located at the first eight sites are shown in Table 3.18.

Table 3.18 The amphorae types located at rescue terrestrial excavations.

Type	Origin	Region	Date	Period	Supply	Content	Amount
LR1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	
LR2	Chios/Knidos	Aegean	4th AD to 6th AD	Late Roman	Imported	Wine	
LR3	Western Asia Minor	Aegean	4th AD to 6th AD	Late Roman	Imported	Unknown	
LR4	Gaza	Levant	4th AD to 7th AD	Late Roman	Imported	Wine	
Agora M 54	Cyprus	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine/Fruit	
Agora K 109	Algeria	North Africa	3rd AD to 4th AD	Mid. Roman	Imported	Wine	
Agora K 114	Italy	Central Med.	1st AD to 3rd AD	Early Roman	Imported	Wine	
Agora G 199	Cilicia	Eastern Med.	1st AD to 2th AD	Early Roman	Imported	Wine/Olive oil	
Agora M 254	Libya	Central Med.	1st AD	Early Roman	Imported	Wine	
Agora M 273	Greece	Aegean	4th AD to 5th AD	Late Roman	Imported	Wine	
Spatheia	Tunisia	Central Med.	4th AD to 5th AD	Late Roman	Imported	Uncertain, possibly olives	
Knidian Early	Knidos	Aegean	3rd BC	Hellenistic	Imported	Wine	
LR7-AE7	Egypt	Egypt	4th AD to 7th AD	Late Roman	Local	Wine	
Rhodian Early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Wine	
Koan	Kos	Aegean	4rd BC to 3rd BC	Hellenistic	Imported	Wine	
Chios	Chios	Aegean	4th BC	Hellenistic	Imported	Wine	
Lamboglia II	Adriatic Coast	Central Med.	1st BC	Hellenistic	Imported	olive oil	
Kapitan II	Asia Minor	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine	

Type	Origin	Region	Date	Period	Supply	Content	Amount
Africana I	Tunisia	Central Med.	2nd AD to 4th AD	Mid. Roman	Imported	Olive oil	
Africana II	Libya/Tunisia	Central Med.	2nd AD to 3rd AD	Mid. Roman	Imported	Wine/Fish sauce	
Africana 2D Grande	Tunisia	Central Med.	End of 3rd AD	Mid. Roman	Imported	Fish sauce	
Pompeii V	Cilicia	Central Med.	1st AD to 2nd AD	Early Roman	Imported	Wine	
Dr 30	Algeria	North Africa	3rd AD	Mid. Roman	Imported	Wine	
Tripolitanian II	Libya	Central Med.	4th AD	Mid. Roman	Imported	Olive oil/fish sauce	
Tripolitanian	Libya	Central Med.	1st AD to 2nd AD	Early Roman	Imported	Olive oil	
Greco-Italic	Italy	Central Med.	4th BC to 2nd BC	Hellenistic	Imported	Wine	
Keay 52	Italy	Central Med.	4th AD to 7th AD	Late Roman	Imported	Wine	
Dr 2-4 (Campanian)	Campania	Central Med.	1st AD to 3rd AD	Early Roman	Imported	Wine	
Thasos	Thasos	Aegean	5th BC 4th BC	Pre-Hellenistic	Imported	Wine	
Dr 1	Italy	Central Med.	2nd BC 1st BC	Hellenistic	Imported	Wine	
Dr 5	Kos	Aegean	1st BC to 2nd AD	Early Roman	Imported	Wine	
Dr 6	Italy	Central Med.	1st BC to 1st AD	Early Roman	Imported	wine and garum	
Dr 7/11	Spain	Western Med.	1st BC to 1st AD	Early Roman	Imported	Fish sauce	
Dr 20	Spain	Western Med.	1st AD to 3rd AD	Early Roman	Imported	Olive oil	
Dr 21-22	Italy	Central Med.	1st BC to 1st AD	Early Roman	Imported	Fruit	
Dr 24	Western Asia Minor	Aegean	1st AD to 3rd AD	Early Roman	Imported	Unknown	
Brindisi	Italy	Central Med.	2nd BC to 1st BC	Hellenistic	Imported	Olive oil/wine	
Cretan	Crete	Aegean	1st AD to 3rd AD	Early Roman	Imported	Wine	
Pamphylian	Pamphylia	Aegean	1st BC to 4th AD	Early Roman	Imported	Wine	
Gauloise 4	France	Western Med.	1st AD to 3rd AD	Early Roman	Imported	Wine	
Samian	Samos	Aegean	6th BC	Pre-Hellenistic	Imported	Wine	
Sinope	Lebanon	Eastern Med.	3th AD to 4th AD	Mid. Roman	Imported	Wine	
Mendean	Macedonia	Aegean	6th BC to 4th BC	Pre-Hellenistic	Imported	Wine	

Type	Origin	Region	Date	Period	Supply	Content	Amount
Mana	Tunisia, Tripolitania	Central Med.	End of 3rd BC to 2nd BC	Hellenistic	Imported	Fish sauce	
Almargo 50	Portugal	Western Med.	3rd AD to 5th AD	Mid. Roman	Imported	Fish products	
Almargo 51	Portugal	Western Med.	3rd AD to 5th AD	Mid. Roman	Imported	Fish products	
Günsenin 1	Marmara Sea (Turkey)	Aegean	10th AD to 11th AD	Islamic	Imported	Unknown	
AE1	Egypt	Egypt	3rd BC	Hellenistic	Local	Wine	
AE2	Egypt	Egypt	2nd BC	Hellenistic	Local	Wine	
AE3	Egypt	Egypt	1st BC to 2nd AD	Early Roman	Local	Wine	
AE4	Egypt	Egypt	2nd AD	Early Roman	Local	Wine	
LR5/6-AE5/6	Egypt	Egypt	5th AD to 6th AD	Late Roman	Local	Wine	

As for Gabbari Necropolis, it dates to the Hellenistic period (third century BC) and was located during construction of a bridge; construction was stopped and the site handed to the team members of CEAlex to conduct a rescue excavation, which lasted for four years from 1997 to 2000. The cemetery contained lots of burial hollow squares on the walls, each closed with a slab made of limestone. The excavations recovered an enormous number of ceramics: oil lamps, painted jars and jugs, and amphorae. According to Senol (2000:369–396, 2002a:191–211, 2002b:467–484), a considerable number of local and imported amphorae were located at this Necropolis. See Table 3.19 and Figure 3.15. Furthermore, many amphorae stamps have been recovered belonging to Rhodain, Knidian, Chios and Koan types (Gankardes-Senol 2007:46–47).

Table 3.19 The amphorae types located at Gabbari Necropolis.

Type	Origin	Region	Date	Period	Supply	Content	Amount
LR1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	916
LR2	Chios/Knidos	Aegean	4th AD to 6th AD	Late Roman	Imported	Wine	4
LR3	Western Asia Minor	Aegean	4th AD to 6th AD	Late Roman	Imported	Unknown	36
LR4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	2063
LR5/6-AE5/6	Egypt	Egypt	5th AD to 6th AD	Late Roman	Local	Wine	464
LR7-AE7	Egypt	Egypt	4th AD to 7th AD	Late Roman	Local	Wine	83
Agora M 54	Cyprus	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine	9

Type	Origin	Region	Date	Period	Supply	Content	Amount
Agora G 119	Cyprus	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine	11
Spatheia	Tunisia	Central Med.	4th AD to 5th AD	Late Roman	Imported	Uncertain, possibly olives	1
Knidian Early	Knidos	Aegean	3rd BC	Hellenistic	Imported	Wine	124
Rhodian Early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Wine	2026
Koan	Kos	Aegean	4rd BC to 3rd BC	Hellenistic	Imported	Wine	157
Lamboglia II	Adriatic Coast	Central Med.	1st BC	Hellenistic	Imported	Olive oil	30
Africana I	Tunisia	Central Med.	2nd AD to 4th AD	Mid. Roman	Imported	Olive oil	349
Dr 1	Italy	Central Med.	2nd BC 1st BC	Hellenistic	Imported	Wine	38
Cretan	Crete	Aegean	1st AD to 3rd AD	Early Roman	Imported	Wine	32
AE2	Egypt	Egypt	2nd BC	Hellenistic	Local	Wine	751
AE3	Egypt	Egypt	1st BC to 2nd AD	Early Roman	Local	Wine	2589
AE4	Egypt	Egypt	2nd AD	Early Roman	Local	Wine	33

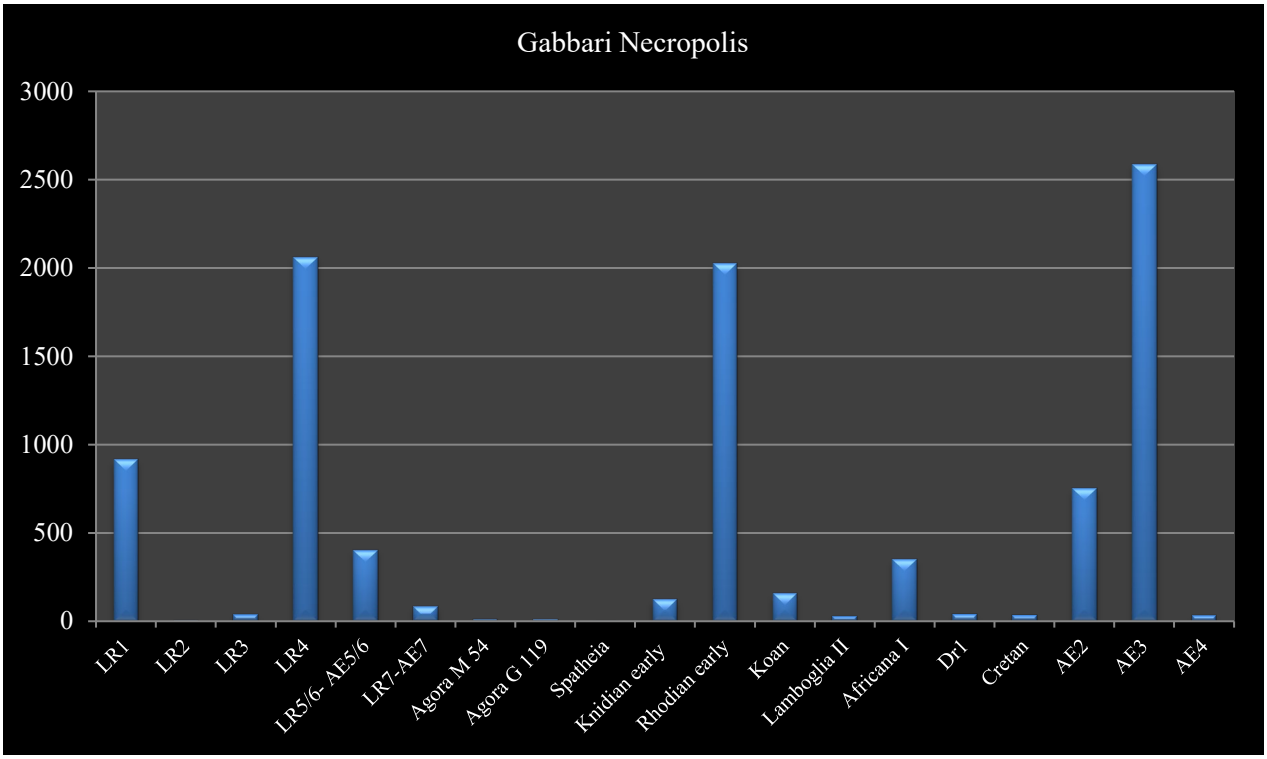


Figure 3.15 The amphorae types located at Gabbari Necropolis

3.2.2 The Terrestrial Sites at the Alexandrian Hinterland

3.2.2.1 Mareotic Region

The Mareotic Region was a massive production centre and a hub between the south and the north; lots of harbours, wineries, kilns, industrial workshops and cultivation areas for vines, grain, linen and papyrus all gathered in this one region located 65 kilometres southwest of Alexandria (Figure 3.16) (Empereur 1998:217–218; Empereur and Picon 1986:103–109, 1989:223–233, 1992:145–152, 1998:75–91; Khalil 2008:9–13, 2010:41–43; Hopkinson 2010:35; Rodziewicz 1998c:245–260).

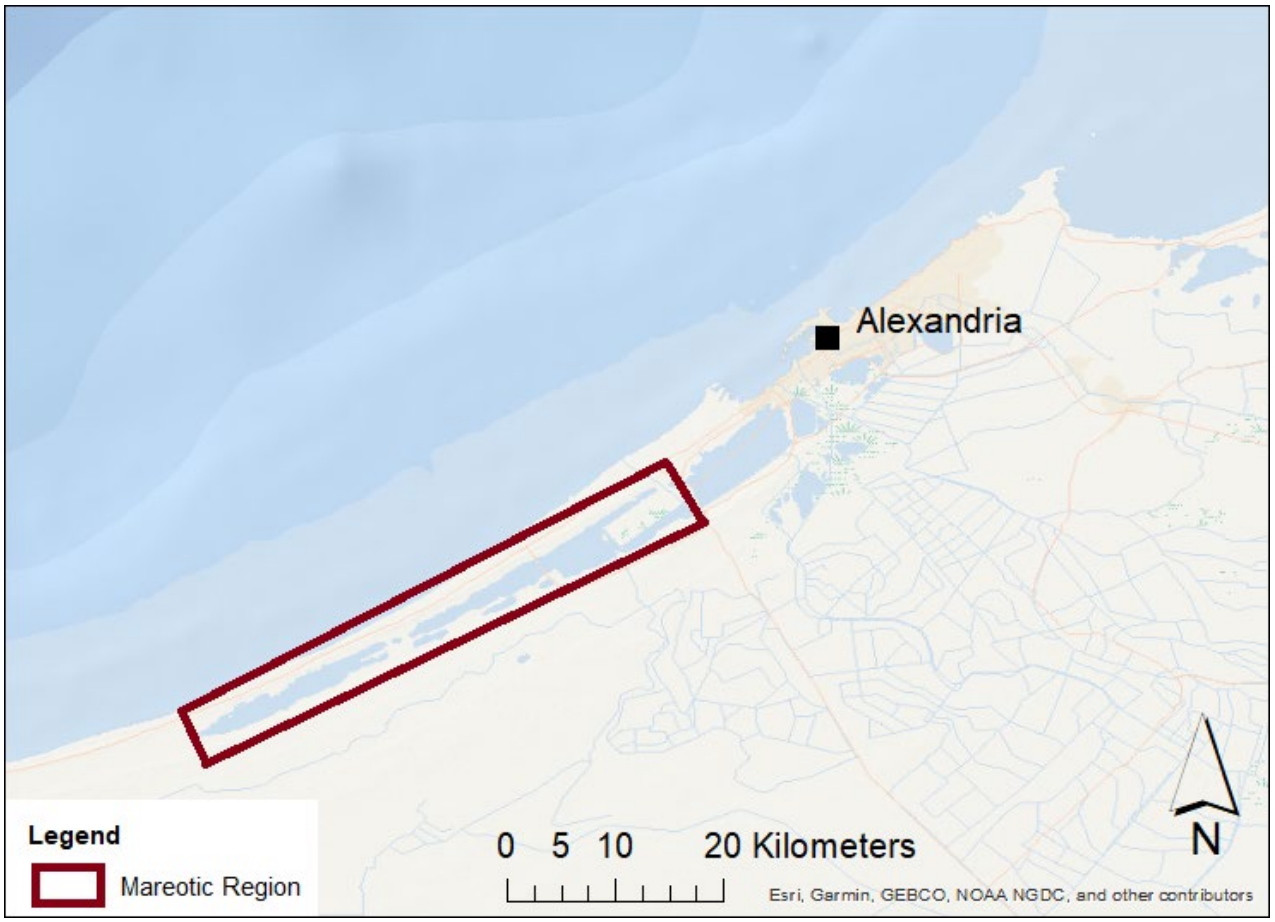


Figure 3.16 Location of Mareotic Region. Maps produced using ArcGIS® software by Esri.

Khalil (2008:9–13) mentions two towns that have been located along the shore of Lake Mareotis called Taposiris Magna and Marea, each associated with harbours. Khalil (2010:136) believes that these towns were significant during the Hellenistic until the late Roman periods based on the archaeological remains located there. Along with the harbours which contributed to the Alexandria prosperity as the same as or even more than the harbours along its coastline. Al-Falaki (1872:19–28) was the first archaeologist to investigate this area and conducted an initial survey of the western arm of Lake Mareotis until Taposiris Magna, which resulted in locating an enormous number of wineries, basins and water wheels. De Cosson (1935) and Blue and Khalil (2011:15–16) considered the Lake Mareotis research as a milestone. De Cosson contributed his description of the Mareotic

region in general, of its history through the pre-Hellenistic until the Islamic periods, of the industries allocated there and of the canals connecting the lake with the Nile and the sea. The University of Southampton, in collaboration with SCA, conducted an extensive survey and excavation research project between 2004 and 2009 at the western arm of the lake (Blue 2010:25–33; Blue and Kahlil 2011; Khalil 2010b:135–145). This project aimed to record the entire area, up to 70 sites dated to the Hellenistic to late Roman periods, by conducting topographical surveys, sedimentology study, and mapping of the archaeological remains like the remains of the harbour infrastructure, jetties, wells, cisterns, wheels, baths and waterfront facilities (Blue and Kahlil 2011; Khalil 2010a:41–42). According to Blue and Khalil (2011:113–290), the excavations conducted by Southampton University and SCA revealed number of imported and local ceramics (fine wares, coarse wares and amphorae) at each of the 70 sites.

The author extracted the amphorae finds located at each site and collected them in one complete table and chart. The repeating amphorae types have been deleted and the total of each type have been calculated and provided in a table. Based on this study, there were 3,548 local amphorae fragments located there in total and 2,957 imported amphorae fragments (Table 3.20 and figure 3.17).

Table 3.20 The amphorae types located at the western arm of Lake Mareotis.

Type	Origin	Region	Date	Period	Supply	Content	Amount
LR1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	1105
LR2	Chios/Knidos	Aegean	4th A.D to 6th AD	Late Roman	Imported	Wine	24
LR3	Western Asia Minor	Aegean	4th AD to 6th AD	Late Roman	Imported	Unknown	8
LR4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	221
LR5/6 – AE5/6	Egypt	Egypt	5th.AD to 6th AD	Late Roman	Local	Wine	44
LR7 – AE7	Egypt	Egypt	4th AD to 7th AD	Late Roman	Local	Wine	48
Egloff 169	Cilicia and Cyprus	Eastern Med.	4th AD	Late Roman	Imported	Olive oil/Wine	28
Kapitan II	Asia Minor	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine	7
Knidian early	Knidos	Aegean	3rd BC to 2nd BC	Hellenistic	Imported	Wine	345
Koan	Kos	Aegean	4th BC to 3rd B.C	Hellenistic	Imported	Wine	571
Rhodian early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Wine	373
Dressel 1A	Campania, Italy	Central Med.	2nd BC to 1st BC	Hellenistic	Imported	Wine	7

Type	Origin	Region	Date	Period	Supply	Content	Amount
Greco-Italic	Campania, Italy	Central Med.	4th BC to 2nd BC	Hellenistic	Imported	Wine	19
Thasos	Thasos	Aegean	5th BC 4th BC	Pre-Hellenistic	Imported	Wine	2
Chian	Chian	Aegean	5th BC to 3rd BC	Pre-Hellenistic	Imported	Wine	2
Agora M 54	Cilicia	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine/Fruit	2
Dressel 2-4	Cilicia	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine	1
Dressel 2-4	Campania	Central Med.	1st AD to 3rd AD	Early Roman	Imported	Wine	4
Dressel 4	Cilicia	Eastern Med.	1st AD	Early Roman	Imported	Wine	1
Pompeii V	Cilicia	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine	5
Africana II	Tunisia/Libya	Central Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine/Fish sauce	11
Tripolitanian II	Libya	Central Med.	4th AD	Mid. Roman	Imported	Olive oil/fish sauce	11
Africana 2D Grande	Tunisia	Central Med.	3rd AD to 4th AD	Mid. Roman	Imported	Fish sauce	8
Dr 30	Algeria	North Africa	3rd AD	Mid. Roman	Imported	Wine	13
AE1	Egypt	Egypt	3rd BC	Hellenistic	Local	Wine	1843
AE3	Egypt	Egypt	1st BC to 2nd AD	Early Roman	Local	Wine	6
AE4	Egypt	Egypt	2nd AD	Early Roman	Local	Wine	667
Mons Claudianus Type 2/12	Egypt	Egypt	NA	Early Roman	Local	Unknown	1
Mons Claudianus Type 22/3	Egypt	Egypt	NA	Early Roman	Local	Unknown	229

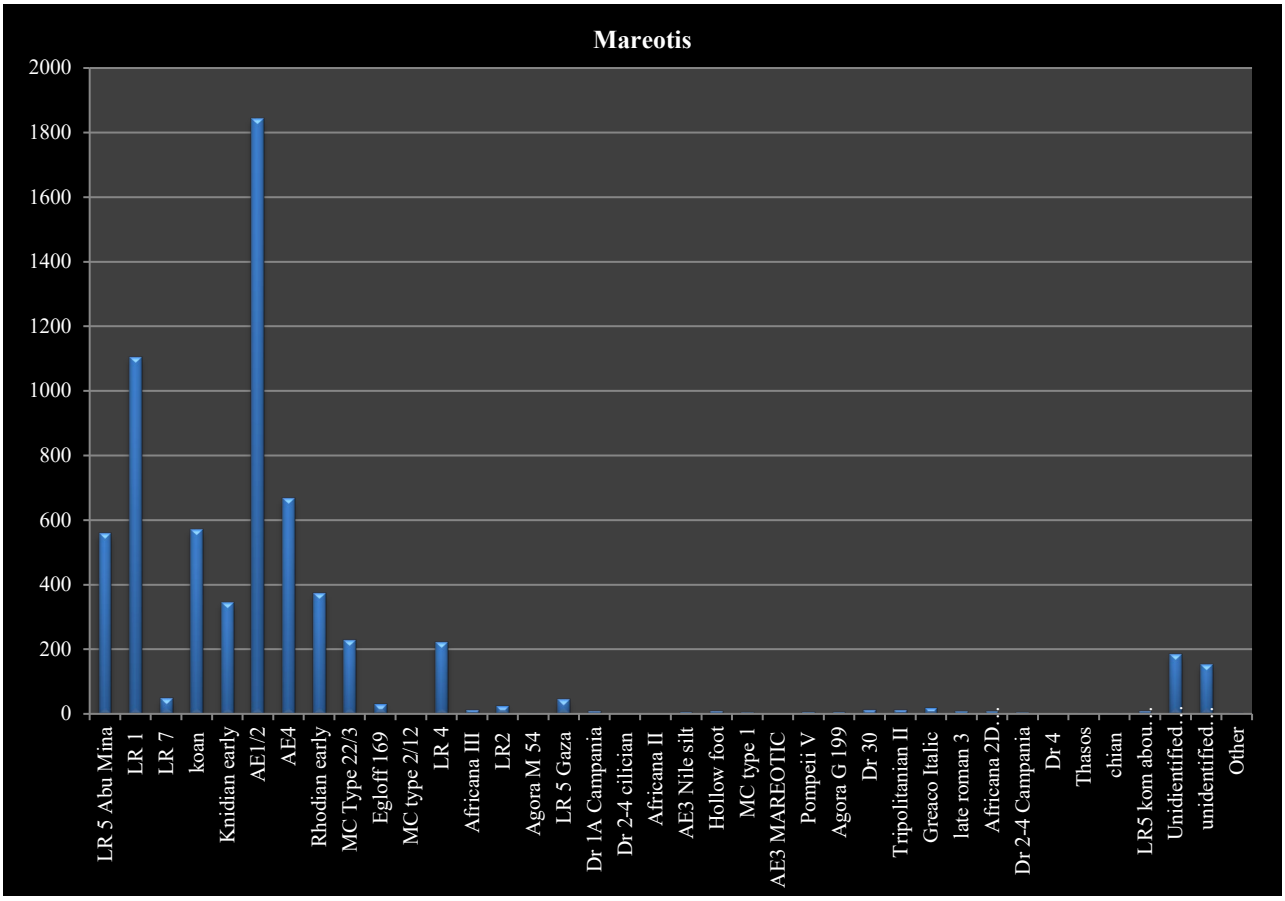


Figure 3.17 The amphorae types located at Mareotis.

The Lake Harbours

Taposiris Magna

Taposiris Magna is located along the north coast to the west of Lake Mareotis (Boussac and El Amouri 2010:87–105; Dixneuf 2011:105). El-Fakharani (1974:257–262) highlighted the remains of a lighthouse that could only be used as a cemetery during the Hellenistic period, and described two harbours located there. Nevertheless, the survey conducted by Blue and Khalil (2011:17) located one of these harbours. In the same token, CEAlex conducted excavations at Taposiris Magna, especially the lighthouse located there and the archaeological remains, which date from the Hellenistic until the Late Roman periods (Blue and Khalil 2011:22–23). As for the amphorae remains located at this spot, Boussac and El Amouri (2010:100–103) describe the amphorae types ranging between LR1, LR4, LR 5 (Gaza), Rhodian and Knidian amphorae, as well as the local AE7.

Schedia

A series of excavations were conducted at Schedia during 1981 and 1992 by SCA and from 2003 to 2005 by Institut für Klassische Archäologie der Universität Göttingen and the Fachgebiet für Klassische Archäologie der Technischen Universität Darmstadt (Germany) with the Deutsches Archäologisches Institut Kairo. According to Bergmann, Heinzelmann, and Martin (2010:115–116)

and Martin (2008:263–269), these excavations revealed numbers of local and imported amphorae. As for the local amphorae fragments, they belong to the following types: AE1, AE2, AE 3, AE3 late, AE 4 and AE 7. Table 3.21 shows the imported amphorae.

Table 3.21 The amphorae types located at Schedia

Type	Origin	Region	Date	Period	Supply	Content	Amount
Schöne-Mau V	___	Eastern Med.	Mid-1st AD to the mid-2nd AD	Early Roman	Imported	Wine	
Agora G197	Crete	Aegean	1st AD to 3th AD	Early Roman	Imported	Wine	
Zemer 36	Gaza	Eastern Med.	1st AD to the 3rd AD	Early Roman	Imported	Wine	
LR 1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	
LR 4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	

Marea

El-Fakharani (1983:175–186) was the first archaeologist to investigate the town of Marea and started a survey on behalf of Alexandria University from 1977 to 1981 on the Byzantine (late Roman) harbour with its four huge limestone jetties. Three harbours are identified by four huge limestone jetties, the remains of a lighthouse and signs of moorings; along with remains of a cemetery, basilica, shops, wineries and some ceramics sherds datable to the Byzantine period (late Roman) (Blue and Khalil 2011:17; Haggag 2010:47–56; Rodziewicz 2010:69–74).

Some limited excavations were carried out at Marea by the University of Boston from 1979 to 1990 (Haggag 2010:47–56) and continued in a larger scale by the PCMA UW under the direction of Grzegorz Majcherek from 2000 until 2011. These excavations revealed tombs, a Christian basilica, an oil press, water channels, a harbour with jetty remains, a pottery kiln and glass workshops (Babraj and Szymańska 2010:75–85; Babraj et al. 2010:55–78; Babraj, Drzymuchowska and Willburger 2014:45–62; Dixneuf 2011:104–105; Drzymuchowska 2008:97–101; Elsayed 2012:163; Khalil 2005:164–170; Szymańska and Babraj 2000: 45, 2007a:71–76). Other excavations undertaken by CEAlex at the Marea peninsula and its central part aimed at topographical, geophysical and archaeological surveys and excavations (Pichot 2010:57–66), along with the work of PCMA UW. CEAlex located a causeway datable to early Roman period (first century AD to third century AD), buildings and variety of ceramic sherds from the third century BC to the first century AD. Located evidence datable to the third century BC and the early Roman period confirms that Marea was in use prior to the Byzantine period (Pichot 2010:66). According to PCMA UW preliminary reports, the ceramics located there include oil-lamps, tableware, cooking wares and late

Roman and Islamic amphorae types (Table 3.22) (Babraj et al. 2010:55–78; Babraj, Drzymuchowska and Willburger 2014:55; Drzymuchowska 2008:97–101; Majcherek 2001:61; Szymańska and Babraj 2000:45).

Table 3.22 The amphorae types located at Marea.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Keay 62	Tunisia	Central Med.	5th AD to 7th AD	Late Roman	Imported	Fish sauce, Wine/Olive oil	
Spatheia	Tunisia	Central Med.	4th AD to 5th AD	Late Roman	Imported	Uncertain, traces of olives	
LR 1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	
LR 4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	
LR5/6-AE5/6	Egypt	Egypt	5th.AD to 6th AD	Late Roman	Local	Wine	
LR7-AE 7	Egypt	Egypt	4th AD to 7th AD	Late Roman	Local	Wine	
Kellia 167	Egypt	Egypt	7th AD to 8th AD	Islamic	Local	Wine	
Kellia 186	Egypt	Egypt	7th AD to 8th AD	Islamic	Local	Wine	

Mareotic Kilns

Khalil (2005:154–157) and Blue and Khalil (2011:19) reviewed the literature and the excavations conducted by CEAlex along the south coast of lake Mareotis, which revealed 28 to 30 amphorae kiln sites, identified by the enormous amount of amphorae sherds present (Empereur and Picon 1986: 103–109, 1989: 223–233, 1992: 145–152, 1998: 75–91; Pichot and Senol 2014: 225–239). These sites date to the Hellenistic and the Byzantine periods. Few kilns survived at Al-Amreya / Margham (second century AD to third century AD) and at Taposiris Magna (first century AD to third century AD) (Dixneuf 2011:105). The latter is considered the largest Roman kiln, which, due to its capacity, could produce up to 100 amphorae in one firing (Dixneuf 2011:100–101; Empereur 1998a:217–218; Rodziewicz 1998c:245–260).

No fixed maps have been produced for these kilns and this was the reason why Khalil (2002:154–157) attempted to relocate them, but the 28 to 30 kilns were apparently destroyed due to the lack of protection and public awareness of the importance of these sites, and he only identified 12 remaining kilns. Empereur and Picon (1998:83) believe that the concentration of kilns on this side of the lake might be due to the richness of this area with good clay, also the existence of the winery which was located close to the kilns at the south of the lake. Five other wineries are situated between Taposiris Magna and Marea. Pichot and Senol (2014:225–239) conducted a study at one of

the kiln sites (Academia) along the south coast of Mareotis lake, and the results revealed 1422 pieces of AE3 amphorae and 1495 pieces of AE4 amphorae. Another study was conducted by CEAlex at Margham's kiln (203 km south of Alexandria), which located local amphorae types ranging between AE 2, AE 4 and AE 3 (Dixneuf 2011:104). Dixneuf (2011:106) concludes that the extensive excavations conducted at the kilns provide direct evidence for the significance of this area from the Hellenistic period through the Roman period until the Islamic period.

By the same token, it is worth noting the local clay that was used in producing the Egyptian amphorae. Khalil (2005:152–153) reviews five Egyptian clays used in producing amphorae in Egypt, as shown in Table 3.23.

Table 3.23 The local clay used for producing amphorae.

Clay	Features/Colour
Nile Silt (Delta)	Dull brown/Red brown
Desert (Qena)	Light Brown/ cream or white surface
Kaolinite (Aswan)	Pale Orange Surface
North-Western Coast clay	No available features
Mareotic clay	Pale brown desert clay/ calcic and sand inclusions

Mareotic Wineries

Khalil (2005:142–152) reviewed the wineries located at Mareotic region and the work conducted by Rodziewicz (1998b:27–36), who located 15 wineries datable to the late Hellenistic, Roman and late Byzantine periods. These wineries were located along the western arm of the lake (Taposiris Magna, South Marea) and along the frontiers of the ancient actual lake at Abu Mina St. Menas and Kom Trouga. Khalil succeeded in relocating five wineries on the south coast of the lake's western arm and five wineries at Kom Trouga and suggests that the rest of the wineries mentioned by Rodziewicz have been destroyed.

Moreover, an enormous number of wine amphorae dating to the Hellenistic period until the Byzantine period have been located along the south coast of the lake (Dzierzbicka 2010:127). However, these amphorae do not represent the actual number constructed from the Hellenistic until the Byzantine period due to the discovery of the lots spouts, which were used to pour the wine from the pressing basin into another basin containing only the juice or the wine (Dzierzbicka 2010:127; Empereur 1993:42–45; Khalil 2005:142–152).

It is worth stressing the relationship between the location of the kilns, wineries, harbours and cultivation areas identified as adjacent to each other in the Mareotic Region. Peacock and Williams (1986:41) identified the relationship between the location of the production areas of the amphorae containers and the location of the production areas of the products/goods such as wine, olive oil and

fish products. Khalil (2005:142–152) highlighted vineyards in the Mareotic region and emphasized the strong relationship between the location of the amphorae kilns and the production areas for the goods, noting that they should be adjacent to the kilns and wineries which are located on the southern shore of the lake. Dixneuf (2011:203–205) and Öniz (2016:18–19) agree with Khalil (2005:142–152), who lists the factors that have impacted the location of the amphorae as the location of the vineyards and the wineries, the good clay for kilns, and a harbour for easy loading and unloading the commercial vessels, which together give Mareoties privileged access to the maritime trade locally and internationally (Khalil 2005:154–157). As Dixneuf (2011:203–205) states, the lake was a source of irrigation and water for the vineyards, being close to the wineries and close to the suitable clay for amphorae production. Also, vineyards were located to the far south of the lake at Abu Mina as evidenced by the discovery of agricultural installations datable to late Roman and Islamic periods (fourth century AD to sixth century AD).

Peacock and Williams (1986:41) hypothesise that some countries provided amphorae to other countries, or that individual potters who made their own production lines were exporting to whoever was in need, or that a deal between the country and potter aimed to produce a number of amphorae to contract. This is exemplified by a written papyrus dated to the third century AD located in Egypt indicating a deal between the potter and the country to produce number of amphorae for a given salary. This raises the notion of transporting empty amphorae around the Roman Empire.

To sum up, the Mareotic region was a dynamic area of Alexandrian maritime trade and the vital link between south and north. Nevertheless, Khalil (2010:43) asserts that the western arm was the main supplier of wine and other products to Alexandria and beyond, which indicates that the movements of goods from the lake to the sea was higher than the movement from the sea to the lake and beyond to the south.

3.2.3 The Terrestrial Sites at the North-Western Coast

3.2.3.1 Marina El-Alamein

Marina el-Alamein is located 107 km to the west of Alexandria. According to Majcherek and Zych (2011:357–378), Marina el-Alamein was a town and harbour during the Hellenistic period (first century BC) and reached the peak through the early and mid-Roman period (first century AD to third century AD). Trade reduced by the end of the third century AD, but it rose again during the late Roman period (end of fourth AD to fifth AD), while the town comes to an end during the sixth century AD. The excavations conducted there by PCMA UW continued from 1987 until 2011. The excavations revealed the harbour, houses, tombs, baths, temple, agora, church and a massive

number of imported and local amphorae, tableware and oil lamps (Daszewski and Zych 2007:147–148; Majcherek 2007b:9–11). Up to 75–80% of the amphorae fragments located at Marina el-Alamein are transported amphorae (Czerner, Bąkowska-Czerner and Majcherek 2015:30–31; Daszewski et al. 1990:15–17; Daszewski 1992:26, 1997:71, 2003:56–58; Daszewski et al. 2004:79–92; Majcherek 1993:215–220, 2007b:9–31; Majcherek and Zych 2011:361; Medeksza 2006:79–80). [9] Table 3.24 shows the amphorae types located.

Table 3.24 The amphorae types located at Marina el-Alamein.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Cretan	Crete	Aegean	1st AD to 3rd AD	Early Roman	Imported	Wine	
Rhodian Late	Rhodes	Aegean	1st AD to 2nd AD	Early Roman	Imported	Wine	
Knidian	Knidos	Aegean	Late 1st century BC	Hellenistic	Imported	Wine	
LR3	Western Asia Minor	Aegean	4th AD to 6th AD	Late Roman	Imported	Unknown	
Kapitan II	Asia Minor	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine	
Dressel 5	Kos	Aegean	1st BC to 2nd AD	Early Roman	Imported	Wine	
Pseudo Cos	Unknown	Unknown	1st AD to 2nd AD	Early Roman	____	Wine	
Pompeii V	Cilicia	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine	
Pamphylian	Pamphylia	Aegean	1st BC to 4th AD	Early Roman	Imported	Wine	
Dr 2-4	Campania	Central Med.	1st AD to 3rd AD	Early Roman	Imported	Wine	
LR4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	
Gauloise	France	Western Mediterranean	1st AD to 3rd AD	Early Roman	Imported	Wine	
Agora K 114	Italy	Central Med.	1st AD to 3rd AD	Early Roman	Imported	Wine	
Cyrenaican	Libya	Central Med.	5th BC to 3rd BC	Hellenistic	Imported	Wine	
Agora G 199	Cilicia	Eastern Med.	1st AD to 2th AD	Early Roman	Imported	Wine/ Olive oil	
Africana I	Tunisia	Central Med.	2nd AD to 4th AD	Mid. Roman	Imported	Olive oil	
AE3	Egypt	Egypt	1st BC to 3rd AD	Early Roman	Local	Wine	

[9] A complete publication dedicated to the amphorae located at Marina El-Alamein is forthcoming from Majcherek.

Daszewski and Zych (2007:147–148) agree that this site played a main role in the ancient maritime trade based on the mass of structural remains and imported amphorae, which reflect the relationship between the Mediterranean basin in general and the other towns in Alexandria and Egypt. The Egyptian Mareotic AE3 and other cooking and table wares from the Nile silt fabric. However, no written evidence confirms the role of that harbour or the town in ancient sources like Strabo, who described the entire Egyptian coast and did not mention anything about that harbour (Strabo 1903:17.1.14). Majcherek and Zych (2011:357–378) believe that might be because this harbour did not exist when Strabo was writing his description about the coast.

3.3 Greco-Roman Museum Amphorae Collections

According to Empereur (1998c:393–399), the Greco-Roman Museum houses 255 complete amphorae ranging between local and imported. All of them were found in Alexandria but the exact find places are unknown. As for the imported amphorae, the following types have been identified along with local amphorae types: (see Table 3.25 and Figure 3.18).

Table 3.25 The amphorae types at the Greco-Roman Museum.

Type	Origin	Region	Date	Period	Supply	Content	Amount
Cretan	Crete	Aegean	1st AD to 3rd AD	Early Roman	Imported	Wine	2
Rhodian Early	Rhodes	Aegean	3rd BC	Hellenistic	Imported	Wine	14
Knidian Middle	Knidos	Aegean	Late 1st century BC	Early Roman	Imported	Wine	3
Koan	Kos	Aegean	4rd B.C to 3rd BC	Hellenistic	Imported	Wine	2
Chios	Chios	Aegean	4th BC	Hellenistic	Imported	Wine	3
Lesbian	Lesbos	Aegean	4th BC	Hellenistic	Imported	Wine	7
Greco-Italic	Italy	Central Med.	4th BC to 2nd BC	Hellenistic	Imported	Wine	4
Dressel 1A	Campania, Italy	Central Med.	2nd BC to 1st BC	Hellenistic	Imported	Wine	1
Dressel 1B	Italy	Central Med.	1st B.C to 1st AD	Early Roman	Imported	Wine	1
Dressel 1C	Italy	Central Med.	1st AD	Early Roman	Imported	Wine	1
Lamboglia II	Adriatic coast	Central Med.	1st BC	Hellenistic	Imported	olive oil	11
Brindisi	Italy	Central Med.	2nd BC to 1st BC	Hellenistic	Imported	Olive oil/wine	1
Kapitan II	Asia Minor	Eastern Med.	3rd AD to 4th AD	Mid. Roman	Imported	Wine	2

Type	Origin	Region	Date	Period	Supply	Content	Amount
Dressel 6A	Italy	Central Med.	Late 1st BC to mid-1st AD	Early Roman	Imported	Wine/ olive oil	16
Pseudo Cos	Unknown	Unknown	1st AD to 2nd AD	Early Roman	Imported	Wine	2
Pompeii V	Cilicia	Eastern Med.	1st AD to 2nd AD	Early Roman	Imported	Wine	5
Dr 2-4	Campania, Italy	Central Med.	1st AD to 3rd AD	Early Roman	Imported	Wine	3
LR4	Gaza	Eastern Med.	4th AD to 7th AD	Late Roman	Imported	Wine	7
Dr 7/11	Spain	Western Med.	1st BC to 1st AD	Early Roman	Imported	Fish sauce	3
Mana	Tunisia, Tripolitania	Eastern Med.	End of 3rd BC to 2nd BC	Hellenistic	Imported	Fish sauce	1
Dr 36	Italy	Central Med.	1st AD	Early Roman	Imported	Wine	1
Dr 43	Crete	Aegean	1st AD to 3rd AD	Early Roman	Imported	Wine/fruit	1
LR1	Cilicia	Eastern Med.	Early 5th AD to late 7th AD	Late Roman	Imported	Olive oil/Wine	1
LR2	Chios/Knidos	Aegean	4th AD to 6th AD	Late Roman	Imported	Wine	2
Tripolitanian	Libya	Central Med.	2nd BC to 1st BC	Hellenistic	Imported	Olive oil	5
Africana Grande	Tunisia	Central Med.	End of 3rd AD	Mid. Roman	Imported	Fish sauce	10
Spatheia	Tunisia	Central Med.	4th AD to 5th AD	Late Roman	Imported	Uncertain, possibly olives	9
AE1	Egypt	Egypt	3rd BC	Hellenistic	Local	Wine	4
AE2	Egypt	Egypt	2nd BC	Hellenistic	Local	Wine	2
AE3	Egypt	Egypt	1st BC to 2nd AD	Early Roman	Local	Wine	95
AE4	Egypt	Egypt	2nd AD	Early Roman	Local	Wine	4
AE5/6-AE5/6	Egypt	Egypt	5th AD to 6th AD	Late Roman	Local	Wine	18
AE7/ LR7	Egypt	Egypt	Late 4th AD to 7th AD	Late Roman	Local	Wine	5

Moreover, the Greco-Roman Museum houses another collection of amphorae stamps (Cankardeş-Şenol 2015a, 2015b, 2015c, 2015d). According to Johnsson (2004:142), the collection includes 91,000 stamps. It is worth noting that this thesis does not cover the handles stored at the Greco-Roman Museum due to the insufficient information available regarding the recovery spots, as these

handles not only belong to Alexandria but also different places across Egypt and Delos (Cankardeş-Şenol 2015a, 2015b, 2015c, 2015d).

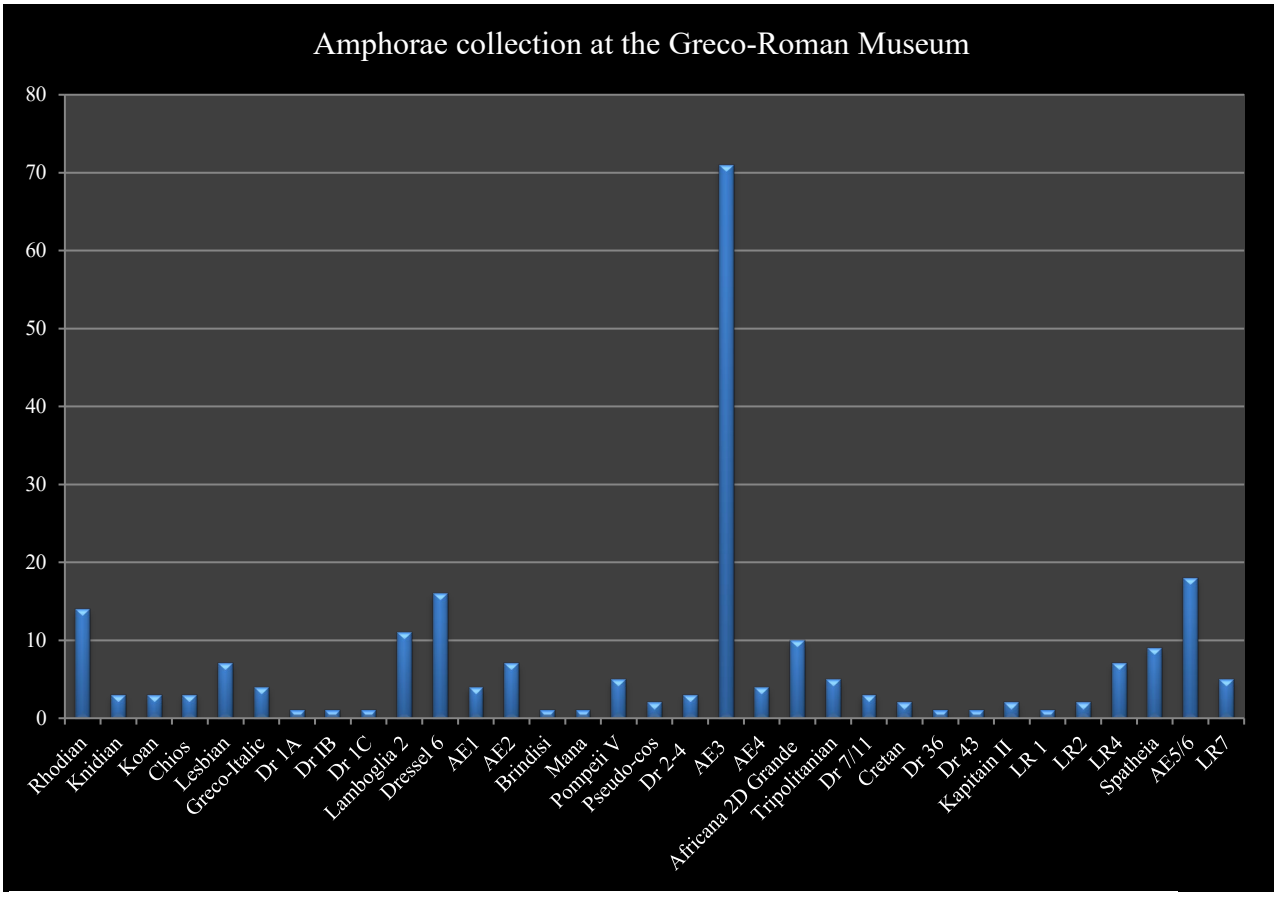


Figure 3.18 The amphorae collection at the Greco-Roman Museum.

3.4 Summary

This chapter summarises a considerable amount of information regarding underwater and terrestrial amphorae sites along the Alexandrian coastline and the North-Western Coast. It covers a large area and shows the various amphorae types that date from pre-Hellenistic, Hellenistic and Roman periods until the Byzantine and Islamic periods. This amphorae evidence is an indication of the unique and significant role Alexandria played through these ancient periods. It will serve as a basis for the network analyses which will be discussed in more detail in chapter six. Further, these amphorae remains represent how Alexandria was connected or had a variety of commercial relationships with almost all the Mediterranean basin and beyond. Chapter Three has discussed the value of each amphora type located. Some of the amphorae collections lack these kind of data. Consequently, these amphorae collections have been excluded from the analytical and statistically study, and more about that will be discussed in the research methods chapter. The following chapter introduces a literature review of the previous amphorae and shipwreck studies undertaken at the

amphorae sites mentioned in this chapter. The next chapter will show what has been done in the field of amphorae research in Alexandria in particular in the last 30 years.

CHAPTER 4. AMPHORAE AND SHIPWRECK STUDIES

This chapter reviews amphorae and shipwreck studies undertaken on material from the Alexandrian sites discussed in Chapter 3. It has two main parts: the first covers the studies conducted at shipwrecks located along the Alexandrian coastline and the Egyptian North-Western Coast. The comparison between existing studies with the amphorae scattered on shipwreck sites provides a better understanding of their context and nature. The second part of this chapter, therefore, focusses on all accessible Alexandrian amphorae studies. As mentioned, many explorations and excavations have been undertaken in Alexandria and its extended coast to the west in the last 40 years (Abd-el-Maguid 2002:1, 2012:197–200, 2015:115; Elsayed 2012:119; Empereur 1997:831–847, 1998b:611–638; Goddio and Clauss 2006:75; Grataloup 2010:157–158; Haldane 1996; Khalil and Moustafa 2002:527–528; Tzalas 2009:352–356, 2010). This chapter will refer to those sites and the disproportionately small number of studies of amphorae from known shipwreck projects (Belov 2014a, 2014b:3–9, 2014c:314–329, 2014d; Robinson 2014; Sandrin, Belov and Fabre 2013:44–59). It also discusses the importance of research into the amphorae evidence from shipwreck sites and how promising such studies can be in addressing a considerable knowledge gap related to maritime trade and connectivity. Lastly, this chapter gives a brief overview of the current state of Mediterranean amphorae studies.

4.1 The Significance of Shipwreck Amphora Studies

As discussed in Chapter 1, ships are floating, closed communities and their wrecking is considered as a specific event in time; every single material group aboard the ship at the time of sinking is related to the aforementioned community and is unique and significant (Fulton 2016:1–2). The remains of ships and their cargoes provide pertinent material to study and interpret, and data to assess maritime trade networks and connectivity patterns between ancient entities (Gibbins 1990:384). Furthermore, shipwreck studies provide a unique source of information about trade and economic aspects in ancient times. This is directly relevant to the connections of vessels between regions and all shipwrecks have the potential to inform us about the movement and transport of products and people (Fulton 2016:2; Parker 1990:335–345). Because amphorae tend to preserve better in underwater environments than organic material such as ships' wooden hulls, their remains provide comparable material groups for the study and identification of trading patterns (Fulton 2016:10).

4.2 Alexandrian Shipwreck Studies

The shipwreck database provided by Parker (1992a) is a comprehensive, and now outdated, source of such sites located in the Mediterranean basin. Each shipwreck is listed with a georeferenced location and a short description of its nature, cargo and date. Parker (1992a:7), however, only refers to two shipwrecks located in Egypt (Table 4.1). Since 1992, the number of ancient Mediterranean shipwreck sites located has increased steadily and in Egypt alone many more shipwrecks are known today, especially in the waters off Alexandria (Abd-el-Maguid 2015; Belova, Belov, Ivanov and Laemmel 2015; Empereur 2000a; Goddio 2000; 2007; Tzalas 2012, 2013, 2015).

Table 4.1 Number of wrecks in each state around the Mediterranean according to Parker (1992a:7, table. 2).

Number of wrecks in each state around the Mediterranean according to Parker (1992a)	
State	**Amount**
Italy	428
France	282
Spain	134
Croatia	92
Greece	84
Turkey	63
Israel	31
Cyprus	15
Malta	12
Netherlands/Germany	11
Britain	10
Lebanon	9
Bulgaria	8
Belgium/ Morocco	7
Libya/ Switzerland/ Syria/ Tunisia	6
Algeria/ Monaco	4
Channel Islands/ Gibraltar/ Romania	3
Egypt	2
Georgia/ Hungary/ Sudan/ Ukraine/ Yugoslavia (Montenegro)	1

Parker illustrates his work with distribution maps for some amphorae types located frequently in the Mediterranean basin, although none of these maps contain any amphorae types found along the Egyptian coastline, as demonstrated in the distribution map of Kapitän II amphora along the Mediterranean coastline (Figure 4.1). Parker's work requires expansion and update with new study

material from Egyptian shipwrecks located along the Alexandrian and North-Western Coast. The amphorae types associated with these newly located wreck sites, their dates, origins and contents provide future scholars with an updated record.

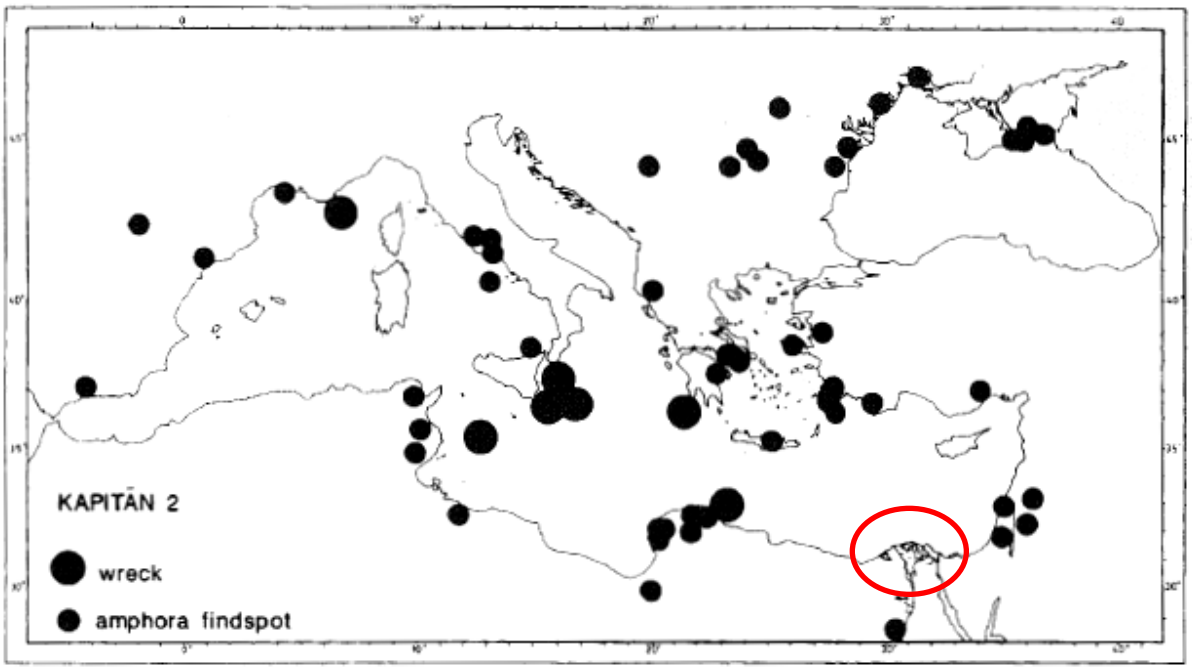


Figure 4.1 Kapitän II dispersion around the Mediterranean Sea (Parker 1992a:555, fig. 13).

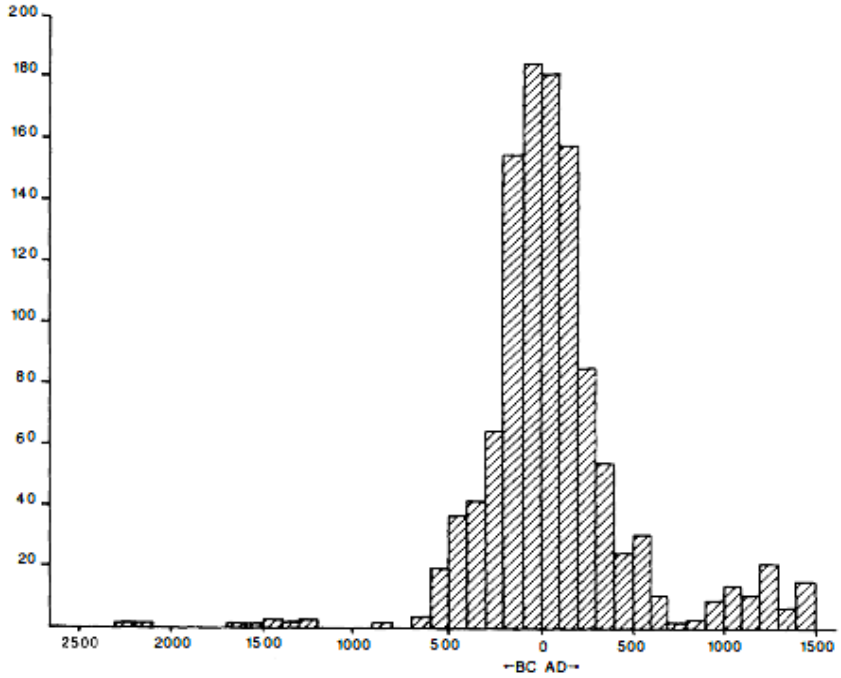


Figure 4.2 The Mediterranean shipwrecks across the time periods according to Parker (1992a:549, fig. 3).

Parker's (1992a:549) work included Mediterranean sites dating from the Pre-Hellenistic period until late antiquity. It is clear from Figure 4.2 that the number of shipwrecks at the Hellenistic and early Roman period increased. This enormous increase was followed by a gradual decrease in the number of the shipwrecks at the mid-Roman period until late Antiquity. Wilson (2011:33–59) used Parker's (1992a) work to investigate maritime trade patterns across the Mediterranean from the pre-Hellenistic period until late antiquity. He points out that Parker's graph on the number of shipwrecks in the Mediterranean fails to show how these sites relate to maritime trade patterns. Wilson (2011:34–35) mentions that Parker dates the shipwrecks based on the mid-point of each shipwreck date range. For example, if the shipwreck date is ranging between 75 BC to 25 AD, then the shipwreck dates to the first century BC as the mid-point is 25 BC.

Wilson (2011:33–59) therefore attempts to adjust the historical periods and divide them into more specific timelines to examine more detailed trade patterns. He proposes an 'equal probability that a ship sank in any particular year within the date range assigned to a wreck' (pp.34). Wilson argues that if a wreck ranges in the date between 75 BC and AD 25; then there is up to a 75 % possibility that the ship might belong to the first century BC and 25% possibility that the ship might belong to the first century AD. Figure 4.3 shows Parker's graph after Wilson's modifications. Wilson's modifications revealed the first century AD was witness to the highest rate of wrecking events. In contrast, Parker's graph shows that most of the vessels wrecked at the first century BC.

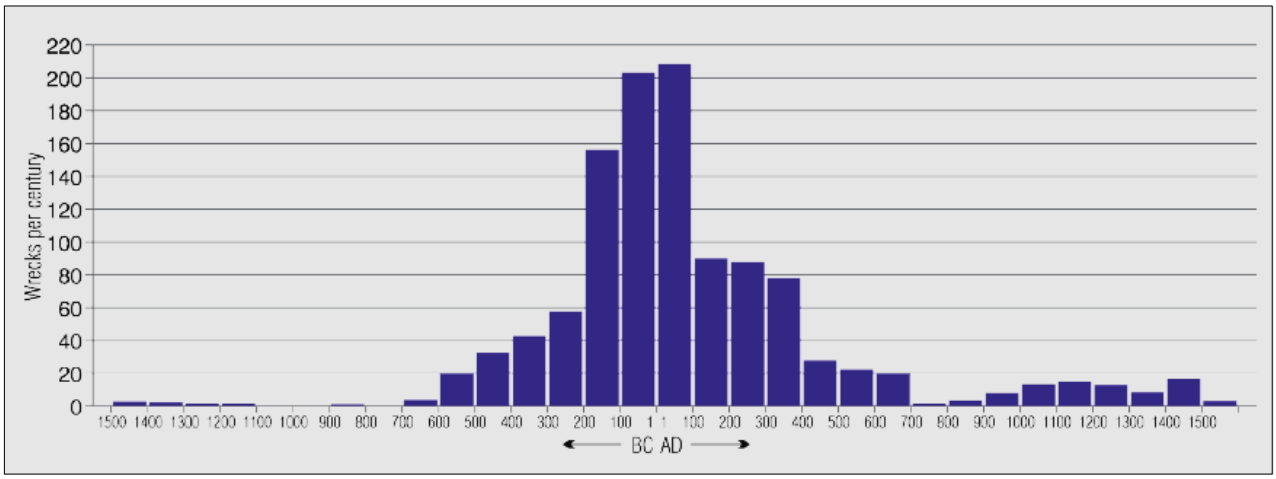


Figure 4.3 The Mediterranean shipwrecks across the time periods after the modifications reproduced by Wilson (2011:34, fig. 2.2). © Copyright 2020, with permission from A. Wilson.

More recently, Bowman, Wilson and Strauss have been working on an update of Parker's database (Oxford Roman Economy Project). Still ongoing, they have increased the number of shipwrecks from 1189 (Parker 1992a:5) to 1646. Wilson collected and interpreted new data and provided new graphs that have incorporated the additional shipwreck sites in the Mediterranean. He also broke

down time into periods smaller than centuries (Figure 4.4). Based his work, a significant decline in shipwrecks from the first to the second century AD is now evident.

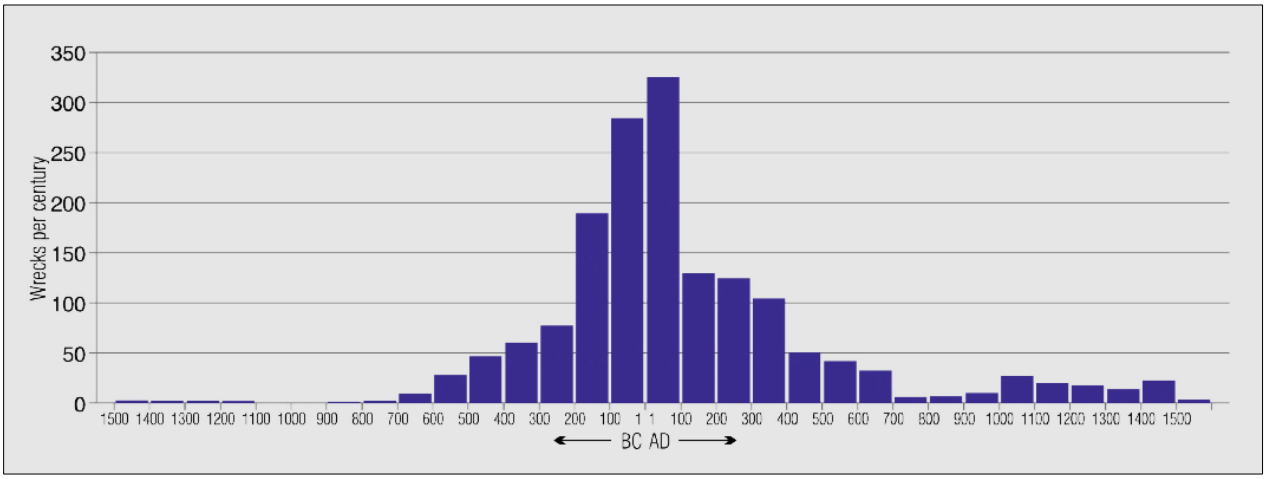


Figure 4.4 Mediterranean shipwrecks after the update of Parker's 1992a work by the Oxford Roman Economy Project (Wilson 2011:35, fig. 2.3). © Copyright 2020, with permission from A. Wilson.

Thereafter, Wilson divided the most recent database into smaller time segments again to investigate the number of shipwrecks through the years and not centuries (Figure 4.5). The results demonstrate a steady increase in the number of shipwrecks from 650 BC to 300 BC. A slight decrease occurs between 250 and 200 BC followed by a steep increase from 200 BC, which continued until the end of the Hellenistic period. After that, another sharp increase in shipwreck events occurs by the beginning of the early Roman period, which continues until the AD 100 decline. No significant change is present between AD 200 and AD 300; however, a gradual decrease in the number of shipwrecks is clear from AD 400 until AD 700 with fluctuations between low and very low numbers from AD 700 onwards.

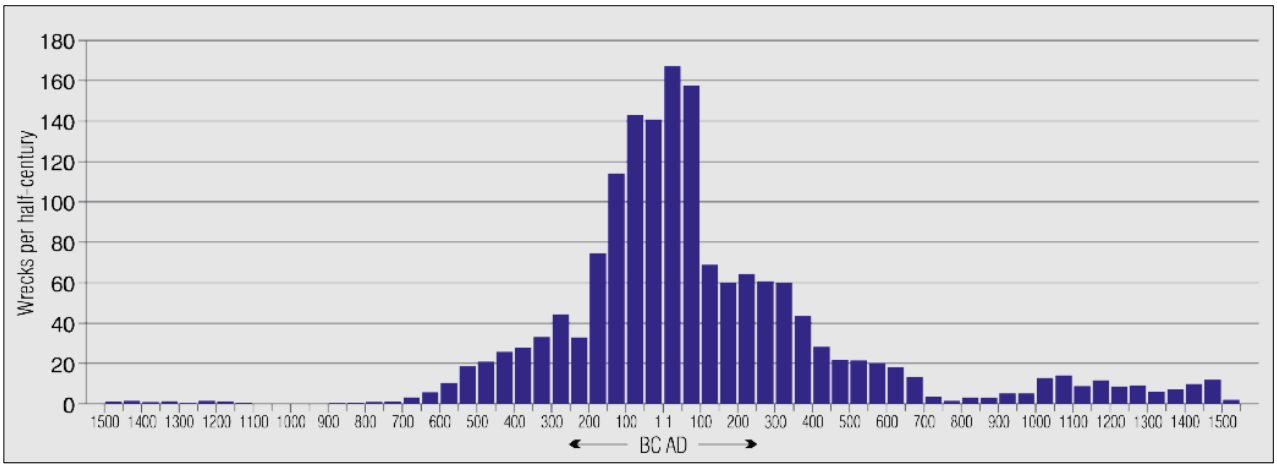


Figure 4.5 Mediterranean shipwrecks after Wilson's update of Parker's 1992 work and division of sites into more specific time periods (Wilson 2011:36, fig. 2.5). © Copyright 2020, with permission from A. Wilson.

Strauss (2006) also created a database in which shipwrecks are catalogued by vessels that carried cargoes from Eastern Mediterranean ports in the Hellenistic period, from the third century BC to the middle half of the second century BC. His database includes three shipwrecks from the Alexandrian coastline (Strauss 2006:411–413). Two of these shipwrecks are located at the Qaitbay/Pharos site (Qaitbay 1 and Qaitbay 2, see Chapter 3, section 3.1.2.6), and the third is known as Alexandria A, as mentioned by Parker (1992a:51). Similar to Parker's work (1992a), Strauss (2006) produces maps containing the locations of different types of amphorae located along the Eastern Mediterranean coastline and, again, none of these maps include amphorae from the Alexandrian coast or Egyptian coastline. As mentioned, it seems that most amphorae specialists exclude or ignore the amphorae remains from the Alexandria coastline. Another example of such omission is seen in Opdebeeck's work (2005). He classifies Mediterranean amphorae, but omits those from the Alexandria area; however, Opdebeeck does acknowledge that there is much to be done in 'unexplored areas' and notes the North African coasts as an example.

Amphorae remains are of course present in Alexandria's archaeological record, they are simply understudied. They are known, for example, from studies undertaken to examine Shipwreck 17, which is one of the 60 shipwrecks located at Aboukir Bay (Belov 2014a, 2014b:3–9, 2014c:314–329, 2014d). Belov's studies include a detailed investigation of the remaining structure of the ship's hull, which he identified as a Nile cargo boat. The ship's wooden hull is dated to 664–332 BC using radiocarbon dating and dendrochronology.

Fabre and Belov (2011:107–118) and Fabre (2015:175–194) also discuss the dates of the 45 shipwrecks located Aboukir Bay based on radiocarbon dating (Figure 4.6). Fabre and Belov's work is applicable to this study as they discuss the presence of ceramic and amphorae finds. Other scholars focus on other shipwrecks in Aboukir Bay. For example, a study undertaken by Robinson (2014) on Shipwreck 43 identifies it as a Nile cargo boat like, similar to Shipwreck 17, and dates it to 785–412 BC. Sandrin, Belov and Fabre (2013:44–59) have investigated a shipwreck located at the middle of the Eastern Harbour. This shipwreck dates to the early Roman period, or the end of the first century BC to the first century AD. This study mentions the amphorae types scattered around the site and their association with other ceramic containers, such as cooking wares, oil lamps, coins and rings.

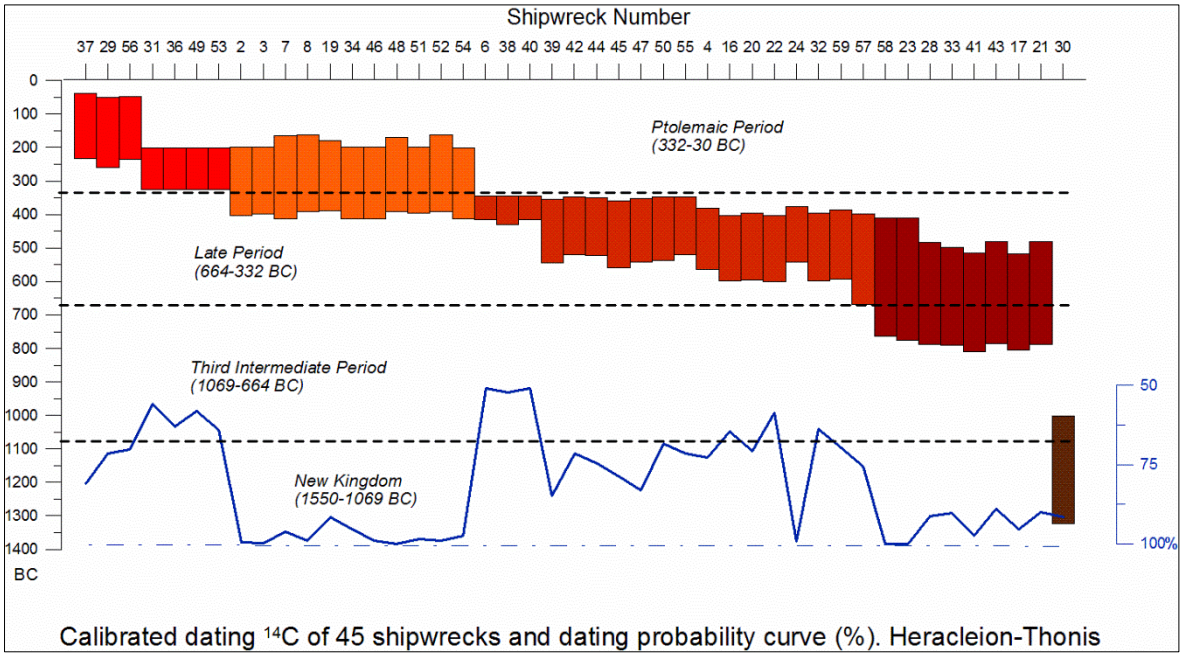


Figure 4.6 The radiocarbon dates for 45 shipwreck sites located Aboukir Bay (Fabre and Belov 2011:106, fig. 1).

4.3 Alexandrian Amphorae Studies

As for Alexandria specific amphorae studies, Gibbins (1990:376) mentioned nearly thirty years ago that the examination of shipwreck sites is closely intertwined with amphorae studies due to their capacity to act as the source of valuable data on production, trade and commerce. Even a limited number of amphorae fragments can provide adequate data on production and consumption areas, which will eventually lead to meaningful information on maritime trade networks in a specific period (Gibbins 1990:382; 2001a). Lawall (1991:229–230) also stresses that the examination of amphorae remains provides new insights to the economic situation of the ancient world. Other relevant amphorae studies related to the study of amphorae in this thesis, but from elsewhere in the Mediterranean, include Keay and Williams' 2014 review of amphorae studies since the pioneering work of Heinrich Dressel in 1899 on the collection from Castro Pretorio at Rome. Keay and Williams (2005) specifically discuss the development of amphorae research within the Roman Empire, and they demonstrate how this area of study has become more attractive and promising to scholars. It sheds light on the growth of the field and the expansion of amphora-related study fields, as can be seen by the significant amount of both general conferences and specialist symposiums. Keay and Williams (2005) advocate creating a comprehensive framework for compiling, sharing and studying amphorae material and features, such as stamps and inscriptions, which would greatly enhance the study of this ubiquitous ceramic and help in more easily identifying fragments or features in the future.

Many scholars devoted their studies to these containers as they potentially reveal aspects of the socio-cultural life of ancient groups as well as economic aspects of ancient communities. The following section reviews studies of amphorae from Egypt that can be divided into three main categories:

1. Comparative studies of amphorae from Alexandrian sites and those from other Mediterranean regions or countries, such as Cilicia and Italy (Senol 2008:109–132, 2013:403–408; Senol and Cankardeş-Senol 2003:119–146).
2. Studies that simply identify the amphorae remains found in a particular location on land or under water in Alexandria (Blue 2010:25–33; Blue and Kahlil 2011; Empereur and Picon 1992:145–152; Grataloup 2010:151–159, 2015:137–160; Khalil 2010b:135–145; Majcherek 2004:229–237; Pichot and Şenol 2014:225–239; Senol 2000:369–396, 2002a:191–215, 2002b:467–484, 2007:57–75).
3. Collective studies about some specific aspect of amphorae located at Alexandrian sites, such as stamps and particular amphora type (Alkac and Cankardeş-Şenol 2016:191–216; Cankardes-Senol 2001:397–408, 2003:213–260, 2007a:33–5, 2007b:85–90, 2011:387–401, 2012:97–104, 2013:387–401, 2015a, 2015b, 2015c, 2015d, 2015e:169–192, 2017:321–368; Cankardeş-Şenol, Alkac and Abdelgawad 2017:297–316; Cankardeş-Senol and Şenol 2013:55–82; Dixneuf 2011; Tomber and Williams 2000:41–54).

The following section presents a closer investigation of these studies and highlights their relevance to this thesis.

4.3.1 Comparative Studies of Amphorae from Alexandrian Sites and Those from Other Mediterranean Regions or Countries

Studies by Senol (2008:109–132, 2013: 403–408) touch upon the maritime trade networks between Alexandria and other Mediterranean countries. Senol (2008:109–132) examines the commercial connectivity between Egypt and Cilicia (Turkey) based on amphorae material from terrestrial sites in Alexandria uncovered by CEAlex. In his study, Senol states that Cilician wine was in demand during the Hellenistic period, especially by the Greek population in Egypt. By the beginning of the Roman period, the Cilician production for export reached its peak.

Yet, Cilician amphora from that period only occur in modest quantities in Alexandria. Based on the terrestrial excavations conducted by CEAlex, Cilician amphora present only 6.9% of the imported amphorae in the Roman period from the first to the third century AD. In addition to Cilician amphora, other types found in Alexandria include Zemer 41 amphora which date to the early Roman period (first century AD), Cilician Dressel 2, 3 and 4 (first century AD), Agora M54 and

Pompei V amphorae which date to the first and second century AD. By the fourth century AD, amphorae like the Cilician Late Roman 1 (LR1) type had become widespread in the Eastern Mediterranean (Senol 2008:112–115). This amphora type, along with LR4 (Gaza) amphora, were the most prominent containers used by the end of the Roman period. The LR 1 amphora was produced in Cyprus from where it was imported into Egypt markets (Senol 2008:115).

Similarly, Senol and Cankardeş-Senol (2003:119–146) point out how the agricultural aspects of Cilicia associated with the trade patterns. They highlight the significance of Cilicia as a production centre of products like wine, fish products, seeds, fruits and nuts since the Hellenistic until the late Roman period. It is striking to note that Egypt imported vines from Cilicia to improve their quality of wine. The same happened with vines brought from places in the Greek world, like Chian, Thasos and Mende. This study also stresses that the Cilician amphorae were widespread across the Eastern Mediterranean, especially Egypt, by the late Roman period (fourth to the sixth century AD). The reason behind the increasing number of LR1 amphorae is the division of the Empire, as mentioned in Chapter Two, which led an increase in trade activity with the Eastern Mediterranean and Aegean regions instead of the Western Mediterranean.

In another work, Senol (2013:403–408) focuses on the movement of commodities between the Italian Peninsula and Alexandria, based on the amphorae recovered from the Pharos/Qaitbay Fort underwater excavations, the Gabbari Necropolis and other terrestrial rescue excavations undertaken by CEAlex. In this study, Senol highlights the strong commercial tie based on the wine trade between the Aegean countries like Rhodes, Knidos and Kos with Alexandria during the Hellenistic period. Meanwhile, the commercial ties between Alexandria and Italy were modest at that time and this is confirmed by the low number of Italian amphorae recovered from the rescue excavation and the shipwrecks in the adjacent waters of Qaitbay Fort (QB 1), along with the Greco-Roman amphorae collection.

By the second century BC, the exchange with Italy became more frequent and occurred on a larger scale than before. The demand for Italian wine increased at the beginning of the Roman period to meet local demands. Senol confirmed Italian ties with Alexandria and refers specifically to the Italian amphorae recovered from the terrestrial sites at the Old Diana Theatre. These Hellenistic Italian amphorae represent 11% of the total number excavated from this site.

Among the Italian amphorae, the Dressel 1 type were the least common in Alexandria as this group represents only 3% of all amphorae recovered from the Diana Theatre site (Senol 2013:403–408). The Italian Lamboglia II represents 3% at Diana theatre, 2% at Consulate land and 18% at the Majestic site. Further, the presence of Italian Brindisi amphora indicates that Alexandria's

population used the Italian oil in significant amounts. Oil produced in North Africa and Spain, however, was preferred over Italian olive oil and the primary choice of local Egyptians in the Hellenistic period. Senol (2013:403–408) also points out that Italian Dressel 6A (DR 6A) amphora excavated in abundance from the terrestrial sites and found in the collection of the Greco-Roman Museum. The presence of Dressel 6A type amphorae testifies to the usage and consumption of wines exported to Alexandria from the Adriatic. Furthermore, Campanian Dressel 2-4 (DR 2-4) amphora were exported to Alexandria until the beginning of the second century AD—copious amounts of these amphorae have been identified at Coptos and the stopover stations at the Eastern Desert which were used in the trading routes to the Red Sea Harbours. This indicates that Alexandria transhipped these amphorae down the Nile to the Red Sea Harbours, and from there to India. This theory is supported by the presence, albeit it in modest amounts, of Campanian DR 2-4 amphora in terrestrial excavations. Like the aforementioned oil, local wine carried in Amphora Egyptian 3 (AE3) was that most often consumed in Alexandria. Senol's study suggests that the Italian wine was consumed on a small scale in Alexandria during the Roman period (third century AD). The main supplier of foreign wine to be shipped to Egypt was the Aegean region.

Senol (2008:109–132, 2013:403–408) and Senol and Cankardeş-Senol (2003:119–146) focus on amphorae distribution but they have yet to address or utilise network analysis for interpreting their data, even though such an approach would provide a better understanding of their data as it would highlight and address direct connections between the sites and between Alexandria and Italy. The aforementioned studies have mainly acted as information on the scale of trade in Alexandria; however, examination of the bigger picture is still needed. Furthermore, approaching and comparing statistics related to amphorae collections that include both material from terrestrial and underwater sites is also an area in need of further study—this has not yet been done.

4.3.2 Studies of Ceramics or Amphorae Remains from Alexandria: On Land or Under Water

Amphorae studies that simply identify and address the presence of ceramics or amphorae remains found in Alexandria include the work of Grataloup (2010:151–159). Grataloup focuses on recognizing and grouping the ceramics types—amphorae, fine wares, cooking wares, cups, and bowls—from the Aboukir Bay excavations, although her examination of ceramics is preliminary in nature (Grataloup 2015:137–160). Her study is illustrated with charts that demonstrate the ceramic types and numbers per type from Aboukir Bay in general (Figure. 4.7). It includes amphora material as a group, but Grataloup fails to provide detail of specific remains and amphorae types.

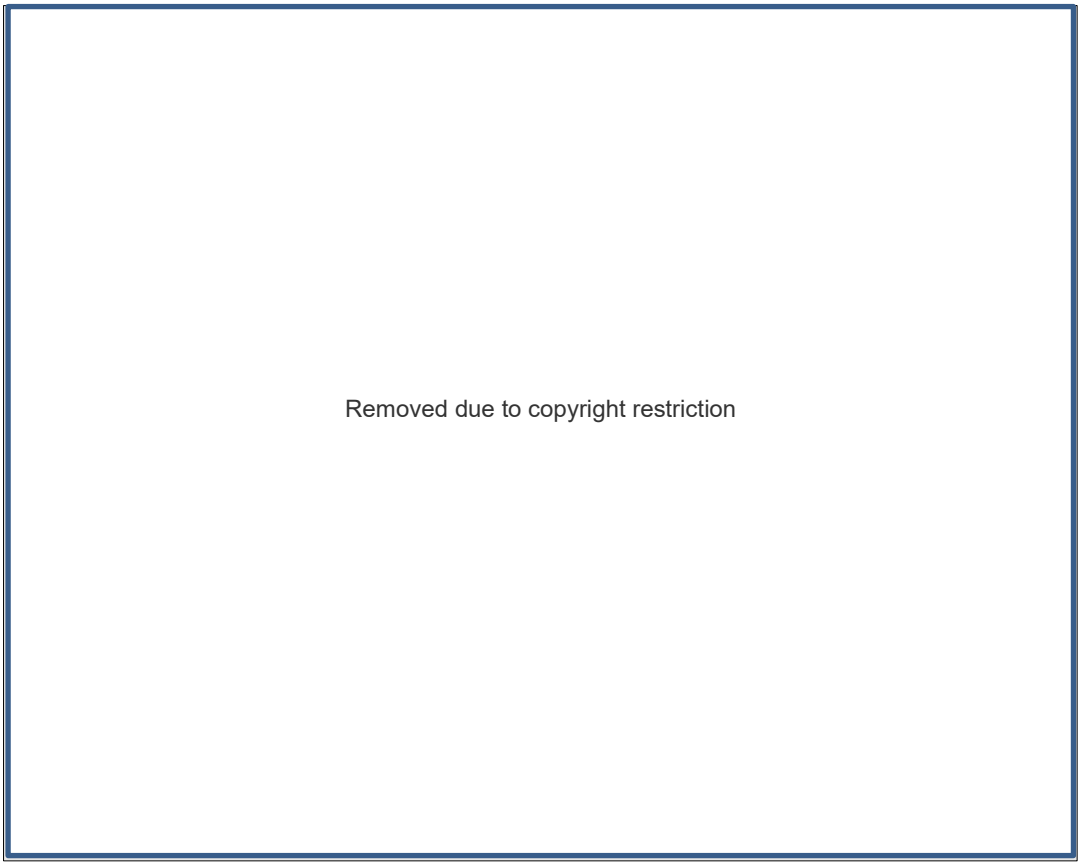


Figure 4.7 The ceramics located at Aboukir Bay (Grataloup 2015:157, fig. 7.17).

Likewise, Senol devotes a number of studies to the amphorae recovered from the Gabbari necropolis (2000:369–396, 2002a:191–215, 2002b:467–484). His studies provided statistics about the amount of each amphora type located at various sectors of the Necropolis. His studies include illustrations, detailed measurements and descriptions for some of the amphorae remains. Further, Gabbari's studies provide insight to the scale of the maritime trade of Alexandria. According to Gabbari's amphorae statistics, Egyptian Amphora (AE3), Rhodian amphora and Late Roman 4 represent the majority of finds. In another study, Senol (2007:57–75) looks specifically at the imported amphorae recovered from the CEAlex terrestrial excavations. According to this study, imported amphorae represent 61.13% of the total finds, while local amphorae represent only 38.87%.

In his study, Senol (2007) states that the local production of wine and amphorae was modest during the Hellenistic period due to the low amount of AE1 and AE2 located at the terrestrial sites, as it represents 4.01% of the total finds (Figure 4.8). At the same time, the Greek amphorae located at terrestrial sites represent 92.66% of the total of imported amphorae. The reason is that the local wine was not preferred by the Greek people in Egypt. The increasing import activity of Greek wine to Alexandria was to cover the needs of the Greek population in Egypt. From the beginning of the

Roman period, AE3 became the preferred wine container, as evinced by the huge amount of AE3 which represents 23.171% of the total finds back to the early Roman period (first century BC). Also, decreasing trade from Greece by the beginning of the Roman period played a role in increasing the local production to cover local needs (Senol 2007:61–62). The terrestrial excavations recorded the initial presence of Italian amphorae like Brindisi, Greco-Italic and Lamboglia II, which represent 7.34% of the finds. Further, Senol (2007) remarks that the Italian amphorae were widespread in the Western Mediterranean during the Hellenistic period (third century BC). Meanwhile, Greek wine production covered all the population's needs across the Eastern Mediterranean by that time (Senol 2007:61–62).

Figure 4.8 Amphorae from the terrestrial sites excavated by CEAlex (Senol 2007:65, fig. 2).

According to this study, Lamboglia II amphorae started to appear in considerable amounts by the second half of the second century BC and continued until the first century BC. The Italian (Campanian) Dressel 2-4 appears in modest amounts as it represents only 0.324% of the finds. Senol states that importing this type of amphora was not important despite the relationship between Italy and Alexandria. Further, Senol highlights the huge number of Brindisi amphorae handles that are part of the amphorae collections at the Greco-Roman Museum. This type of amphora offers direct evidence that Apulia in Italy, was the production center and the main source of olive oil exported to Alexandria along with North Africa by the second half of the century BC. Nevertheless, the presence of Brindisi and Tripolitan amphorae was very modest at the terrestrial excavations, along with the modest percentage of Dressel 20 (Spain) by the early Roman period (Senol 2007:62). Also, Lund (2000:77–99) states that the Brindisi olive oil produced in Italy was widespread in the Eastern Mediterranean during the Hellenistic period until the beginning of the Roman period.

Further, the import of olive oil from Italy was suspended by the beginning of the Roman Period (end of the first century BC and first century AD). North Africa[10] and Spain became the main sources of olive oil imports to Alexandria. The considerable number of Tripolitan amphora located at the terrestrial excavations confirms this view. At the same time, the local olive oil only covered local needs. Because of the low quality of the local olive oil, Alexandria started to import olive oil from North Africa. North Africa continued to be the main source of olive oil until the sixth century AD. After that, it declined along with the fish products (Senol 2007:66–68).

Besides, the huge amount of Rhodian and Knidian amphorae located at Alexandrian terrestrial sites is direct evidence of the importance of these production centers and the strong relations with Alexandria. It is worth noting that the Rhodian amphora represents 72.76% of the total finds, while the Knidian amphora represent 17.17%. Rhodian amphora was prominent throughout the Hellenistic period and the Knidian amphora is the second most prominent during the fourth and third century BC. By the third century BC, the wine produced at Rhodes became famous around the Eastern Mediterranean. In addition, Koan amphora represents 8.78% of the total finds which was in the competition with Rhodian, Knidian amphora along with Chian amphora which represents 1.11% of the total finds. Also, due to the dispersed quartering of the Roman military throughout the Roman Empire, covering their needs for wine and other goods was essential. This led to the import of cheap wine from the Aegean region alongside Egyptian production. Decline touched Rhodes and Knidos by the beginning of the Roman period (Senol 2007:63–64). During the third and fourth century AD, trade with the Aegean continued despite the evidence of only a modest amount of LR2 located at Gabbari Necropolis. By the fifth century AD, LR1 was widespread across the terrestrial sites which confirm the relationship between Alexandria and Cilicia. By the end of the Roman period, LR1 Cilicia was the most prominent. Further, local Alexandrian production of wine increased, and import activities declined by the end of the Roman period. By the Arab conquest of the seventh century AD, local wine cultivation declined, and trade activities were affected by the insecurity that threatened the Mediterranean basin (Senol 2007:67–69).

Further in this study, Senol investigates the amphorae located at the Old Diana Theatre separately. This is due to the differences between the percentage of the imported amphorae at this site, which represent 55.3% of the total finds in contrast with the total of the other terrestrial sites which was 61.13% as mentioned earlier. Further, the high percentage of AE3 is the main highlight of the amphorae finds at Old Diana Theatre (Figure 4.9). Senol states in his conclusion that these statistics

10 According to Senol (2007: 66–68), North Africa includes Tunisia and Libya. Nevertheless, those countries belong to Central Mediterranean based on the Mediterranean Sea division conducted by the researcher. More about that mentioned in chapter 6.

might not give the exact scale of the trade activity, especially that in the late Roman period and Arab conquest, due to the damage affecting these sites before the rescue excavations. Despite this limitation, this study highlights the enormous number of amphora produced at Cilicia, like LR1, and Gaza, like LR4, along with the local production of AE3 AE4, AE5/6 and AE7. Senol concludes that the amphorae located at this site showed the relations between Alexandria and Italy, North Africa, the Aegean, Spain and the Black Sea. Further, Senol sheds light on the unidentified forms which could change the view of trade if examined for identification and classification.

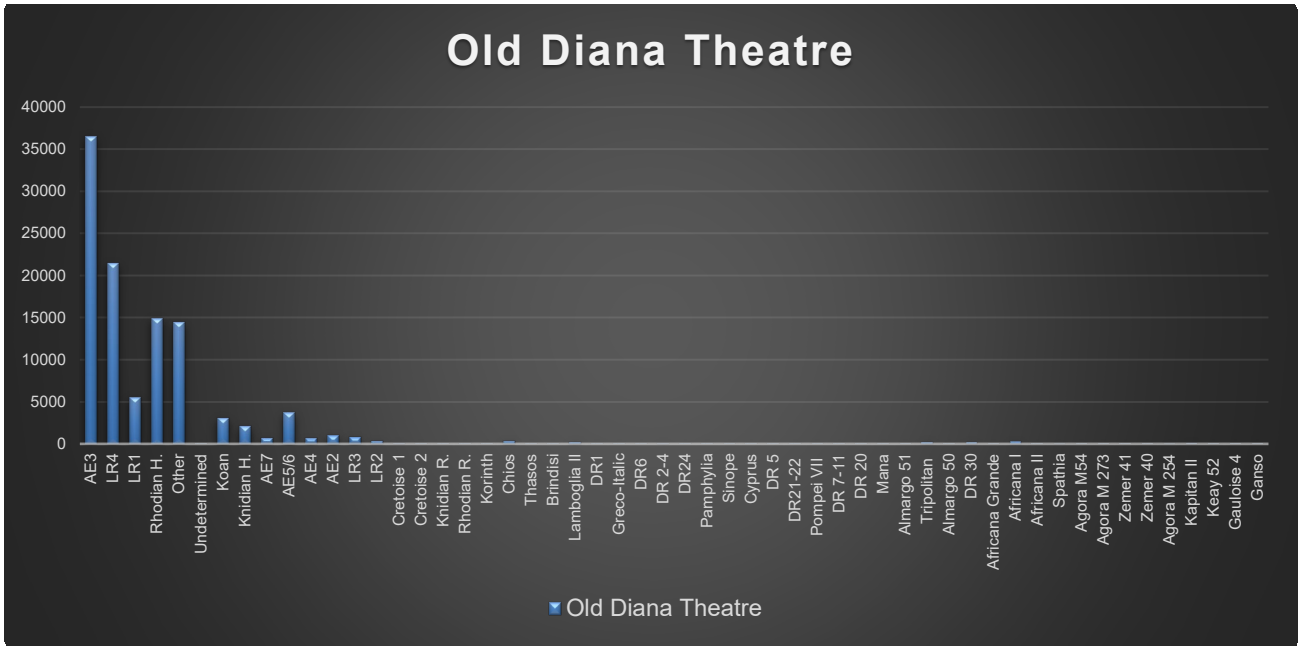


Figure 4.9 The amphorae located at Old Diana Theatre. This graph produced based on the data provided by Senol 2007:57–75.

Likewise, some studies undertaken on the Mareotic region by Empereur and Picon (1992:145–152) investigate a number of the amphorae recovered from some amphorae kilns and workshops using fabric analysis. Further, Pichot and Şenol (2014:225–239) focus on material recovered from a site called Akademia located the southern shore of Lake Maroetis. Moreover, considerable work has been done on the Mareotic region by the University of Southampton, in collaboration with SCA, as mentioned at the previous chapter. These works provide detailed data about the amphorae located in this area (Blue 2010:25–33; Blue and Kahlil 2011; Khalil 2010b:135–145). By the same token, Majcherek (2004:229–237) concentrates on the amphorae evidence located at Kom El Dikka. He presents the amphorae types and their percentage located at each spot of Kom El Dikka area. According to his study, the amphorae located at this site are datable to the late Roman period.

In this study, Majcherek (2004:231) highlights the shortage of some goods and products in Rome, which led to demand for imports from Egypt and vice versa. After the death of Emperor

Theodosius, the Roman Empire was divided into eastern and western empires by the fourth century AD, which had an effect on the movement of goods and the relationship between the ancient entities around the Mediterranean. This division led to a decline in the flow of goods from the western Mediterranean to Alexandria. In the same time, the goods from the eastern empire, the Aegean and the Levant, increased by the fifth century AD along with the local production as well (Majcherek 2004:231). This is clear from the amphorae located at each spot at Kom El Dikka.

According to the charts provided by Majcherek (2004:229–237), LR4 amphorae produced at Gaza, Palestine, are the most common amphorae finds representing 31% of the total, while LR1, AE5/6 (LR 5/6) and AE7 (LR7) came later with few North African amphorae. Further, Majcherek acknowledges that the Gazan amphorae have been lcoated in large amounts at Alexandria when compared with the other places around the Mediterranean. Furthermore, based on the finds at Kom El Dikka, the amphorae originateing from the Eastern Mediterranean represent the biggest portion of amphorae finds, along with a very modest representation of amphorae produced in the Western Mediterranean (Majcherek 2004:232).

Apart from these studies, no detailed or analytical study has been conducted at the rest of the amphorae sites mentioned at the previous chapter, excepting some preliminary reports and initial analysis about the nature of the remains. For Instance, Empereur provides a series of preliminary reports of the excavations undertaken at the Qaitbay/Pharos underwater site while highlighting the amphorae remains located (1996:963–970, 1997:831–836, 1998b:611–616, 1999:545–548, 2000b:595–603, 2001:679–685, 2002a:615–620). Similarly, a series of preliminary reports provided for the terrestrial excavations conducted by CEAlex contain again only initial data about the archaeological finds (Empereur, Albert and Olivier 1994:504–519; Empereur 1996:959, 1997:837–842, 1998b:617–621).

Additionally, while outlining the excavations conducted by the Hellenic Institute of Alexandrian studies between 1998 and 2012, Tzalas (2002a:61–74; 2013:320–384; 2015:347–364) highlights the amphorae recovered from Ibrahimia and Shatby underwater sites. Likewise, only initial information is provided in the preliminary reports for Ibrahimia and Shatby underwater sites (Tzalas 2000b, 2003:74–79, 2006, 2009, 2010, 2011, 2012, 2014, 2016a, 2016b). Meanwhile, no detailed study has yet been undertaken to examine the amphorae remains, only the studies that concentrate on the anchors located in the surrounding area (Tzalas 2002b:791–796). Similarly, the Mammura preliminary reports provide some initial information about the underwater site with no further analysis or examination (Abd-el-Maguid 2002:1, 2015:115–121; Elsayed 2012:159; GDUA 1999; 2000, 2001, 2002; Khalil 2002:17–18).

To conclude, the studies in this section focus mainly on one site without investigating possible links between its amphorae material and that found at other sites in or around Alexandria. Moreover, there are no studies devoted to any amphorae recovered from the underwater sites along the Alexandrian coastline and the North-Western Coast, except the general study conducted for the Aboukir Bay ceramics by Gratalop (2010:151–159, 2015:137–160).

4.3.3 Collective Studies About Some Specific Aspect of Amphorae Located at Certain Alexandrian Sites, such as Amphorae Stamps or a Specific Amphora Type

The third category of amphorae studies is focused on a specific aspect of the amphorae finds, rather than the jars in general. A number of detailed and specified studies have been undertaken by Cankardeş-Senol devoted to the amphorae stamps recovered from the terrestrial sites during the excavations conducted by CEAlex over the last 30 years. For example, Cankardeş-Senol (2001:397–408) focuses on examining the amphorae stamps located at Gabbari Necropolis. Similarly, Cankardes-Senol (2003:213–260) examines the handle stamps on only Hellenistic Rhodian amphorae recovered from Gabbari Necropolis. In another study, Cankardeş-Şenol (2017:321–368) examines separately the stamps of the amphorae handles located at one terrestrial site called Majestic Cinema. Additionally, Cankardes-Senol (2007a:33–56) examines the stamps recovered from all the terrestrial sites in general, while concentrating on the Rhodian stamps. The massive amount of Rhodian amphorae located in Alexandria as a result of rescue excavations is evidence of the direct and strong connections between Alexandria and Rhodes. It is worth stressing that Rhodes was one of the wine production centers exporting to Alexandria (Cankardeş-Şenol 2011:387).

Moreover, Cankardeş-Şenol (2007b:85–90) conducted a study on a specific group of names that appeared on some stamps located at the terrestrial sites. Also, Cankardeş-Şenol (2012:97–104) presents the amphorae stamps located at Shatby Necropolis terrestrial excavations. Likewise, Cankardeş-Şenol (2013:387–401) studies the amphorae handle stamps originated from Italy and located at the terrestrial excavations in Alexandria. In this study, Cankardeş-Şenol points out that during the Hellenistic period (third century BC) Alexandria covered most of the local needs for wine and olive oil from Italy. This is based on the presence of the Greco-Italic amphorae at the terrestrial sites, along with the other Italic amphorae like Lamboglia II, Brindisi, Dressel 1, Dressel 2-4 and Dressel 6.

Further, Cankardeş-Şenol dedicated four volumes (2015a; 2015b; 2015c; 2015d) to the Rhodian amphorae stamps located at Alexandria from the land excavation finds stored at the Greco Roman Museum and some of the Lucas Benaki stamps collection. This collection includes up to 91,000 stamps (Johnsson 2004:142). These studies contain stamps located not only at several sites around

Egypt, but also at Delos. In another work, Cankardeş-Şenol (2015e:169–192) focuses on the stamp types originating from Knidos and located at the terrestrial sites in Alexandria. This study mentions that Knidos was one of the famous production centers for wine and amphorae in the Aegean region. Meanwhile, Alexandria was a main market for Knidian products during the pre-Hellenistic and Hellenistic periods and this is based on the amphorae located at the terrestrial sites. Furthermore, this study notes that Knidian wine and amphorae production continued from the early seventh century BC and through the Roman and Byzantine periods until the seventh century AD.

In one such study, Cankardeş-Senol and Şenol (2013:55–82) concentrate on examining a Basket-Handled amphora type associated with their stamps, which was located at the terrestrial excavations at Alexandria. This study notes that this particular type of amphora represents 10% of the total amphorae finds from the terrestrial sites. Basket-Handled amphora were produced at Cyprus, the Levant and Egypt from the eighth century BC through to the middle of the Hellenistic period. This study highlights the relationship between Alexandria and Cyprus as the latter was a famous and important centre for producing wine and olive oil in particular. Trade between Egypt and Cyprus was active during the Hellenistic period. The study does not address Cypriot amphorae found at other sites, either terrestrial or underwater, in Alexandria.

Besides, Alkac and G. Cankardeş-Şenol (2016:191–216) provide an initial investigation of the stamps originating from Miletus and located at the terrestrial excavations in Alexandria. Further study conducted by Cankardeş-Şenol, Alkac and Abdelgawad (2017:297–316) applied a fabric analysis to the same collections of stamps. By the same token, Cankardeş-Şenol (2011:387–401) focuses on the Italian amphorae stamps recovered from the terrestrial rescue excavations and the underwater excavation at Quitbay Fort, besides the stamps in the Greco-Roman Museum in Alexandria. This study stressed the connection between Italy and Alexandria from the third century BC until the first century BC.

More specialised studies are provided by Dixneuf (2011:49–50) who sheds lights on the Egyptian amphorae located at the terrestrial sites in Alexandria. His study revealed that the AE1 and AE2 amphorae represent 4% of the total of the amphorae from the Hellenistic period onwards. This is due to the increasing demand of Aegean wine, particularly that produced at Greece, Rhodes and Knidos, during this period. By the beginning of the Roman period, Aegean wine imports declined, especially from Rhodes and Knidos, and was replaced with local production of AE3 which constitute 60% of the total amount of Egyptian amphorae finds. Figure 4.10 shows the high percentage of AE3 in contrast with the low percentage of the AE4, which was believed to be used only for import activities and not for local use.

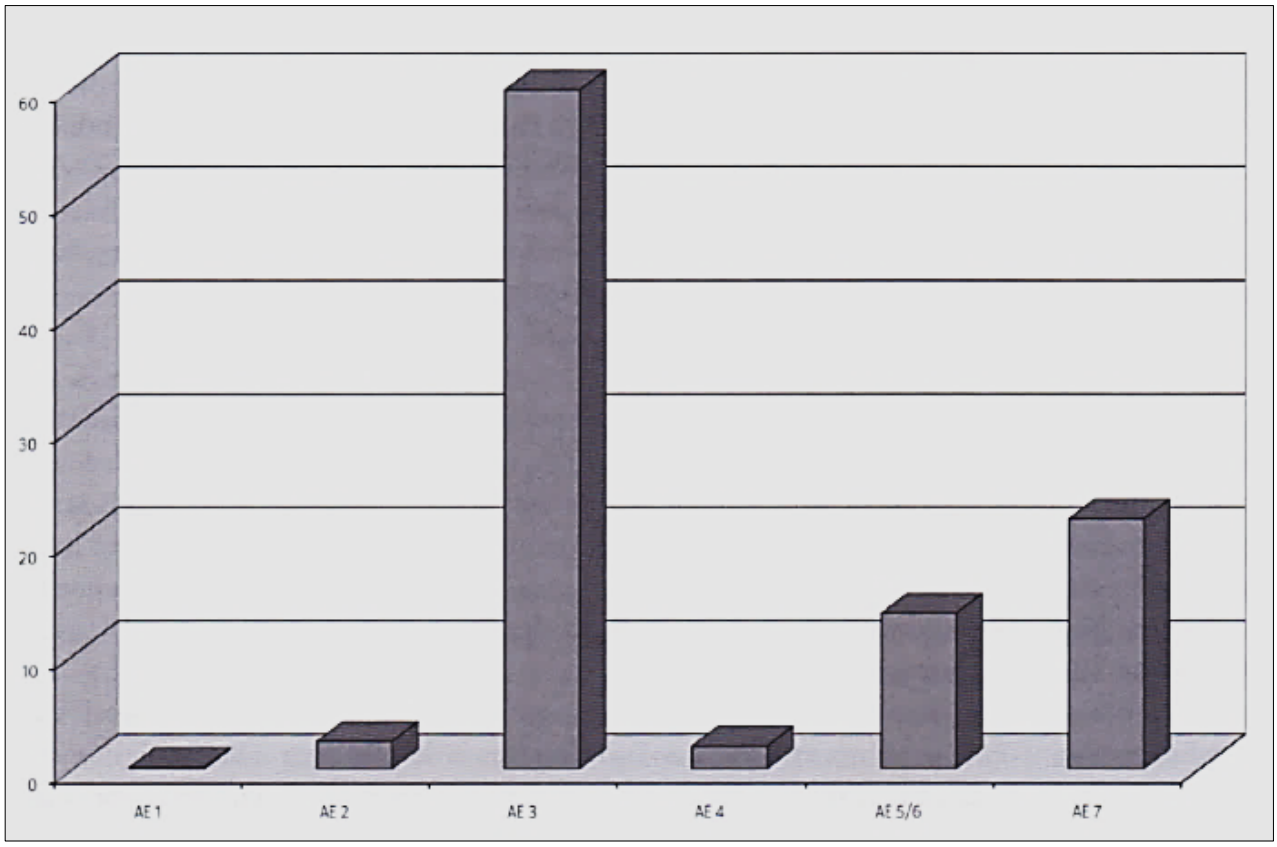


Figure 4.10 The Egyptian amphorae located at Alexandria based on the terrestrial excavations conducted by CEAlex respective team (Dixneuf 2011:50, fig. 7). © Copyright 2020, with permission from Centre for Alexandria Studies.

As mentioned before about the division of the Roman Empire, imports from the Western Mediterranean and the Aegean declined by the beginning of the fourth century AD, and all the import activity turned to the Levant and Eastern Mediterranean. The division of the Roman Empire to western and eastern parts led to the decline of the relationship between Egypt and the Western Mediterranean. This relationship was replaced with a stronger link with the eastern part of the Empire along with an increase in the local production of amphorae like AE5 and AE7 (Dixneuf 2011:220–221). A similar study conducted by Tomber and Williams (2000:41–54) highlights the Egyptian amphorae production during the Roman and Byzantine periods. This study discusses the distribution of Egyptian amphorae in the Western Mediterranean.

4.4 Mediterranean Amphorae Studies

Reviewing some of the Mediterranean amphorae studies provides a wider image of the types of amphorae studies and their tendency. Further, such studies provide guidance for interpretations of the results of this thesis results and help make more sense of the previous Alexandrian amphorae studies results mentioned in this chapter. This part does not cover all the Mediterranean amphorae studies as that is beyond the scope of this chapter. It discusses the amphorae fields of exploration and their approaches or methods of study and data analyses across the Mediterranean Sea. For

example, some studies are devoted to examining the development of a certain amphora type across certain time periods, like the study provided by Knapp and Demesticha (2017) that focuses on investigating the trade patterns and connectivity in the Bronze and early Iron age based on the amphorae evidence located in the Aegean and the Mediterranean basin. This study traced the development of maritime trade, the amphorae types and their transported products and showed how they changed over the early Bronze age through the Middle and late Bronze age until the early Iron age. Further, Knapp and Demesticha highlight the Bronze and Iron Age harbours and shipwrecks in the Mediterranean. Additionally, this study conducted a capacity analysis for the amphorae, which helped estimate the size of maritime trade during these early time periods. Also, this work sheds light on the term connectivity and how it indicates the movement and exchange of people, culture and products and how examining maritime trade could provide direct evidence of the size and strength of maritime connectivity.

Another study examines the distribution of the Italian amphorae evidence across the Eastern Mediterranean (Lund 2000:77–99). This study acknowledges that Italian wine was widespread across the Eastern Mediterranean by the end of the second century BC (Figure 4.11). This was because Delos became a 'free port' which encouraged more traders and merchants to establish more trading opportunities with their Mediterranean neighbours. According to the chart created by Lund (2000:86), the amount of imported Italian amphorae transported to the east was very modest in the early of the second century BC; however, it was markedly increased later as shown in the chart. This study notes that 3,000 Italian amphorae have been located in the Eastern Mediterranean in Greece, Delos and Alexandria. The biggest portion was in Alexandria with 40 % of the Italian finds across the Eastern Mediterranean, with 24 % for Delos and 21 % for Greece respectively. This is based on the amphorae collections stored at the Greco-Roman Museum at Alexandria. Additionally, Italian wine was a very famous export product to the Aegean region, especially Greece, along with Alexandria. Despite Alexandria and Greece being the richest find places of Italian amphorae, no Italian populations settled at Alexandria or Greece (Lund 2000:86–88).

Further, the Archaeology group at the University of Southampton represented by Keay and Williams (2005) have launched a digital database for Roman amphorae. This database is a comprehensive, open access, digital and detailed source, which could be used to identify any amphora fragments that have been recently located. The database contains illustrations, photographs, thin section petrographic analayses for each type and their origin. The reason behind creating this comprehensive digital database is the overwelming number of new studies related to Roman amphorae published recently using different approaches. It was challenging for scholars to compare the newly located fragements with other published examples, so Keay and Williams

created the database to represent a complete source of the amphorae produced during the Roman period.

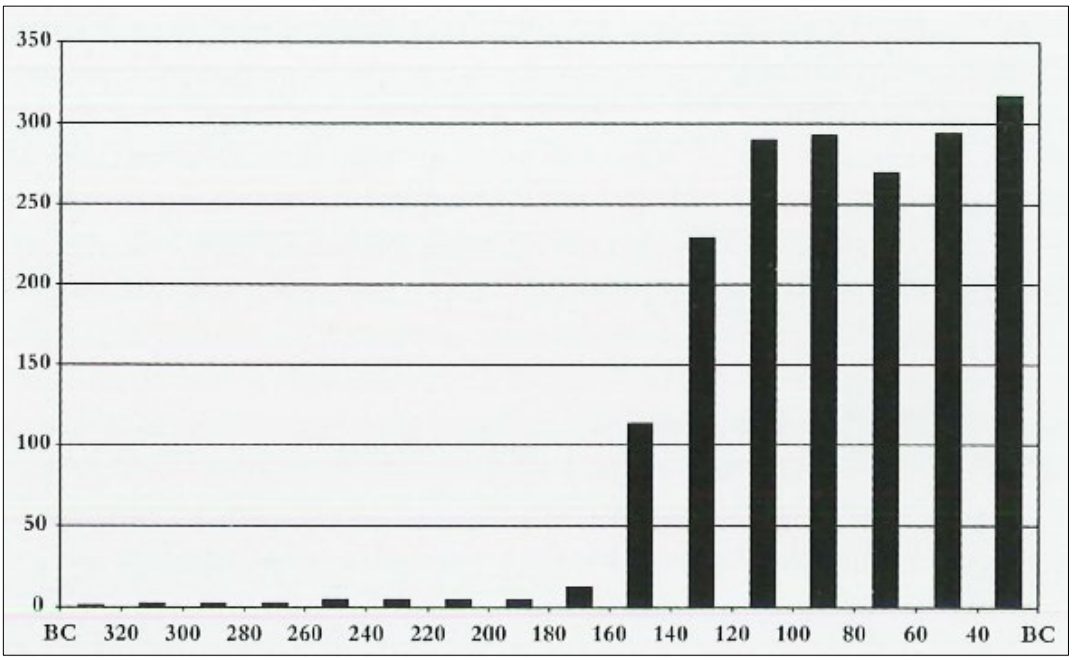


Figure 4.11 The distribution of the Italian amphorae at the Eastern Mediterranean at the Hellenistic period (Lund 2000:87, fig. 10). © Copyright 2020, with permission from J. Lund.

Whitbread (1995) contributes to amphorae knowledge with a study examining the amphorae types produced in Greece along with their production centres. In this study, Whitbread aims to shed some light on the amphorae production centres in Greece and reconfirm the source of each Greek amphora type by conducting petrographic analysis. The lack of data about the type of amphora that transported various products, the ability to identify the production and consumption areas, along with the concept of reuse and discard are all issues that have encouraged researchers and scholars to develop their techniques to develop better understanding of ancient maritime trade (Foley et al. 2012:389–391). It is worth commenting on the use of some intrusive methods for ceramic analysis as a principal method for a considerable number of the amphorae studies undertaken across the Mediterranean. The ceramic analysis methods include petrographic analysis, chemical analysis and deoxyribonucleic acid (DNA). The following section highlights these methods.

4.4.1 Petrographic Analyses

Petrographic analysis aims to identify the composition of the clay used to make the amphorae; however, for successful identification, the kilns' or towns' or countries' fabrics should be known beforehand. In the same time, some fabrics can be identified by eye, like the volcanic dust/elements from Italy (Peacock and Williams 1986:14; Peterson 2009:1; Williams, D.F. 2004:444).

Petrographic analyses have the potential to reveal the essence of the fabric such as if it is local or imported, along with specific data about the exact source in one country or region (north, south, east or west).

Thin section petrography has been used by archaeologists for decades to study the mineral elements in pottery clay, which will create a typology in an analytical method and will provide the researcher with a clear vision of ancient pottery productions. When the pottery remains lack surface decorations and attributes like inscriptions or stamps, then the clay offers clues to identify the similarities and differences between these remains by conducting analyses of the clay (Childs 1989:24; Fitzpatrick, Carstensen and Marsaglia 2008:60; Gasparic, Horvat and Mirtic 2014:229; Middleton 1997:73–79; Quinn 2010; 2013).

4.4.2 Chemical Analyses

Chemical analyses provide a detailed identification of the chemical elements present in the clay. It classifies the samples into groups based on the similarity of the chemical elements present in the samples. This provides an indication of the same production sources or centres of a group of samples with similar elements (Krotscheck 1998: 119; Waksman 2011:201–212). According to Peacock and Williams (1986:15), chemical analyses is effective with plain and featureless amphorae fragments while petrographic analyses is effective with distinctive fragments like handles, bases, rims or necks (Gibbins, Robinson and Taylor 1997:9–21; McGovern and Hall 2016:592–622; Zlatevaa and Rangelovb 2015:221–227).

4.4.4 Deoxyribonucleic Acid (DNA)

According to Foley et al. (2012:389–397), classic literature like Plato along with ancient coins and wall paintings are limited sources from which to identify amphorae contents. Further, although the inscriptions and stamps on the amphora surface give direct information about the origin, date and sometimes contents; most of the amphorae lack these devices. For these reasons, content analyses have the potential to provide precise identification of the amphorae's transported products. Foley and his co-authors (2012) developed deoxyribonucleic acid (DNA) analysis as a new technique to identify the contents of some Greek amphorae.

Foley et al. (2012:389–397) and Hansson and Foley (2007:1–8) used DNA analysis on nine amphorae dating from the fifth to the third centuries BC. This study used two methods for collecting the samples from the interior side of the amphora, which are scraping (destructive, using a sharp tool), and swapping (non-destructive, using swabs). These methods were used twice while the samples were dry and then after immersion in water. Further, swapping methods is more effective and informative, due to the ability to take the swab from more than one spot inside the

amphora, which could help in providing information about whether the amphora was reused or not in the case of the results revealing several products. The results for this study were surprising due to the high percentage of olive DNA samples in six amphorae, grape DNA in five amphorae and juniper DNA in eight amphorae, which is direct evidence of amphorae reuse.

4.4.5 Non-Intrusive Study

Peacock and Williams (1986:14) highlight the tendency to use thin section petrographic analyses on amphorae fragments, along with the other methods mentioned earlier. It is worth noting that some of the Alexandrian and Mediterranean studies used one or more of these methods (Cankardeş-Şenol, Alkac and Abdelgawad 2017:297–316; Fitzpatrick, Carstensen and Marsaglia 2008:59–82; Hein et al. 2008:1049–1061; Mange and Bezeczky 2006:429–460; Peacock and Williams 1986; Waksman 2011:201–212; Whitbread 1995). Some of these methods are intrusive or inapplicable and cause irreversible damage to the samples. It would not cause a big loss in the case of the availability of a large amount of amphorae evidence; however, it is destructive for the limited amphorae collections. For example, the petrographic procedure for preparing ceramic samples includes cutting a piece of the ceramic and grinding it for flatness, then it is glued using a transparent glass slide. After that, the ceramic piece is cut down again to thicknesses of 1 to 2 mm, then the sample is ready for examination to identify the constituents and texture (Peterson 2009:8). Preparing the sample for chemical analysis includes sample cutting, grinding and converting into a powder to be mixed with other chemicals (Waksman 2011:201–212).

At the same time, identifying the amphorae types by eye by the distinctive fragments is possible, but still does not provide the exact typology; however, it could yield an initial identification based on the available evidence. Further, Gibbins (1990:384) mentions that non-intrusive amphorae studies could serve as a tool in studying wreck sites without involving any excavation, surveys or intrusive examination of the archaeological evidence. The United Nations Educational, Scientific and Cultural Organization 2001 *Convention on the Protection of the Underwater Cultural Heritage* (UNESCO 2001 Convention) strongly recommends non-intrusive techniques of analysis over intrusive techniques. Therefore, this project aims to prove that the non-intrusive study has the potential to fill gaps in knowledge using the available data from collections, along with preliminary reports, databases, previous studies and ancient written sources.

Further, Parker (1990:345) notes the deficiency of data provided from underwater excavations in the Mediterranean. He also claims that a comparative study of materials that have never been studied before and others that have been studied and published is significant for the sake of filling a

gap and to complete the view of maritime history in the Mediterranean Sea, especially in the Hellenistic and Roman periods; which is what this thesis plans to accomplish.

4.5 Summary

The studies discussed in this chapter provide significant source and comparative material for this research. These studies make up the body of previously published works based on which the commercial ties and connectivity between Alexandria and other Mediterranean locales can be investigated using the amphorae remains from this region. A comparison between amphoric evidence and research results from the sites selected in this study with other studied sites will provide a more comprehensive and complete narrative of maritime trade and connectivity in the ancient Mediterranean. The following chapter is devoted to describing network analyses as the main study approach for this project. Chapter Five discusses the network analysis theory, terminology, rationale as a principal analytical method for the amphorae data collections and how archaeologists and historians have applied it in various archaeological studies.

CHAPTER 5. NETWORK ANALYSIS

This chapter introduces Social Network Analysis (SNA) as an approach to the study of connectivity and interactions between archaeological sites and ancient entities. The first part of this chapter discusses the definition of SNA, its usage, significance and the reasons for applying this approach to archaeological studies and shows how it can serve as a tool for examining and investigating historical and archaeological phenomena. Additionally, it details the current status quo of network analysis theory, elements, structure and terminology. Further, this chapter elaborates on some of the most popular social network analysis software that is used for mathematical data analyses. The second part of the chapter explores previous archaeological studies that have applied SNA as a method of data analysis. It discusses how archaeological data is converted into network analysis data to serve as a basis for the network structure. It provides a general review of network analysis studies in archaeology as a discipline and shows how SNA is applied in such studies.

5.1 Social Network Analysis (SNA)

SNA is an interdisciplinary approach that first appeared in the 1930s and 1940s. It studies relationship patterns and provides an analysis and better understanding of the social structure and interactions of entities, such as persons, organisations or groups (Butts 2008:13). It is a theoretical framework for identifying social structure and for testing hypotheses (Ghali et al. 2012:4; Hawe, Webster and Shiell 2004:971; Kosorukoff and Passmore 2011:77; Panda et al. 2012:26–28; Prell 2012:19; Wasserman and Faust 1994:17–21).

According to network theory, SNA is a set of certain actors or nodes and links, edges, ties, vertices and arcs that define the relation between the actors, along with set of attributes for each actor or node. It indicates the social relationships between the actors using a network analysis (Bandyopadhyay, Rao and Sinha 2011:1; Carolanm 2014; Hanneman and Riddle 2005:4,18; Denny 2014:3; Knoke and James 1982:12; Knoke and Yang 2008:7–10; Kosorukoff and Passmore 2011:1; Newman 2010:39; Marin and Wellman 2011:11; Prell 2012:8; Scott and Carrington 2011:4; Sheble, Brennan and Wildemuth 2016:339–340; Wasserman and Faust 1994:20). The nodes could be people, organisations or groups, while the links could be friendship, attending events, cooperation or commercial trade (Krempel 2011:559).

5.2 Why Network Analysis?

Prell (2012:1) mentions that social connectivity and interactions at one single entity could have a direct or indirect effect on the other neighbouring entities. Hence, identifying how the entities are

tied together and why could give answers related to world connectivity and interactions and open our eyes to innovative ideas for social development. Network analysis is more than a simple approach to exploring the way the actors are tied together; it investigates the interactions and the relationships between the network nodes such as people and groups. Also, network analysis is a method to explore differences and variations in social or historical structure. It expresses the domination, success and decline of network's nodes; and it clarifies the connectivity patterns between them (Knoke and James 1982:5; Knoke and Yang 2008:10; Sheble, Brennan and Wildemuth 2016:339). Network analysis serves as a tool of explanation and understanding of the pattern of the social interactions at different entities (Ghali et al. 2012:4; Hawe, Webster and Shiell 2004:971; Kosorukoff and Passmore 2011:77; Panda et al. 2012:26–28; Wasserman and Faust 1994:17–21).

Network approaches estimate the relationships between people to people, object to object, people to object, people to events or events to events. Such relationships control the history of the people or objects. Consequently, a network approach provides us with knowledge of how the relationship between people, entities, countries or objects was, and to what extent these impact other relationships or networks (Brughmans 2012:625–626; Knoke and James 1982:5). Furthermore, Brughmans and Poblome (2011:256–260) stressed the significance of applying the network analysis approach to a project aiming at studying the connectivity between different entities and how promising this approach is if applied to archaeological studies. Network analysis examines the relationship, exchange and connectivity between actors or entities using material culture.

5.3 Network Analysis in Archaeology

5.3.1 Artefacts or Material Culture as Social/Interacting Nodes

Network science is a comprehensive methodology containing methods and approaches for managing, representing and analysing network data in a relational and statistical framework (Collar et al. 2015:6). Network science developed in the twelfth century and focuses on identifying the connections and interactions between individuals, groups, entities, organisations or past phenomena (Seland 2016:191–205). According to Borgatti et al. (2009:892), interest in network analysis studies increased across the last 10 years, especially in the social sciences such as psychology, business, communications, law, crime and economy and health, physical and biological sciences of diseases, atomic interactions and chemical interactions, and trade relationships. It is used widely by sociologists and anthroplogists to investigate the social connections which provide information on the behaviour of the population and social networking (Borgatti et al. 2009:892–893; Knappett 2011:8; Knoke and James 1982:7; Knoke and Yang 2008:2; Kosorukoff and Passmore 2011:4;

Mickel 2016:1097; Panda et al. 2012:25). It is striking to note that using network analysis in archaeological studies started in the 1960s and increased during the last thirteen years (Collar et al. 2015:1; Knappett 2011:8, 51; Malkin, Constantakopoulou and Panagopoulou 2007:1–9; Mickel 2016:1095; Mills 2017:380; Östborn and Gerding 2014:75). Network analyses has been used in archaeology to investigate and visualise the movement processes of people, goods, cultural and social ideas and to study ancient societies and entities, along with the maritime connectivity between them (Brughmans 2012:624; Graham 2006b:48; Mickel 2016:1095; Rutherford 2007:26–27). Additionally, Leidwanger et al. (2014:1–9) emphasise that using network analyses could help provide a new perspective and a comprehensive interpretation of the connectivity and in simulating changes across different periods.

Network analysis is a different way to analyse the archaeological data record and grey literature and acquire a comprehensive insight to the connectivity, if any, between ancient entities. Also, such connectivity patterns shed light on the influence of these ancient entitites over people and places. Network analysis is also a way of organising and visualising the data for better understanding (Brughmans and Poblome 2011:272). By the same token, Knappett (2011:52–58) states that the network analysis approach helps in 'reconstruction' of cultural or social changes, developments or fluctuations that happened over time using data that needs to be prepared and adjustable to suit the network analysis. This approach is based on the connectivity and relation between the nodes which suits the study's aim to identify dynamic networks and social interactions. Also, one of the advantages of this approach is the applicability of using people and things as nodes rather than only people. As for the things, ceramics are the main highlight of human interactions and the primary evidence on any archaeological site. In most cases, ceramics have the largest representation of all artefacts located at every archaeological site (Knappett, Malafouris and Tomkins 2010:588).

Knappett (2011:7–8,179–184) sheds light on the usual use of humans as nodes and social relations as links and how material culture is often ignored or considered as secondary or background data in the whole process, or how studies concentrate at either humans or things, but not both. In contrast, the relationship between the objects and the humans is described as a 'reflexive' relationship. In other more familiar words, the objects are made by people, but objects are 'transformed' through time by use and movement by people (Fulton 2016). This has led to people being considered the main and active network nodes rather than objects. But in truth each object can make an individual network based on its connections and relationship with its makers, distributers and consumers.

Furthermore, Knappett argues that Actor-Network theory (ANT), which is the proxy of objects that focuses on identifying the links and the relations between people and objects, is a suitable approach

to deal with and handle the relations between things and humans in network thinking (Fulton 2016). The reasons behind that are to find the balance between them and to consider the things and humans as network nodes/actors in the whole structure. As mentioned earlier, social network analysis has been used for decades in the social sciences but by ignoring things or material culture in general. Combining the Actor-Network theory with the social network analysis could provide the balance and equality between the things or cultural materials and people through network thinking.

Collar et al. (2015:6) exemplify the application and use of network analysis in conjunction with geographic information systems GIS in archaeological studies, which provides a geographical representation of the archaeological data. The geographical data is different from the other usual archaeological data that requires adaptation especially for GIS as this is mainly used for other disciplines and fields of knowledge. The same condition applies to network analysis as the data requires certain and specific adaptation and arrangement for inclusion in a network analysis, particularly for identifying the connectivity and relationship patterns. Moreover, the network analysis approach provides a chance to represent the connectivity and realtionships between the nodes/actors and to visualise these interactions in a clear and dynamic way. It gives a new perspective to read and investigate past phenomena of the ancient history. Network analysis extracts the absolute values of the available datasets and explores the hidden linkage between them, which enhances and develops our insights to history and material cultural. It converts the archaeological data into matrices and graphs through points (nodes) and lines (links) (Graham 2006a 92–93; Knappett 2011:8; Mickel 2016:1096; Mills 2017:391; Östborn and Gerding 2014:75).

5.4 Network Analysis Theory

5.4.1 Network Data Structure Types

The network analysis approach offers two types of network structure or data collection. Both depend on the research aim and what the researcher wants to achieve. In other words, the researcher should collect data that consists of nodes and links based on that aim. Then, if the aim is related to identifying all the possible connections between all the nodes, then whole or full network structure is the way to represent this data. If the aim focuses in identifying the connection between particular nodes rather than the others, then ego-centric network structure is the way to represent this data.

5.4.1.1 Whole/full network

The whole/full network is aimed at addressing all the relationships between all the network's nodes. Consequently, collecting relational data about each node is essential (Hanneman and Riddle 2005:7; Knoke and James 1982:18; Prell 2012:11; Marin and Wellman 2011:19). Identifying the absolute

connectivity between all the network nodes provides a comprehensive insight to the way the nodes interact, enabling better understanding of the examined.

5.4.1.2 Ego-centric network

An ego-centric network focuses on one main focal node as an ego and its relationships and connectivity to other nodes, which are called in this case alters. Also this network contains the relationships if any between the alters (Carolanm 2014; Hawe, Webster and Shiell 2004:972; Knoke and Yang 2008:14; Prell 2012:8–9, 119; Marin and Wellman 2011:20; Newman 2010:46; Wasserman and Faust 1994:41–42). In terms of the ego-centric network language, (n) refers to the number of alters while (L) refers to the number of links between the alters (Prell 2012:121).

5.4.2 Data Representation and Visualisation

According to Hanneman and Riddle (2005:21) and Knoke and Yang (2008:40), matrices (also known as sociomatrices) (Denny 2014:4; Scott and Carrington 2011:4) and graphs (also known as sociograms) are two types of mathematical tools involved in the social network analysis data representation and visualisation. Using both types is fundamental for investigating the network structure, because matrices provide detailed and organised sheets of the available mathematical data. Graphs visualise and describe the mathematical data. The following section provides more about the matrices, their types and the graphs.

5.4.2.1 Data Representations

Matrix

A matrix is a mathematical algebraic method for sorting and categorising the network relational data collections. It is used for mathematical computer network analyses and calculations (Carolanm 2014; Hanneman and Riddle 2011a:337; Knoke and Yang 2008:40–43; Scott 2000:63; Prell 2012:13; Wasserman and Faust 1994:94, 150). It is a dataset containing rows and columns; each actor has one row and one column and each entry in the matrix is called a cell. Each corresponding cell between a row and a column contains the tie, if any, between two actors (Denny 2014:5; Hanneman and Riddle 2005:26; Scott and Carrington 2011:4; Wasserman and Faust 1994:150–154).

Denny (2014:4–5), Prell (2012:14) and Scott (2000:43) list the main features of the matrix convention when discussing the matrix elements. For example, (m) refers to the number of rows in the matrix while (n) refers to the number of columns. At the same time (i) refers to an individual row, (j) refers to an individual column and (a) refers to the value in the cell. It is worth stressing that the rows should come before the columns in describing the matrix. So the form would be a(i,j); this

is to simplify the analysis and interpretation when referring to a specific entry in the matrix. Furthermore, the matrix has two different types as follows:

One-mode network matrix

One-mode network matrix which the rows and the columns contain the same nodes forming a square matrix because the number of nodes in the rows and the columns is the same. This type of matrix known as adjacency matrix as an indication to adjacency and non-adjacency nodes, in other familiar words; if the nodes in the matrix are adjacent or tied to each other or not. This type of matrix gives an idea of how one set of nodes interacting with each other's (Carolanm 2014; Hanneman and Riddle 2011a:337; Knoke and Yang 2008:40–43; Prell 2012:13,16; Scott 2000:40,63; Scott and Carrington 2011:4; Wasserman and Faust 1994:35, 77–84,94,150).

Two-mode network matrix

In a two-mode network matrix the rows and the columns contain two different sets of nodes; the rows' nodes are not the same as the columns' nodes, forming a rectangular matrix because the number of nodes in the rows and columns are different (Carolanm 2014; Scott 2000:39–40). These types of matrices are also known as incidence matrices (Kosorukoff and Passmore 2011:93; Prell 2012:13; Scott 2000:41). Organising the data in a two-mode matrix gives an idea of how the nodes in each set interact or are tied to the other nodes in the other set (Hanneman and Riddle 2011a:338; Wasserman and Faust 1994:85).

According to Wasserman and Faust (1994:35,291), there is a subtype of the two-mode network called affiliation network which contains one set of nodes and one set of events. This type of network sheds light on how the nodes affiliate to the events, which could be clubs, organisations or groups, especially where nodes might be not connected to each other directly. By applying this type of matrix, an indication of connectivity might appear between the nodes (Hawe, Webster and Shiell 2004:972; Newman 2010:53; Panda et al. 2012:39).

Applying the affiliation network investigates the ties between the nodes through the events and the ties between the events through the affiliated nodes. This investigation helps to complete the puzzle of social interactions and identify the reasons behind it. As for the affiliation network matrix, the corresponding cell between the node and the event contains (1) if the node is affiliated and (0) if no affiliation is identified (Wasserman and Faust 1994:296–299). Scott (2000: 41) illustrated these types of matrix, as shown in Figure 5.1, and highlighted the matrix of affiliation which gives information on how the events are tied together or related to each other without mentioning the actors in direct way.

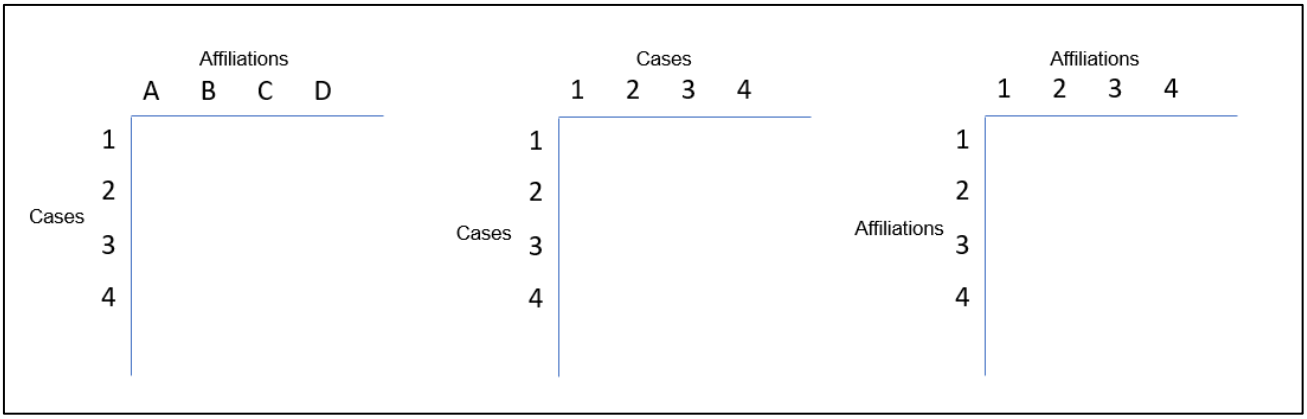


Figure 5.1 Types of network matrices (after Scott 2000: 41, fig. 3.3).

5.4.2.2 Data matrix entry measurements

Binary measurement matrix

A binary measurement matrix is used for recording the existence and absence of the ties between the nodes; if the tie is present then (1) is placed in the corresponding cell in the matrix between the particular two nodes and (0) in the case of the tie's absence (Hanneman and Riddle 2005:11,27–28; 2011a:337; Prell 2012:16).

Valued measurement matrix

A valued measurement matrix is used for investigating the strength of ties and connectivity between the network's nodes. Instead of placing (1) in the corresponding cell in the matrix between the nodes as mentioned above, a number or a numerical value is used (Hanneman and Riddle 2005:11; 2011a:337; Prell 2012:75–76). The data matrix can be analysed and visualised using social network analysis software. The software package selected for this analysis is UCINET which will be discussed in more detail in chapter six.

5.4.2.3 Data visualisations

The network analysis approach provides a visualisation for the available data through a graph or sociogram. A graph or sociogram is a visualised version of the network matrix data and a method for describing it (Scott 2000:63–65). The nodes in the graph are represented by labelled dots or points, while the ties are represented by lines with arrowheads if the relationship is directed or without if the relationship in undirected. In the latter case the lines represent the existence of the tie between the nodes. Also, the directed tie is called an arc, the undirected tie an edge and the connected nodes are called adjacent nodes (Figure 5.2).

On the one hand, a graph is a word for the visualised network in the case that the relationship between the nodes is undirected, and digraph is a name for the directed network and a bipartite if the graph contains two different sets of nodes. On the other hand, the network that contains value

measurements is called weighted/valued network, and unweighted/unvalued for the binary measurements network. It is worth stressing that the thickness of the ties indicates the value measurement and the strength between nodes in the weighted network (Bandyopadhyay, Rao and Sinha 2011:3–4; Datavu 2013; Hawe, Webster and Shiell 2004:972; Knoke and Yang 2008:40–41; Kosorukoff and Passmore 2011:108; Krempel 2011:559; Prell 2012:9–10, 16–17 ; Scott 2000:64–67; Scott and Carrington 2011:4, 13; Sheble, Brennan and Wildemuth 2016:339–340; Wasserman and Faust 1994:93–94). Moreover, (N) refers to the number of nodes in the network while (L) refers to the number of ties (Prell 2012:10).

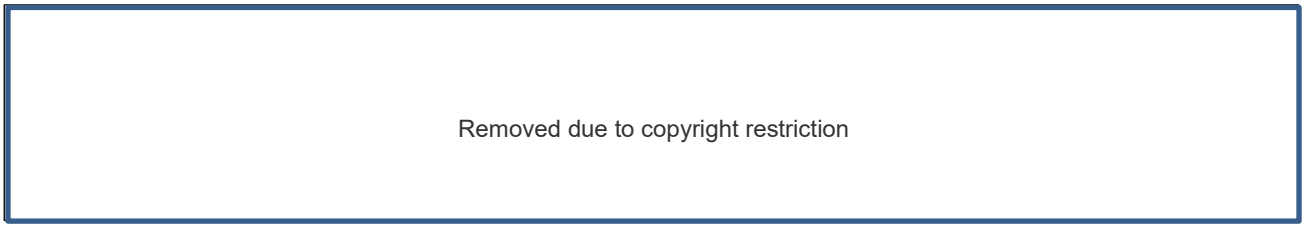


Figure 5.2 From the left to the right, directed tie, undirected tie, weighted network, no tie exists (Sheble, Brennan and Wildemuth 2016:340, fig. 34).

5.4.3 Levels of Measurement and Analysis

According to Wasserman and Faust (1994:17) and Hanneman and Riddle (2005:11), a number of mathematical measurements and analyses could be applied to the network data collection like centrality degree, closeness, betweenness and similarity and dissimilarity. Selecting certain types of measurements is based on the research questions and the aims behind using the network analysis approach.

5.4.3.1 Levels of network analysis for whole/full network

Centrality degree

The node with the highest centrality degree means that this node has the highest degree of ties and connectivity in the network, either ties from or to the central node (Prell 2012:96–97; Scott 2000:83). Measuring the centrality degree helps in pointing out the prominent and the most important actors in the network and gives an idea about the possibility of power over the other nodes (Hawe, Webster and Shiell 2004:974; Panda et al. 2012:29; Sheble, Brennan and Wildemuth 2016:342). It is interesting to note that centrality degree ignores the direction of ties and their value, as it only focuses on the number of alters connected to the ego in a binary symmetric matrix, which means the upper half is the same as the lower half (Prell 2012:97–98). At the same time, measuring centrality degree on valued data could be tricky and misleading due to the influence of the value over how central the node is. In other words, the node with a single stronger tie will be the one with the highest degree of centrality; however, other nodes might have more than one weaker tie that is more central than the one with the stronger tie (Knappett 2011:41–42; Prell 2012:98).

Betweenness centrality

The term ‘betweenness centrality’ clarifies the count of how many times a specific node is spotted between two other network’s nodes (Prell 2012:104). It gives information of the number of nodes that are connected to that specific node indirectly. So, nodes that have the highest betweenness centrality arecconsidered a bridge and a connecting node between two other unconnected nodes. Betweenness centrality measurements are based only on binary data (Ghali et al. 2012:8; Hawe, Webster and Shiell 2004:974; Panda et al. 2012:29; Prell 2012:105).

Closeness centrality

The term ‘closeness centrality’ focuses of how an actor or node could reach the other nodes and measures the shortest distance and path between them. The node with the shortest distance measurement is the node that has the most closeness centrality. As with the degrees of centrality and betweenness, the data should be binary, and all the nodes are connected (Ghali et al. 2012:7; Panda et al. 2012:29; Prell 2012:107–108). The results of all these three centrality measurements range between (0) to (1), which indicates the maximum centrality (Denny 2014; Kosorukoff and Passmore 2011:45).

5.4.3.2 Levels of network analysis for an ego-centric network

By the same token, different levels of analysis apply to the ego-centric network. According to Hanneman and Riddle (2011b:341–342), several analyses could be applied to the ego-centric network, such as the network size, density and structure equivalence. The following section provides more detail about these levels of analysis.

Size

The size is measured by counting the number of nodes or individuals in the network. This level of analysis shows the size of the network, which could act as a comparative aspect in the case of the availability of other networks. It is worth noting that the network size could be measured for a whole/full network as well (Hanneman and Riddle 2011b:341–342).

Density

The measurement of density is based on the count of ties included in the network and it ranges between 0 and 1.0; the later means that the network is dense. It is worth pointing out the impossibility of using density to compare networks due to the difference in the size between each network (Ghali et al. 2012:7–8; Hawe, Webster and Shiell 2004:973; Prell 2012:121). Therefore, size and density give only a general view for the structure of the network (Hanneman and Riddle 2011b:341–342).

Structure Equivalence / Similarity and Dissimilarity

Structural equivalence and the similar measure indicate that two nodes have the same relation or connectivity with the other network nodes. Yang et al. (2017:43–70) explained the similarity measure by considering friendship as a link and the nodes as people. If two nodes have similar interests, then the possibility of similarity is high. Hanneman and Riddle (2005:94–95) exemplified the structure equivalence idea by simulating if the first node likes the second node and the third one likes the second, then the first and the third are equivalent. Despite that, the first node is different from the third one, but both have the same type of relations. The high similarity measure between nodes indicates the proportion of similarity and vice versa. These types of measurements give us information regarding whether the nodes have similar distribution patterns or not and how they are connected to other nodes in the network (Yang et al. 2017:43–70).

5.5 Social Network Analysis Software

Social network analysis software is a tool for providing data analyses through sophisticated mathematical calculations. Network analysts and developers provide a wide variety of software packages to process the data prepared in matrices. SNA software presents the statistical and mathematical analysis for the data provided allowing the researcher to simulate and visualise the data though graphs. Every software provides a number of levels of analysis and each researcher must choose the appropriate software. Some software requires training due to its complications like UCINET/NetDraw (Borgatti, Everett and Freeman 1992:12–15; 1999; 2002), Pajek (Batagelj and Mrvar 1998:47–57; 2002:477–478; 2014) and Gephi (Bastian, Heymann and Jacomy 2009). Others can be covered through reading their instruction manuals, like Visone (Baur 2008) and Cytoscape (Shannon et al. 2003:2498–2504). Most software types are open sources and can be downloaded for free.

5.6 Network Analysis Approaches for Archaeologists

Collar et al. (2015:1–32) reviewed and investigated archaeological studies that use a network analysis approach in terms of abstracting the past phenomena through network data to the visualisation methods that are the basis of any network analysis research. In this review, Collar et al. (2015:4) summarised the network analysis model in several steps, as shown in the following table:

Table 5.1 The network model phases.

Network Model Phases	Explanation
Past phenomenon	The area of research
Abstraction/conceptualization	Research questions and aims
Data representation	Modify the data through nodes and links
Methods	Select an appropriate level of analysis
Temporality	Chronology
Visualization	Present the network model in graphs of points and lines

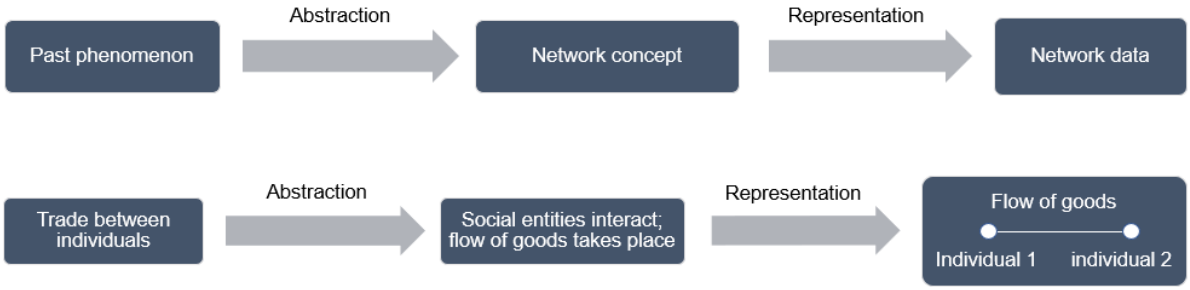


Figure 5.3 Network analysis model (after Collar et al. 2015: 5). Copyright 2020 by Springer Nature.

This network model used the example of prehistoric trade networks, which were conceptualised by tracking the movement of goods and trade operations. The data were represented as nodes and links, the nodes are the social entities and the links are the goods, then a chronology set is selected, after which the visualisation of the network falls into place (Figure 5.3) (Collar et al. 2015:4). Table 5.2 shows the model applied for this thesis based on the model provided by Collar et al. (2015:1–32).

Table 5.2 Illustration of the network analysis model of the thesis.

The Network Analysis Model	
Phenomenon	Trade networks between Alexandria and the rest of the Mediterranean basin.
Conceptualisation	The transported amphorae, their contents and production regions and the variations that happened across time periods, in terms of using specific types, exchange of specific type of products and the prominent or specific production region.
Data representation	Nodes are the archaeological sites while the links are the amphorae types, transported products and production regions of these amphorae.

Methods/tools	Exploratory and statistical social network analysis, centrality degree and the similarity and dissimilarly (Pearson correlations coefficient).
Temporality	The data divided into six time periods starting from the pre-Hellenistic through the Hellenistic, early, mid and late Roman until the Islamic period. Different networks are allocated for each time period based on the amphorae types, contents and production regions.
Visualisation	Ego and two mode network graphs generated by NetDraw along with charts representing the centrality degrees.

Using network analysis becomes a research relational method in the araheological studies (Mills 2017). A workshop was organised by Leidwanger et al. (2014:1–9) at the University of Toronto to encourage collaboration between network analysts, historians and archaeologists to find a framework for investigating maritime connectivity. The main aim of this workshop was to examine the material culture or artefacts within a network analysis framework to investigate maritime connectivity through long periods of time. This workshop also aimed to provide a path for scholars who are interested in examining maritime connectivity phenomena in the ancient Mediterranean, along with highlighting network theory as a framework for similar studies.

The structure of the maritime networks has been highlighted in this work, which contains, in most cases, nodes representing the archaeological sites and links representing the connectivity patterns. Additionally, Leidwanger et al. (2014:6–7) point out to that investigating the archaeological remains could play a major role in identifying the connectivity between ancient entities, and discuss the applicability of using a shipwreck and its cargo as a 'mobile node' through a number of options. The most significant one is using the cultural materials or the archaeological remains of ship cargoes, like pottery sherds and transported amphorae, as a connection factor or link between the sites that have the same type of amphora or pot. It is worth stressing that the material culture is the key point in this doctoral study as it represents the evidence of interaction and connectivity between the ancient entities across four thousand years. Besides, Leidwanger et al. (2014:1–9) stress the significance of using a wide range of cultural material to investigate the connectivity patterns. For example, iconographic sources, coins and inscriptions along with written sources, could provide a more complete view of the whole story.

Furthermore, Leidwanger et al. (2014:1–9) mention that several variables and factors could have a critical and direct influence on the ascent, continuation and decline of maritime networks. For example, the marine conditions of wind, currents, etc. affect the way the merchants define and choose their marine routes. They also consider the sea bottom configuration along with the changes

in vessel structure and the harbour facilities and designs. Moreover, the navigation and seafaring experience was always challenging due to sudden changes in environmental conditions. The economic and political situations are also major factors of the networks' fluctuations. Together with Malkin, Constantakopoulou and Panagopoulou (2007:1–9) examined Mediterranean networks through the collaboration between two small adjacent Aegean islands, Herakleia and Schinoussa, during rough weather to protect their boats and the exchange between them through their ports. The same approach was applied to the Mediterranean basin but on a wider scale.

Mills (2017:379–397) reviewed the previous studies that have used network analysis as a method and divided them into three categories as follows: historical networks (archival, documentary and epigraphic sources) (Graham 2006b), spatial or geographical networks (like using the GIS as an integrated research method) (Wernke 2012:1111–1122) and material networks (using material culture and archaeological artefacts) (Borck et.al 2015:33–57; Brughmans 2010:277–303; Brughmans and Poblome 2011:255–279, 2016a:1–18, 2016b:393–408; Golitko and Feinman 2015:206–247). However, this thesis considers all these network types. It has combined all these types together, as archival and documentary data have been used along with the material culture (amphorae) and has applied a GIS platform to provide a fixed geographical map of shipwreck sites. Similarly, Östborn and Gerding (2014:77–78) and Brughmans, Isaksen and Earl (2012:359–369) reviewed some of the archaeological and historical studies that have applied network analysis as an approach with a focus on the technical methods used in these studies. One example uses proximal point analysis (PPA) for visualising the connectivity and interaction patterns between different contexts and their adjacent neighbours in the Early Bronze age in the Cyclades Islands (Broodbank 1993; 2000). Proximal point analysis (PPA) is 'a nearest neighbour technique for constructing networks' which indicates the degrees of connections between the network nodes, showing how, in other words, each node connects to their adjacent nodes. This type of analysis was also applied to the study of the extent of religions in the Roman Empire (Brughmans, Isaksen and Earl 2012:359–369; Collar 2007:149–162; 2013). Collar used proximal point analysis (PPA) to link the geographical distributions of the religious inscriptions with their nearest neighbours, to evaluate the movement of the religions between the entities and track the changes that happened in that social aspect in the Roman Empire.

Significant examples of applying network analysis to archaeological data and using material culture as a proxy is provided by Brughmans (2010:277–303) and Brughmans and Poblome (2011:255–279, 2016a:1–18, 2016b:393–408), who aim in their studies to investigate the 'past conception' and connections as well as the distribution of the Roman tableware in the eastern Mediterranean by using network analyses to better understand the ancient entities. They used a database of ICRATES

(Inventory of Crafts and Trade in the Roman East) containing 30,000 sherds dating to between 25 BC and AD 150 along with data extracted from 357 publications as a trail to shed light on the transport and the movement of the actual complete containers, using network analyses based on the typology and the geographical concept as a tool to interpret and investigate past phenomena. This study aims to identify the exact trade routes from the production region until eventual deposition. For example, using a specific route might be based on topographical and geographical factors like navigation and sailing hazards, the topography of the seabed, the configurations of the harbours and the weather conditions in general, and investigating the topographical and geographical factors would lead to identifying the reasons behind the distributions of the ceramics. Two networks have been created, the first one is an exploratory network based on the location of the sherds and their typology. The second network is geographical, or distance based; in other words, the geographical distance is factored as the shortest distance between the sites, which might be one of the factors impacting the distribution patterns.

The aim was not just to list the factors that influenced every trade route, but to examine how the archaeological remains could help provide the reasons behind their distribution and the rule of geographical distance. Consequently, a distance-based network selected along with the exploratory one to help give a complete picture of the trade routes. Then, a comparison aimed to investigate the maximum and potential interpretations of connectivity and trade patterns, as the exploratory network highlighted the distribution patterns while the distance-based network examined the validations of these patterns. To do so, this study used two mode networks; nodes were the sites or types based on the existence of the type (ties) on certain site and the link between them represents the volume or the number of sherds located there.

This network was narrowed down to two smaller, distinct one-mode networks. One was based on the connectivity between the sites (nodes) and the sherd types (ties) located at the same site demonstrated ‘co-presence’. The sherd type is used as the node in the second network and the sites are the ties. It is worth stressing that scales of connectivity were organised on the basis of the types of the pottery that share different distribution patterns among the archaeological sites. The variation of co-presence of these types in the archaeological sites indicates the different type of relationships between them, and consequently the production regions. This approach facilitates following and recording the change, emergence or disappearance of certain types for every period, and then the exploration of patterns and distributions.

Another example for using the material culture in a network analysis is provided by Golitko and Feinman (2015:206–247), who investigate the movement, production, exchange, distribution and

trade network of obsidian in pre-Hispanic Mesoamerican from 900 BC to 1520 AD. This study is based on archaeological sites that represent ancient settlements. An enormous amount of obsidian has been located in central Mexico and the Guatemalan and Honduran highlands as it was an easily transported raw material used for manufacturing tools for thousands of years before the appearance of steel from Europe. Consequently, examining the obsidian would provide a tool for investigating the trade networks in this region. This study is a continuous examination of the Mayan obsidian network (Golitko et al. 2012:507–523), concentrating on classical, terminal classical, early post-classical and late post-classical as four time periods based on the obsidian located at 121 Mayan archaeological sites. The continuous study provides a more comprehensive investigation that covers all pre-Hispanic Mesoamerica through eight time periods as follows: pre-classic (periods one–two), middle pre-classic (period three), late pre-classic (period four), early-middle classic (period five), late classic (period six), early post-classic (period seven), and late post-classic (period eight). The data was arranged in matrices and visualised in graphs. As for the network structure, obsidian was the link between the nodes, which are the archaeological sites that represent the ancient settlements. Moreover, a number of analyses were applied like size, density, betweenness and centrality degree, along with Brainerd-Robinson (BR) coefficient, which is a similarity tool. The Brainerd-Robinson (BR) coefficient requires some manual mathematical calculations as it is not available in social network analysis software (Peeples 2011). The network data and visualisation of Golitko's study was processed using UCINET and NetDraw and revealed how dynamic the trade network is and how the connectivity and interactions changed across the time periods.

By the same token, Graham (2006a) aimed in his study to identify and examine the social and economic connectivity between Rome and the Tiber valley of central Italy as its hinterland from the first century AD until the fourth century AD using the brick industry in the Tiber valley as a tool to identify this interaction. Archeometric analyses for the clay fabric and X-ray diffractions were completed to identify the production regions. Also, the brick's stamps have been used as another tool to investigate the social connections, especially those stamps that contained the makers' and owners' names, which in turn show a network of social interactions between the makers and the owners.

The archaeometric results of the study undertaken by Graham (2006a) revealed that the lands used for manufacturing the bricks were through an agency that used patronage as their strategy. It is interested to note that patronage was a legal system in the Roman Empire and examining this system would give information about the types of interactions. Firstly, this study identified the network patterns of the land usage patronage system along with the social and geographical connectivity through the bricks. These networks were structured such that the people and the bricks

acted as nodes and the interactions through the archaeometric results, along with the epigraphic resources, were the links. Secondly, another network applied the stamps and the manufactured clay used as a relational tie, while attributes between different contexts were used as network nodes to measure the similarity between them.

In the same way, Östborn and Gerding (2014:75–88; 2015:306–344) studied the changes in the distribution of the bricks in Europe during the Hellenistic period from 400 BC until 25 BC by examining the similarity in the context of the bricks (nodes) between the studied sites, which led to the identification of the connectivity between them. The network was structured from 275 bricks recovered from 113 sites and 233 contexts, which served as nodes. The links were the similarity between the bricks' attributes. Furthermore, Östborn and Gerding (2014:75–88) discuss network analysis and its power to reveal hidden correlations and similarity connections between the archaeological data. Also, this study stresses that the selection of a specific analysis should be based on the aim behind each study and the nature and the availability of the archaeological data.

Graham and Weingart (2015:248–274) examined the commercial trade and exchange of bricks in the Tiber Valley during the Roman period. The study used the stamps on the bricks to track the connectivity patterns based on the similarity of the location of each break find spot, the manufactured fabric and the stamp type. The data used in this study was based on the research done by Graham (2006a). The data were modified to construct a two-mode network. The brick stamp types is one set of nodes and the different types of connections, like maker's name, the owner, the region and date, along with the manufactured clay fabric, represent the second set of nodes. The one-mode network thus created contains the bricks that are connected by their production place within their time periods.

Additionally, another one-mode network was created based on the maker of brick, owner and dated individually by time period, and these data were processed through Gephi software. The clustering coefficient was measured, which provides indications of the connections' density between each node in the network. Also, the average path length was determined, which provides a measurement of the number of links between each two nodes in the network. Using these different types of information and evidence within a network framework provides a detailed view of the existence or absence of the stamp types, fabrics, names and production region, while creating the network.

Borck et al. (2015:33–57) used the network analysis approach to examine the interactions between pre-Hispanic settlements (700 sites) in North America based on the similarity of the ceramic wares used (more than 4.3 million pieces). The ceramics were located at these settlements and, along with the population for each settlement, will give evidence of the social life, 'population and habitant

stability and instability' and the connectivity across 250 years starting from 1200 AD until 1450 AD. This study focused on identifying the embeddedness or the stabilisation of the networks and examined to what extent stabilisation influences the habitation behaviours towards geographical and environmental disasters. Additionally, this study aimed to investigate the changes that occurred in the social interactions between the settlements. To achieve these aims, the data were divided into several matrices, each one dedicated to a 50-year time period only. The analysis applied a similarity measurement of the Brainerd-Robinson coefficient to the ceramic's shreds in terms of the type, clay material, technology and the distributions. This helped to identify the connectivity patterns between the sites or settlements.

Brughmans (2013:623–662) sets an example for using the affiliation network in archaeology. With the intention of identifying the distribution of the Roman pottery, a link was drawn between specific sites and a specific pottery type located there. This study assumed that some of these sites have pottery related to or affiliated with certain production areas, which will define the production and consumption relationship or network. The visualisation of this network through lines and points (graph) is a step forward towards identifying the changes that might have happened in the ancient trade that influenced maritime connectivity from the fourth century BC to the fifth century AD in the Mediterranean Basin. As Brughmans (2013:623–662) claims, the graph is a tool to provide us with the main structure of the network; it clarifies the nodes and the ties in a way that defines the relationship between them, if any. Equally importantly, Mol, Hoogland and Hofman (2015:275–305) provide an example of an ego-network by investigating the similarity and dissimilarity between material culture like ceramics and human and animal remains located at Saba Island (Caribbean) to examine the socio-economic hierarchy and the connectivity between the island's settlements. In this study the archaeological settlements or sites were represented by the nodes and links by the material culture.

Sindbæk (2007b:59–74) provides another example of the affiliation network and an example of using epigraphic resources as the primary data and converted them into network matrices and graphs. This study aimed to investigate the connectivity and interaction patterns in Scandinavia during the Viking age using Anskar's vita (Rimbert 1921) as an epigraphic historical resource dedicated to the Viking age in Scandinavia. This study also used artefact distribution in south Scandinavia during the Viking age in combination with the written source. A two-mode affiliation network was created to contain 72 archaeological sites or settlements as one set of nodes and 31 types of artefacts—coins, ceramics, glass, beads and tools— as the second set of nodes using the common types or styles as a links. No level of analysis has been selected as this study only relied on examining the co-presence and co-existence of the artefacts at the archaeological settlements and

used the network analysis approach as a visualisation and simulation tool for the archaeological data.

Likewise, Seland uses network analysis to identify the interactions and connectivity between the ports and harbours and the exported and imported products based on what is mentioned in the *Periplus of the Erythraean Sea* (Casson 1989; Seland 2016:191–205)). The *Periplus of the Erythraean Se*a is a historical and written source on the maritime trade, navigation and history of the Indian Ocean during the Roman period. Seland structured the network using 57 harbours or ports and 110 products according to the *Periplus*. Three types of networks were applied: a one-mode network (harbours–harbours) which sheds lights on the relationships between the harbours, a one-mode network (products–products) and a two-mode-network (harbours–products). The data was processed and visualised using Gephi software. This study gives an example of how powerful and flexible network analysis can be when applied to different types of data and that textual data can be converted to matrices and graphs or nodes and links.

Further, Sommer (2007:97–111) uses the network analysis approach to investigate the Phoenicians' exchange network in terms of the cultural and economic interaction in the Early Iron Age in Greece and Levant using written and epigraphic sources. Also, Blake (2013:203–222) investigates the relationship and connectivity between a number of social groups and contexts in west central Italy during the late Hellenistic period using shared, common transported products as tie. Another example of incorporating epigraphic sources into network analysis data is the study done by Fulton (2016), who focuses on the shipwrecks' cargoes in the Mediterranean as isolating items and produced a model to connect these different items. This study used examples of shipwrecks' cargoes from the late Roman Republic period and Imperial Roman period, from 300 BC to 300 AD. Fulton aimed to provide a better understanding or interpretation of past phenomena by considering a method to connect all the ship cargoes through a social and cultural framework. This method sought to track and understand the movement of materials or artefacts between ports and regions based on the sites' excavations and written resources, along with iconographic and epigraphic sources.

A different example of using network analysis is provided by Mickel (2016:1095–1126) who sought to investigate the flow of knowledge and information between different working teams of researchers and their social structure using a series of excavation seasons conducted at Çatalhöyük, Turkey over 20 years. In doing so, topic identifier and modelling and social network analysis was applied along with the archival project data, reports and diaries to track and clarify the flow of ideas and information at Çatalhöyük. The archival reports and documents are the nodes while the topics, ideas, co-membership in the team and co-authorship of the produced papers represent the ties. The

data was processed using Gephi software and density, centrality degree and betweenness were applied as the levels of analysis.

Another interesting study was done by Isaksen (2005; 2007; 2008) to examine the transport network routes of the Roman Baetica towns in Hispania (modern Andalusia in southern Spain) during the Roman era. This study aimed to identify the significance of the towns or sites in terms of the political and economic situation and shed light on the changes in the relationship ties between the towns or sites from 500 BC until 500 AD. Initially, the data used in this study was extracted from archival written sources along with the epigraphic sources on the Roman itineraries. Secondly, GIS and network analysis were applied to the data to investigate the spatial significance of the Baetican towns and their roles in the transport network. GIS have been incorporated in this study to provide a fixed geographical map for the towns and their transport routes. As for the network structure, the Roman towns represented the network nodes while the links are the transport routes. Different levels of analysis were applied, like closeness centrality and betweenness centrality. The first, as mentioned earlier, measures the degree to which each node can reach the others in the network. The measurements are between (0) which indicates a not easily accessible node and (1) which indicates an easily accessible one reachable by other nodes. In the same manner, betweenness centrality measures how each node has the shortest path between the others and identifies the nodes which act as an in-between node that connects nodes which are otherwise unconnected. The measurements are as the same as the closeness measurements (0) and (1) and the data were processed using Pajek software.

Moreover, Brughmans, Keay and Earl (2012:280) examined the connectivity between the settlements at south Spain during the Roman period across ten centuries in terms of the economic, political, social and geographic aspects. They created a two-mode exploratory network that contained 190 sites as nodes and ceramics shreds were presented in the network structure as links, along with coins and landscapes. The social network analysis software Cytoscape was used as a visualisation tool in this study. Similarly, Rivers, Knappett and Evans (2013a) focused in their study on the spatial or geographic network model and aimed to investigate the influence of the interactions between the sites in terms of their geographical aspect. Sindbæk (2007a) also sought to apply a geographical network to investigate the trade routes during the Viking age in Scandinavia. In addition, Knappett and Ichim (2017:399–412) track the interactions and the changes that happened between the Bronze age settlements at eastern Crete based on ceramic remains and artefacts in terms of the production centres, exchanges between the settlements and usage. This study also used the ruins of the buildings at these settlements in general and at Petras in particular in terms of the shared styles. The settlements are the nodes and the links are the ceramics and shared

building styles. The analysis applied betweenness centrality that provided measurements of the position of each node in the network and the strength of their connections.

In a similar manner, Crabtree (2015:144–181) investigated the sharing and exchange of food products between groups of people and settlements in south west America across 20 years in order to examine the inhabitants, survival ways and the reasons behind occupying certain spots, along with the abandonment of other places. This was achieved by applying some dendrochronological analysis to the soil to track the food resources in comparison with the available data related. The settlements represented the network nodes while the exchange patterns were the links. The shortest path length was applied in this study as a level of analysis, which indicates the shortest trail or route linking two nodes in the network.

5.7 Summary

This chapter has provided a detailed insight to social network analysis as a methodological approach and how it has been applied to archaeological studies. Reviewing these studies reveals that SNA as a research method helps to investigate the connectivity and interactions between different entities. It provides a new perspective for examination of material culture. Most importantly, network analysis can be applied to different disciplines and is not limited to specific types of nodes. Network nodes could be people, objects, entities, communities, groups, ideas, religions or events. This chapter has shown the variations of archaeological study and the differences in applying network analysis to their studies. Some studies used network analysis as only a visualisation tool to simulate and visualise the archaeological data in graphs and some used it as a visualisation, analytical and statistical tool. It is particularly interesting to note the potential of network analysis in transforming the written and epigraphic sources to network matrices and graphs, or nodes and links (Seland 2016:191–205; Sindbæk 2007b:59–74).

On the one hand, the archaeological sites or ancient settlements represent network nodes because of their characteristics as principal evidence of human interactions. On the other hand, the links range between the material culture, context and variable attributes of the sites like the usage, location, size or volume of artefacts. Further, one of the main advantages of using SNA is the free open source software like UCINET/NetDraw, Pajek, Gephi, Visone and Cytoscape, which serve as processing tools for the analytical data. SNA software saves the researchers from doing the complicated mathematical calculations by themselves. The following chapter is dedicated to the methods applied to this research. Chapter Six contains the network analysis datasets and how the archaeological data was handled, prepared and transformed into network matrices. It also goes through the types of networks applied and the level of network analysis selected.

CHAPTER 6. METHODS AND DATASETS

This chapter discusses the methods and the approaches applied to study the material culture—the amphorae—recovered or located at Alexandria and the North-Western Coast. As discussed in chapter four, this research is mainly based on documentary evidence, archaeological records, preliminary reports and previous studies; however, the author was granted permission to access three amphorae collections. This chapter also deals with amphorae recording, cataloguing and type identifications, although it focusses mainly on network analysis methods, data structure and management. Furthermore, it presents detailed discussion of the datasets, the phases and level of network analyses applied to this thesis, as well as of the software selected for statistical and mathematical analyses.

6.1 Permits and Permissions

The author sought out the respective authorities or collection holders—Egyptian or foreign expedition directors—for permission to access and study amphorae materials in their collections. The following people are responsible for specific collections:

- Harry Tzalas (The Hellenic Institute of Ancient and Mediaeval Alexandrian Studies HIAMAS)
- Alexander Belov (Russian Institute of Egyptology in Cairo RIEC)
- Emad Khalil (The Alexandria Centre for Maritime Archaeology and Underwater Cultural Heritage CMAUCH).

Initial approval from the individual responsible for the collection of HIAMAS and final approval from the sector head are required to access archaeological collections, record material, document through illustration and photography and taking samples (Appendix 3). Because the amphorae fragments found by RIEC and CMAUCH have been recovered for photography and measurement and returned to their find spots underwater, no permissions were required, and the amphorae data were made available.

6.2 Fieldwork and Library Research Abroad

Table 6.1 The library research plan.

Library	Why	The outcome
The library of French Centre for Alexandrian Studies in Alexandria (CEAlex)	It contains a collection of sources about Ancient Alexandria and maritime trade in the Mediterranean.	Collection of data on the amphorae located in their study areas (preliminary reports, maps, photographs, results).
Institut français d'archéologie orientale (IFAO) Library in Cairo, Egypt.	It houses unique resources and publications about terrestrial excavations in Alexandria.	
The Polish Centre of Mediterranean Archaeology, University of Warsaw in Cairo, Egypt.	It contains all that has been done at the Kom El-Dikka, Mareotis region and Marina el-Alamein.	

6.3 Cataloguing

Access and permits for the study of three amphorae collections have been granted to the author, including material from the sites of Ibrahimia, Shatby (Alexandrian coastline) and Marsa Bagoush (North-Western Coast). In July 2017 the author had undertaken archaeological photography and illustrations, in addition to conducting detailed measurements for these collections. Amphorae collections included in this research and their access status are listed at Table 6.2.

Table 6.2 Underwater amphorae sites accessed in this study.

Region	Underwater Site	Direct access	Preliminary reports/ previous publications
Alexandrian Coast	Aboukir	x	✓
	Mammura	x	✓
	Ibrahimia	✓	✓
	Shatby	✓	✓
	Eastern Harbour	x	✓
	Qaitbay/Pharos[11]	x	✓
	Western Harbour	x	✓
North-Western Coast	Ras El-Hikma	x	✓
	Tannum Reef	x	✓
	Ras Hashafa	x	✓
	Ras Hawala	x	✓
	Marsa Oum El-Rakham	x	✓
	Marsa Bagoush	x	✓

The dataset was constructed based on the three amphorae collections mentioned above, along with the amphorae fragments recovered from Aboukir, Mammura, Eastern Harbour, Western Harbour and the underwater sites along the North-Western Coast, in addition to the terrestrial site 'Kour Island', based on the available information provided in preliminary reports and publications. The dataset includes detailed description, features, visual characterisations, colour, standard dimensions, photographs and illustrations if any, along with the corresponding dating, content, distribution areas and origin determinations (see Appendix 1).

6.4 Approaches to Studying the Amphorae Fragments

Two approaches were applied in this thesis to study the amphorae fragments recovered from the underwater sites, as follows:

1. Macroscopic identification, which is a visual identification of the amphorae fragments to identify their types.
2. Network and statistical analysis.

[11] Qaitbay Fort/ Pharos amphora collection added to the dataset to give an idea about the amphora types located there; however, the collection is still under studying by the CEAlex respective team.

6.4.1 The Macroscopic Identification

6.4.1.1 Amphora type

Identifying amphorae types is a challenge due to the unrecognizable and minor differences between the many types of amphora. The majority of the amphorae collections selected in this study housed identifiable fragments ranging between upper parts with handles, rim, neck or lower parts with a complete base; along with some complete, entire and intact pieces (Figure 6.1); making the identification of the amphorae types possible using the following studies and taxonomies:

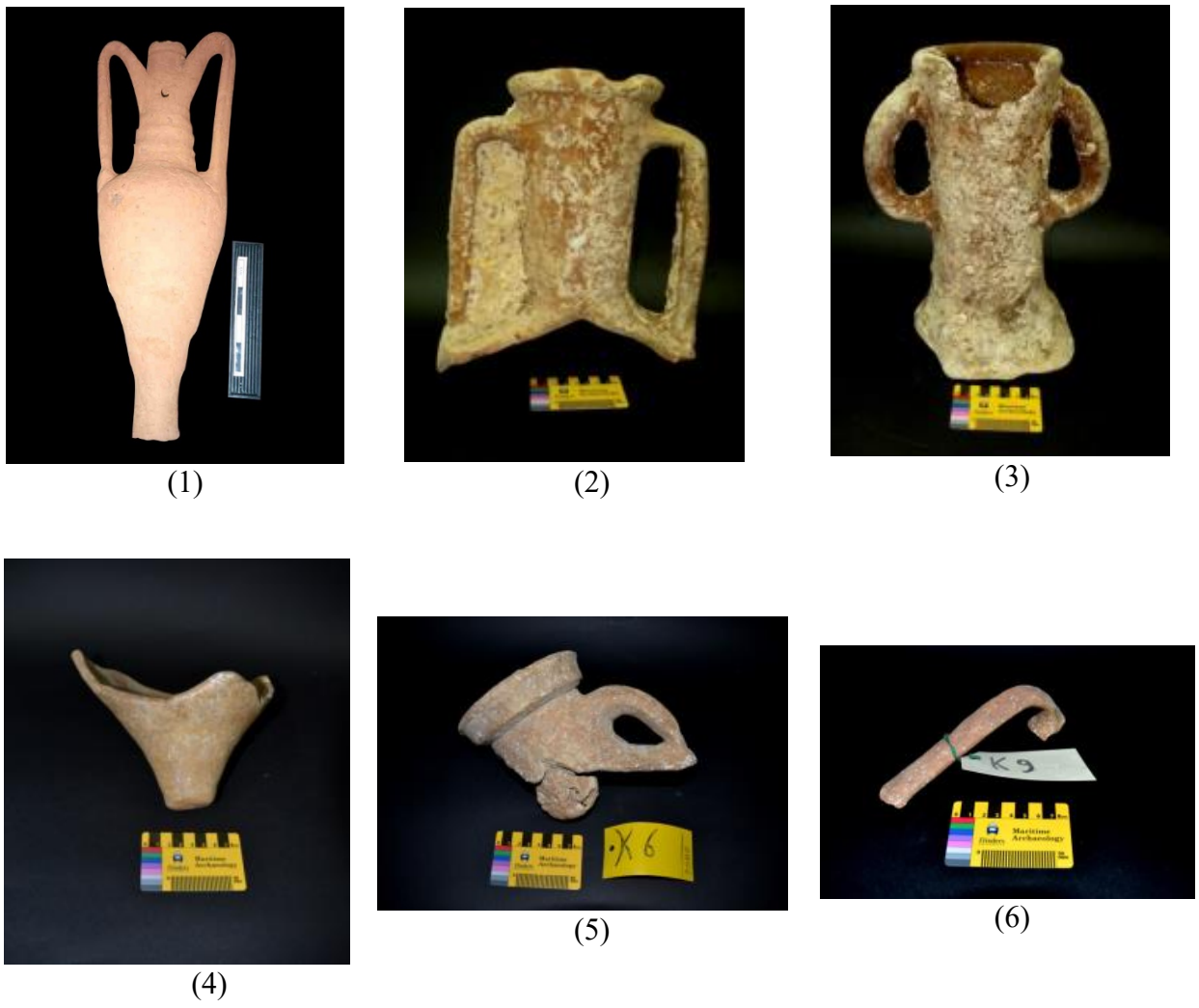


Figure 6.1 1. Complete amphora form Mammura collection 2. Upper part of amphora from Marsa Bagoush collection 3. Upper part of amphora from Marsa Bagoush collection 4. Amphora base form Shatby collection 5. Part of amphora neck and one handle form Ibrahimia collection 6. Amphora handle form Ibrahimia collection.

- Dressel (1899) work includes a classification and illustration of the amphorae collections from Rome.
- Lamboglia (1955) expands upon Dressel's work by adding more amphorae types.
- Joncheray (1976) treats amphorae recovered from underwater sites in the Mediterranean.

- Keay (1984a; 1984b) focuses on Late Roman amphorae and this will be particularly useful for the late material examined in this thesis and the corresponding maritime trade network analysis.
- Peacock and Williams (1986), because of the breadth of material included, will be especially applicable to the archaeological sites along the Alexandrian coastline, which contain amphorae from the Aegean (Rhodes), eastern (Cyprus) and western Mediterranean, Adriatic and Black Sea regions, along with local Egyptian production.
- Amphora study by Sciallano and Sibella (1994) in their *Amphores comment les identifier* as it too includes a large number of amphora types.
- Amphora study by Lawall and Lund (2013) in *the transport amphorae and trade of Cyprus*, which focuses on Rhodian amphorae.
- Dixneuf (2011) focuses on the Egyptian amphorae productions, along with creating a specific typology for the variations of each Egyptian amphora.
- Baily (1998) focuses on the Roman and late antiquity Egyptian amphorae.

On the one hand, the identification of typology conducted on the collections from underwater sites revealed that they belonged to pre-Hellenistic and Byzantine periods. On the other hand, the period selected in this study is from the fourth century BC to fifth century AD, which covers the Hellenistic, Roman and late Roman periods; so the earlier and later periods (Pre–Hellenistic and Islamic period) are beyond the scope of this study. Nevertheless, the author annotated these early and late amphorae with a date, archaeological photographs, description and other information in Appendix 1, to give a wider perspective of maritime trade movement and connectivity before and after the selected period, and also to serve as a source for further study that might be conducted by upcoming researchers.

Specific typologies have been applied to the amphorae recovered from all the underwater sites along the Alexandrian coastline and North-Western Coast. In other words, most of the amphorae types have sub-types and variations applied by the author. For example, the Egyptian amphora type AE3 and AE3 late and their subtypes have variants like AE 3–1.5 variant B, AE 3–2 Variant A, AE3 Late/ AE3T–2 variant B, AE3 Late/ AE 3T–3.2 Variant B. Due to the availability of archaeological photography for the amphorae recovered from the underwater sites, specific identifications have been applied to these collections, even if only the general type have been mentioned in the preliminary reports and publications.

In contrast, publications for the terrestrial archaeological sites provided only the general type and unfortunately these publications and studies lack archaeological photography or illustrations for the

recovered or found amphorae, which makes applying a specific typology to them impossible. For example, the research by Southampton University and SCA (Blue 2010:25–33; Blue and Kahlil 2011; Khalil 2010b:135–145) alongside the study of amphorae from the Serapium has mentioned generic types like the AE3 amphora (Empereur 2002:39–84). This generalised typology appeared again the amphorae collections in the Greco-Roman Museum (Empereur 1998c:393–399), where the Rhodian and Knidian types were identified without any information on whether they were early, middle or late. Moreover, Greco-Italic amphorae types have been sighted without specifying the subtypes or variants, like Greco-Italic Will type A1 or MGS 6 Greco-Italic Will type A2.

6.4.1.2 Unidentifiable amphorae fragments

Groups of unidentified fragments have been included in some collections due to the lack of any diagnostic features or characteristics and could not be successfully identified (Figure 6.2).

(1) (2)

(3) (4)

Figure 6.2 1. Upper part of amphora from Shatby collection (Photograph by the author © Copyright 2020) 2, 3 and 4 amphora fragments from Marsa Bagoush collection (Photographs by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil).

6.4.1.3 The colour of the clay

The clay colour was identified using Munsell Soil Colour Chart (2010) for the amphorae collections recovered from the Shatby and Ibrahimia collections. Also, visual characteristics were applied to these collections due to the direct access granted to study them.

6.4.2 Network and Statistical Analyses

This research project aims to study the relations, interactions and co-existences between the Alexandria and the rest of the Mediterranean basin through a network analyses, which are used in this thesis as both analytical and visual tools.

6.4.2.1 Network Data Structure

According to Knoke and James (1982:10) and Scott (2000:2–3), the data in this research consists of three types as follows:

1. Network nodes/actors represented by the archaeological sites.
2. Attribute data that concludes the properties or characteristics and additional data of the archaeological sites. This is organised in cases by variables matrices; the cases are the archaeological sites in the rows and the variables are the attribute data which are the sites' ID, the sites' region and geographic coordinates in the columns (Scott 2000:38–39).
3. Relational data that includes the ties between the nodes/actors, which are represented by:
    - Amphorae types/ shapes.
    - Amphorae source of production/ origin.
    - Amphorae contents/ transported products.

The different types of ties provide diversity in the type of connectivity (Knoke and James 1982: 5; Wasserman and Faust 1994:37). Additionally, as Marin and Wellman (2011:20) remark, two types of ties could be used in the network analyses which are asymmetric, or directed, and symmetric, or undirected, ties based on either binary or valued data. Most of the ties used in this research are undirected; however, only directed ties are considered for the production region aspect.

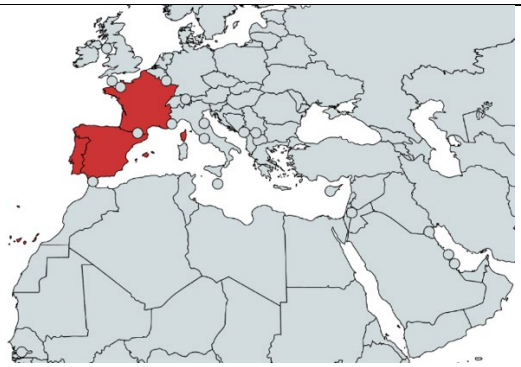
An archaeological macroanalysis conducted for the amphorae collections selected in this study revealed that:

1. The cargo contents and the transported products carried in the amphorae from the collections included wine, olive oil, olives, fish sauce, fish products, dried food, sesame oil, cereal and other unknown products. It is worth stressing that most of the amphorae types carried more than one product (see Chapter 3, Table 3.1 and Table 3.6). Suggestions and lack of certainty are the main issues related to the identification of

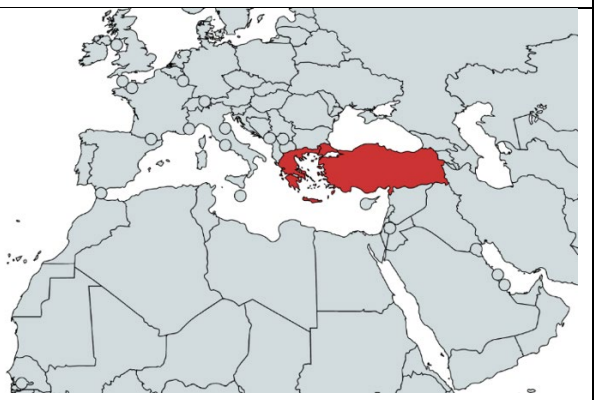
products carried in specific amphora. Therefore, only the most agreed transported product for each amphora type was selected for this network analysis.

2. There are 70 amphorae types located at the underwater sites.
3. The production sources for these amphorae belong to different places around the Mediterranean. These sources are grouped into five regions, excluding Egypt[12], (Table 6.3 and Figures 6.3, 6.4, 6.5, 6.6, 6.7 and 6.8):

Table 6.3 The amphorae production regions in the Mediterranean Sea.

Central Mediterranean	Italy Adriatic coast Sicily Libya Tunisia (Carthage)	 **Figure 6.3 Map showing the central Mediterranean region. Produced using Mapchart.**
Western Mediterranean	France Spain Tyrrhenian Sea	 **Figure 6.4 Map showing the western Mediterranean region. Produced using Mapchart.**

[12] Egypt is separated from the Eastern Mediterranean to highlight the local production.

Eastern Mediterranean/ Levant	Cyprus Cilicia/ South Coast of Turkey Asia Minor/Anatolia Gaza/Palestine Jordan Lebanon Syria	 **Figure 6.5 Map showing the eastern Mediterranean region. Produced using Mapchart.**
North Africa	Algeria Morocco	 **Figure 6.6 Map showing the north African region. Produced using Mapchart.**
Aegean	Greece Crete Rhodes Knidos Western Coast of Turkey/ Western coast of Asia Minor Marmara Sea	 **Figure 6.7 Map showing the Aegean region. Produced using Mapchart.**

Egypt		 **Figure 6.8 Map showing Egypt location. Produced using Mapchart.**

6.4.2.2 Network Data Management

All data collected for this dissertation was sorted and organised in adjacency matrices, which included both binary and valued matrices. Hanneman and Riddle (2011a:338) discuss the complex ties or relations that might exist between the network actors. As this research has a multitude of nodes and relational data, the data is organised in a number of matrices for each type of tie (Prell 2012:14). Also because of the complexity and size of the data, it was recorded and saved on Excel sheets on a computer file and provided also in Appendix 2.

The Underwater Sites

Phase 1 General view/Co-presence

Phase 1 is an exploratory network analysis that provides a broad and general view for the movement of the products—neither is the data used in this phase divided according to the periods nor the amount of each type—and highlights the connectivity between ancient entities in the Mediterranean basin, which as aforementioned is evidence of co-presence. This phase aims to explore the initial connections and the significance of the sites along with the diversity of amphorae types located there. Also, this phase highlights the co-presence of the same amphorae types, content and production regions between those from underwater sites with those from the terrestrial sites and the collections in the Greco-Roman Museum.

A binary two-mode network has been applied in this phase, which by definition comprises two sets of actor/nodes, a dyadic network, and actors and events, known as an affiliation network (Wasserman and Faust 1994:29). In this case, the dyadic network was chosen because this phase ignored the chronology, which is equivalent to events in network analyses terminology. Three adjacency matrices (binary two-mode network)[13] sheets have been prepared for the underwater sites

[13] See Appendix 2.

selected in this study as one set of nodes in terms of the 1) amphorae types 2) amphorae contents and 3) the production regions/sources as the second set of nodes (see Appendix 2, Section 11.2.1.1).

Phase 2 Connectivity and strength across the time periods–Track the changes overtime
Phase 2 aims to examine in depth the connectivity in terms of the three aspects mentioned before according to six time periods as follow:

- Pre-Hellenistic period from the fifth to fourth century BC.
- Hellenistic period from 323 BC to 31 BC (The end of the fourth to the end of the first century BC).
- Early Roman period from the first to the second century AD.
- Mid Roman period from the third to the fourth century AD.
- Late Roman period (Byzantine) from the fifth to the sixth century AD.
- Islamic period (Arab conquest) from seventh to the tenth century AD.

In addition, this phase aims also to investigate the amphorae types and content in terms of appearance, disappearance and spreading at several sites, and also to report and investigate the connectivity between Alexandria and the different production regions in the Mediterranean basin. In doing so, two steps have been undertaken as follows:

Step A: sites attributes
The author explored and grouped the amphorae types according to the period, as shown in Table 6.4.

Table 6.4 The chronology of the amphorae types located at underwater sites.

Period	Amphora type
Pre-Hellenistic (The Fifth to fourth century BC)	Mendean
	Klozomenai
	Basket-handle (type 3)
	Chain
	Chiote
	Samian
	Milesian
	Thasos
	Persian Torpedo
Hellenistic (The end of the fourth to the end of the first century BC)	Cyrenaican I
	Rhodian Early
	Rhodian Middle
	Knidian Early

Period	Amphora type
	Knidian Middle
	Greco-Italic/ Will A1 (Variant A)
	Greco-Italic/ Will A2 (Variant B)
	Tripolitanian I
	Koan
	Brindisi
	Lamboglia II
	AE2
	Lesbian
	Chios
Early Roman (The first to the second century AD)	Agora G 199
	Rhodian Late
	Knidian Late
	Agora M 54
	Agora K 114
	Dressel 2-4
	Agora G 197
	Dressel 2-4 Pompeii
	Dressel 2-4 Imitated (Italian Campanian shape)
	Dressel 5
	Dressel 6A
	Dressel 9
	Dressel 20
	Cretan
	Beltrán 2A
	AE2-3
	AE3/ AE 3-2, Variant A
	AE3/ AE3-I.4
Mid-Roman (The third to the fourth century AD)	Kapitain II
	Africana 2D Grande
	Africana 2B Grande
	Africana I
	Tripolitanian III
	Dressel 23
	AE3/AE 3-1.5 Variant B
	Sinope
Late Roman (Byz.)	LR1
	LR 2

Period	Amphora type
(The fifth to the sixth century AD)	LR 3
	LR 4
	LR 5/6–AE5/6
	LR7–AE7
	AE3 Late/ AE 3T-2, Variant B
	Spatheia
	Beltrán 72
Islamic (The seventh to the tenth century AD)	Günsenin 1
	Günsenin 2
	AE3 Late/ AE 3T-3.2, Variant B
	AE 8-1, variant B – Eglaff 766-767
	Subgroup Late Roman 13 close to Peacock & Williams Class 54
	AE8-2/ Imitations for LR7
	Globular
	Bailey O 17
	Bailey V 17-18
	Bailey W26-8

Then the sites' attributes sheets were created; 18 sheets in total were prepared in terms of the amphorae types, contents and production sources for each period. These sheets provided the site ID, site name, site zone, longitude and latitude, along with the value/amount (Appendix 2, Section 11.2.1.2). The sites' attributes sheets also contain detailed information regarding which site contains which amphorae types, along with the amount in a comparative way, as well as the production areas and the amphorae contents.

Step B: valued data

The author combines all the underwater sites as one site, Alexandria, to examine maritime trade movement between Alexandria and the production regions around the Mediterranean Sea and to show the changes that happened in trade movement across the time. It includes a total of each amphora type located in every site and a total of each content and production region identified. In doing so, an affiliation network was used in this phase: six excel sheets contain valued ego-centric two-mode affiliation matrices representing Alexandria as one set of nodes and the amphorae types as the second set of nodes and each matrix representing time. Additionally, 12 Excel sheets contain valued two-mode affiliation matrices representing the other two aspects: Alexandria at each period as one set of events and content and production region as one set of nodes (Appendix 2, section

11.2.1.2.2). The reason behind the ego-centric network is the large number of amphorae types, which makes adding them at one single matrix impossible and misleading. Hence, the preference to breakdown the amphorae types and prepare one matrix for each time period and their associated types.

Terrestrial Sites

The same methods applied to the data generated from the underwater sites, have been applied for the terrestrial sites as well. Investigating the terrestrial sites provides a broader image of the size of the maritime trade and movement based on the date of materials (amphorae fragments) recovered from the study area. The author used the data generated from three terrestrial sites, including the Serapium, Gabbari Necropolis and Mareotic Region,[14] to identify the strength of the connectivity. The amphorae types were grouped together according to the periods and all 76 types, as listed in Table 6.5.

Table 6.5 The chronology of the amphorae types located at the terrestrial sites.

Period	Amphora type
Pre-Hellenistic (The Fifth to fourth century BC)	Mendean
	Chain
	Thasos
	Samian
Hellenistic (The end of the fourth to the end of the first century BC)	AE1
	AE2
	Knidian
	Rhodian Early
	Koan
	Chios
	Lamboglia II
	Greco-Italic
	Cyrenaican

[14] Due to the lack of the information related to the exact number of the amphora types located at the seven terrestrial sites, as mentioned in Chapter 3, Section 3.2, these sites were downgraded to include only three of them. Despite the availability of the quantitative data regarding the amphora located at Old Diana Theatre (see Chapter 4. Section 4.3.2), it excluded from the network analysis due to the overwhelming size of the amphorae finds here versus the amounts of the amphorae located at the remainder of the sites. Adding Old Diana Theatre amphora collections to the network analysis would change dramatically the results without considering the other amphora collections. Therefore, Old Diana Theatre amphora collection was used only to conduct a comparison between it and the network analysis results, along with the previous quantitative amphora studies. See Chapter 8 for more details.

Period	Amphora type
	Tripolitanian I
	Brindisi
	Mana
	Zemer 36
	Dressel 1
	Dressel 1A
Early Roman (The first to the second century AD)	Pseudo Cos
	Rhodian Late
	Agora M 54
	Agora K 114
	Agora G 199
	Agora M 254
	Agora G197
	AE4
	Pompeii V
	Pamphylian
	Gauloise 4
	Schöne-Mau V
	Dressel 2-4 Cilicia
	Dressel 2-4 Campania
	Dressel 4
	Creten
	Dressel 5
	Dressel 6A
	Dressel 7/11
	Dressel 20
	Dressel 21-22
	Dressel 24
	AE3
	Mons Claudianus 2/12
	Mons Claudianus 22/3
Mid-Roman (The third to the fourth century AD)	Dr 30
	Agora K 109
	Africana I
	Africana II
	Africana 2D Grande
	Africana III
	Kapitan II

Period	Amphora type
	Tripolitanian II
	Tripolitanian III
	Almargo 50
	Almargo 51
	Sinope
	Dressel 4 Cilician
Late Roman (Byz.) (The fifth to the sixth century AD)	LR 1
	LR 2
	LR 3
	LR 4
	Egloff 169
	Agora M 273
	AE3 Late
	LR 5/6- AE5/6
	LR7-AE7
	Spatheia
	Keay 8B
	Keay 25
	Keay 35
	Keay 36
	Keay 45
	Keay 52
	Keay 62
Islamic (The seventh to the tenth century AD)	Günsenin 1
	Kellia 167
	Kellia 186
	Kellia 172

Then 18 Excel sheets were prepared for the three terrestrial sites for each period according to each aspect. Then these sites were combined as one site, which is Alexandria (see appendix 2, section 11.2.2).

The Amphora collection at the Greco-Roman Museum in Alexandria

As mentioned in Chapter 3, Section 3.3, the amphora collection stored at the Greco-Roman Museum located in Alexandria, but the exact find spots are unknown. Moreover, no pre-Hellenistic or Islamic amphorae were observed or identified in this collection after grouping the amphorae types according to period (Table 6.6). Due to the absence of the exact find spot of each amphora in

this collection, the author allocated the location Alexandria as a central node. An ordinal two-mode matrix has been created for each period as an affiliation network—Alexandria – amphorae types, Alexandria. – amphorae contents and Alexandria – production regions (Appendix 2, Section 11.2.3).

Table 6.6 The chronology of the amphorae types at the Greco-Roman Museum.

Period	Amphora type
Hellenistic (The end of the fourth to the end of the first century BC)	Brindisi
	Mana
	Rhodian
	Knidian
	Koan
	Chios
	Lesbos
	Greco-Italic
	Dr 1A
	Lamboglia II
	AE1
	AE2
Early Roman (The first to the second century AD)	Pompei V
	Pseudo-cos
	Dr 1B
	Dr 1C
	Dr 6
	Dr 2-4 Campania
	AE3
	AE4
	Africana Grande
	Tripolitania
	Dressel 7/11
	Cretan
Mid-Roman (The third to the fourth century AD)	Dr 36
	Dr 43
	Kapitain II
Late Roman (Byz.) (The fifth to the sixth century AD)	LR 1
	LR 2
	LR 4
	Spatheia
	LR5/6-AE5/6

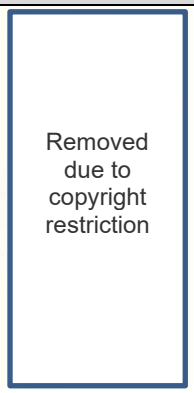
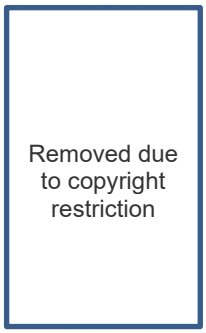
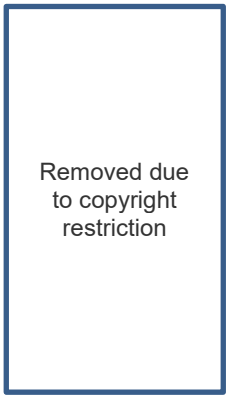
Period	Amphora type
	LR 7-AE7

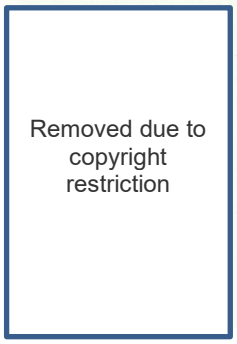
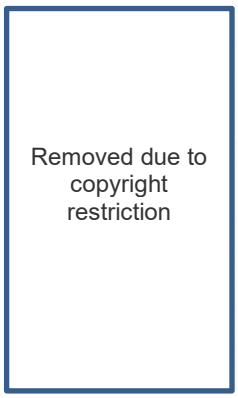
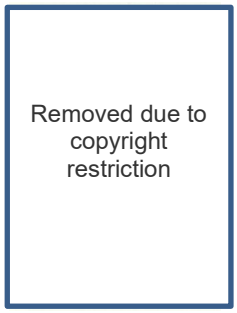
Alexandria as one site across the time periods

In this phase, the data generated from the underwater and terrestrial sites, along with the data from the amphora collection at the Greco-Roman Museum, were combined to provide a more comprehensive assessment of maritime trade in Alexandria and the Mediterranean basin. This led to combined binary and combined valued affiliation two-mode networks. The data sheets include Alexandria across the periods as one set of events and the three other aspects—amphorae types, transported products and production regions—as a set of nodes. (See Appendix 2, Section 11.2.4.1 for the combined binary data and Appendix 2, Section 11.2.4.2 for the combined valued data).

One of the main issues in the data collection is the generalisation of the amphorae typology as a result of collecting the data about the amphorae evidence located at the terrestrial sites and the amphora collection at the Greco-Roman Museum (Blue 2010: 25–33; Blue and Kahlil 2011; Empereur 1998c:393–399; Khalil 2010b:135–145; Senol 2000:369–396; 2002a:191–211; 2002b:467–484). For example, there are amphorae types that were continually produced over several decades with differences in the shape, like Rhodian and Knidian amphorae types. That is to say, there is a Rhodian type dating to the early Hellenistic period and another type dating to the third century BC and a late type dating to the early Roman period (first to second century AD) (Alpözen, Berkaya and Özdaş 1995:92–95; Monachov 2006:69–96; Sciallano and Sibella 1994:88–89). According to Will (1982:338–357), a number of forms of the Greco-Italic amphora type have been identified, such as Will type A1 and Will type A2. In the same manner, a number of AE3 amphorae subtypes were identified by Dixneuf (2011:93–113), as AE3-I.4 and AE 3-2, variant A, AE 3-1.5 variant B, which were recognised by the author and applied to the amphorae located at the underwater sites. Applying a specific typology for one collection of amphorae and not for the other creates an obstacle for combining the data. Hence, generalising the typology for some types was crucial. Table 6.7 shows which amphorae types have been combined under a general type (Figures from 6.9 to 6.23).

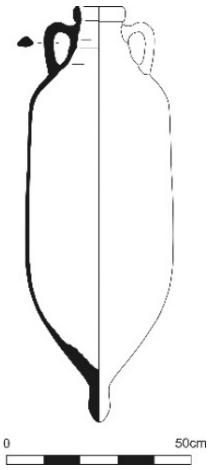
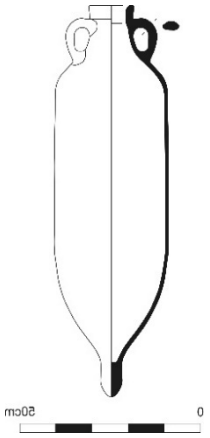
Table 6.7 The general amphorae types and their sub-types.

Amphora type (specific)	Appearance	Amphora type (general)
Rhodian Early	 **Figure 6.9 Rhodian early amphora (Sciallano and Sibella 1994:87).**	Rhodian H
Rhodian Middle	 **Figure 6.10 Rhodian middle amphora (Illustration from Sciallano and Sibella 1994:88).**	
Rhodian Late	 **Figure 6.11 Rhodian late amphora (Illustration from Sciallano and Sibella 1994:88).**	Rhodian L.

Amphora type (specific)	Appearance	Amphora type (general)
Knidian Early	 **Figure 6.12 Knidian early amphora (Illustration from Alpözen, Berkaya and Özdaş 1995:86).**	Knidian H.
Knidian Middle	 **Figure 6.13 Knidian late amphora (Illustration from Alpözen, Berkaya and Özdaş 1995:89).**	
Knidian Late	 **Figure 6.14 Knidian late amphora (Illustration from Alpözen, Berkaya and Özdaş 1995:91).**	Knidian L.

Amphora type (specific)	Appearance	Amphora type (general)
Greco-Italic Will A1	Removed due to copyright restriction **Figure 6.15 Greco-Italic Will A1 amphora (Will 1982:357, Fig. b).**	Greco-Italic
Greco-Italic Will A2	Removed due to copyright restriction **Figure 6.16 Greco-Italic Will A2 amphora (Will 1982:357, Fig, a).**	
AE3/ AE3-I.4	 **Figure 6.17 AE3/ AE3-I.4 amphora. Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.**	

Amphora type (specific)	Appearance	Amphora type (general)
AE3/ AE 3-2, Variant A	 **Figure 6.18 AE3/ AE 3-2, Variant A amphora. Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.**	AE3
AE3 Late/ AE 3T-2, Variant B (Dixneuf 2011 :141).	 **Figure 6.19 AE3 Late/ AE 3T-2, Variant B amphora. Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.**	AE3 Late
Africana Grande (Empereur 1998c:395)	NA	
Africana II	Removed due to copyright restriction **Figure 6.20 Africana II amphora. Illustration from Sciallano and Sibella 1994:80.**	

Amphora type (specific)	Appearance	Amphora type (general)
Africana 2B Grande	 **Figure 6.21 Africana 2B Grande amphora. Illustration from University of Southampton (2014) Roman Amphorae: a digital resource. After Panella 1973 by Penny Copeland. © Copyright 2020, with permission from D. Williams.**	Africana Grande
Africana 2D Grande	 **Figure 6.22 Africana 2D Grande amphora. Illustration from University of Southampton (2014) Roman Amphorae: a digital resource. After Panella 1973 by Penny Copeland. © Copyright 2020, with permission from D. Williams.**	

Measuring the similarity between the nodes is one of the measurements applied in this research. The data used for calculating these measurements is the combined data of the amphorae contents and the production regions across all the periods. According to amphorae evidence data analysis, each

period has different and specific types of amphorae; hence, a similarity measure for the amphorae types would not give valuable or useful information.

6.4.2.3 Social network analysis software

After preparing the data in Excel sheets and matrices, the data was entered in the social network analysis software for statistical analysis and visualisation. The social network analysis software is a tool for analysing the data through sophisticated mathematical calculations. The software selected for this research is UCINET/NetDraw. UCINET is a package for all the types of networks and offers a considerable number of network data analysis methods. NetDraw is software that combines with UCINET for visualising and drawing the network. It provides a visual representation of the network's nodes, links and size through coloured and labelled graphs to simplify the reading of the network model (Borgatti, Everett and Freeman 1992:12–15; 1999; 2002; Huisman and Duijn 2011:285–286; Knoke and Yang 2008:2–3; Kosorukoff and Passmore 2011:12,36; Prell 2012:83; Scott 2000:178–179; Wasserman and Faust 1994:737). NetDraw will generate a model for each period according to each relational tie of amphorae types, contents and production regions, which will define the connectivity patterns and the changes and fluctuations that happened across the ancient periods (Broodbank 2000).

6.4.2.1 Levels of network analyses

Statistical analyses were undertaken at each data matrix individually as an initial level of analysis to explore and remark on the results based on one type of data, then statistical analysis was applied to the combined data (Table 6.8). The amphorae located or recovered from the underwater sites are the main focus of this study, but the material from the terrestrial sites and museum collections were included to create the most comprehensive dataset to assess maritime trade in the Mediterranean. Consequently, a binary valued two-mode network was selected for the underwater collection to examine and identify the most important underwater site, amphora type, transported product and production region. The levels of network analysis selected for this phase was the centrality degree, which will help to shed light on the important nodes in the network.

Centrality degree was applied to the combined binary data collection, while similarity and dissimilarity were applied for the valued one—the Pearson correlation coefficient. Hanneman and Riddle (2005:100–103) and Prell (2012:178) point out that the Pearson correlation coefficient, referred to as (r), is a tool to clarify and measure the structural equivalence between two nodes. The Pearson correlation measures the similarity between the rows or columns in a network, especially with the valued data. This statistical analysis compares the degree of similarity and dissimilarity between the nodes by comparing the matrix rows and columns.

Pearson correlation provides the following measurements, which range from:

- (-1.00) measurement indicates inconsistency and dissimilarity in ties and relations between two nodes; to
- (+1.00) measurement indicates consistency and similarity between two nodes.

The combined data matrices processed through UCINET–tools–similarity and dissimilarity–Pearson correlation. The software calculated correlations for the rows and columns (Everton 2004:26; Hanneman and Riddle 2005:100–103).

Table 6.8 The levels of network analysis.

Data Collection type	Relational data	Matrix type	Level of analysis
Underwater collection	Amphora type	Binary two-mode network	Centrality degree
	Amphora content		
	Amphora production region		
	Amphora type	Valued two-mode affiliation network	N/A
	Amphora content		
	Amphora production region		
Terrestrial collection	Amphora type		
	Amphora content		
	Amphora production region		
Greco-Roman Museum collection	Amphora type		
	Amphora content		
	Amphora production region		
Combined data collection (binary)	Amphora type	Binary two-mode network	Centrality degree
	Amphora content		
	Amphora production region		
Combined data collection (valued)	Amphora type	Valued two-mode affiliation network	Pearson correlation coefficients
	Amphora content		
	Amphora production region		

These different levels of analyses provide a dynamic network and different patterns of connectivity. It gives a chance to investigate the changes and the fluctuations between the production regions, the usage of the amphorae types and the content in Alexandria as one comprehensive site. Nodes could appear and disappear across the period, links might be weak at a certain period, strong in another period and decline later. This will lead to the definition and tracking of the changes that happened in the extent of the trade and in the products transported from the pre-Hellenistic until the Byzantine period.

6.5 Summary

Chapter 6 outlined the methods and approaches applied to this amphorae research. The chapter detailed the status of permission for each amphora collection recovered or located from the underwater sites along the Alexandrian coastline and its extension at the North-Western Coast. Then the chapter tackled the amphorae identifications and taxonomies. The main part of this chapter was dedicated to the network analysis approach, data set and data management. Three amphorae collections were examined and investigated in this research as follows: 1) the underwater collections 2) the terrestrial collections 3) the Greco-Roman Museum amphorae collections. Despite the amphorae recovered from the underwater sites being the main concern of this research, amphorae from terrestrial sites along with the amphorae collections at the previous mentioned museum are examined side by side with the underwater one. The reason behind this, as mentioned in the introduction, is the diversity of these amphorae and their state as transported and foreign examples that arrived at Alexandria by the sea.

The data collections were organised in matrices to be processed through the social network analysis software UCINET/NetDraw. Firstly, three binary two-mode matrices were prepared for the underwater amphorae collections in terms of the amphorae types, amphorae contents or transported products and production regions. Centrality degree was applied to these matrices to give a general view of the presence and absence of the amphorae types and to highlight the prominent underwater site, amphora type, content and production region. Additionally, it will identify the important nodes in each network. Secondly, six time periods were applied for the same collections. In doing so, eighteen valued two-mode matrices were prepared. The last and the most significant data analysis is the binary and valued combined data analysis, which will give a comprehensive image of the maritime connectivity between Alexandria and the rest of the Mediterranean basin. Centrality degree and similarity and dissimilarity were applied to this data as levels of network analysis. These analyses will show to what extent the periods are similar or dissimilar to each other with regard to the amphorae types, contents and the production regions. Measuring these changes and the

fluctuations will answer the research question and fulfil the research aims. The next chapter presents the results of these network analyses.

CHAPTER 7. RESULTS

This chapter presents the results of the network analyses undertaken on amphorae collections used in this research. As discussed in Chapter. 1, section 1.5.2, the aims of this study focus on assessing the ship cargo containers located along the Alexandrian coastline and its extension to the North-Western Coast of Egypt and to provide a better understanding of the economic history of Alexandria in particular and Mediterranean Sea in general. This study aimed also to identify the connectivity and the tie strength between Alexandria and the production regions around the Mediterranean Sea. Furthermore, this study aimed to track and investigate the fluctuations that occurred since the pre-Hellenistic period until the Islamic period in terms of the of appearance or dominance of specific amphorae types, contents and production regions.

In order to address these aims, the following amphora evidence was examined: 1) the amphorae evidence located at the six underwater sites along the North-Western Coast and seven underwater sites along the Alexandria coastline, 2) the amphorae evidence recovered from three terrestrial sites, and 3) amphorae collections at the Greco-Roman Museum. After that, all data were combined to provide a comprehensive picture of Alexandria as a single large site across all the time periods.

7.1 The Data Analysis Results for the Underwater Sites

7.1.1 Phase 1 Results (Binary Data)

The results of this phase provide the centrality degree and number of nodes and ties in total and for each aspect as follows: amphora type, content and production region along with the centrality degree and number of nodes and ties for the underwater sites accordingly. Each aspect is illustrated with a network graph. The graphs contain red and blue points, where red represents the underwater sites and blue represents the amphorae types. The differences in the size of these points represents the variations in the centrality degree. In other words, the node with more links or ties than others is the most central and appears larger in the graph.

7.1.1.1 Amphorae types–underwater sites

Table 7.1 The centrality degree and number of nodes and ties for each amphora type.

Amphora type	Centrality degree (%)	No. of ties	No. of nodes
		Total	
		108	83
		Breakdown	
Rhodian Middle	0.154	2	14
Knidian Early	0.231	3	14
Koan	0.308	4	14
AE2-3	0.154	2	14
LR4	0.308	4	14
LR1	0.231	3	14
LR2	0.077	1	14
Dr2-4 Pompeii	0.231	3	14
Rhodian Early	0.308	4	14
AE3 late/ AE3T-2, Variant B	0.308	4	14
Greco-Italic/ Will Form A2	0.308	4	14
Lamboglia II	0.154	2	14
Dr 20	0.154	2	14
Rhodian Middle	0.231	3	14
Lesbian	0.154	2	14
Rhodian Late	0.154	1	14
Knidian Middle	0.154	2	14
Knidian Late	0.077	1	14
Agora G 199	0.154	2	14
Chios	0.154	2	14
Chain	0.077	1	14
Dr 5	0.077	1	14
AE2	0.077	2	14
Greco-Italic/ Will Form A1	0.077	1	14
Dr 6	0.077	1	14
Sinope	0.077	1	14
Dr 23	0.077	1	14
Cretan	0.077	1	14

Beltran 2A	0.077	1	14
Beltran 72	0.077	1	14
Africana I	0.077	1	14
Agora M 54	0.077	1	14
AE 8-1 Variant B	0.077	1	14
AE 8-2	0.077	1	14
LR7-AE7	0.077	1	14
Dr 9	0.077	1	14
LR 3	0.077	1	14
Agora K 114	0.077	1	14
AE3.1.5 Variant B	0.077	1	14
AE3-2 Variant A	0.077	1	14
AE3.1.4	0.077	1	14
AE3 late/ AE3T-3.2, Variant B	0.077	1	14
LR5/6-AE5/6	0.077	1	14
Bailey O 17	0.077	1	14
Bailey O 17-18	0.077	1	14
Bailey W26-8	0.077	1	14
Dr 2-4 Imitated Pompeian	0.077	1	14
Dr 2-4 Imitated Campanian	0.077	1	14
Agora G 197	0.077	1	14
Brindisi	0.077	1	14
Subgroup LR 13	0.077	1	14
Günsenin 1	0.077	1	14
Günsenin 2	0.077	1	14
Globular	0.077	1	14
Spatheia	0.077	1	14
Samian	0.077	1	14
Mendean	0.077	1	14
Klozomenai	0.077	1	14
Basket-handle (Type 3)	0.077	1	14
Chiote	0.077	1	14
Milesian/Miletus	0.077	1	14
Thasos	0.077	1	14
Persian Torpedo	0.077	1	14

Kapitain II	0.077	1	14
Africana 2D Grande	0.077	1	14
Africana 2B Grande	0.077	1	14
Cyrenaican I	0.077	1	14
Tripolitanian I	0.077	1	14
Tripolitanian III	0.077	1	14
Dr 23	0.077	1	14
Unidentified	0.538	7	14

Table 7.2 The centrality degree and the number of nodes and ties for each underwater site according to the amphorae types.

Underwater site	Centrality degree (%)	No. of nodes	No. of ties
		Total	
		83	108
		Breakdown	
Marsa Bagoush	0.386	71	27
Aboukir	0.214	71	15
Mammura	0.171	71	12
Marsa Oum El-Rakham	0.157	71	11
Shatby	0.143	71	10
Qaitbay/Pharos	0.143	71	10
Eastern Harbour	0.029	71	2
Western Harbour	0.043	71	3
Tannum Reef	0.043	71	3
Ras El-Hikma	0.057	71	4
Ibrahimia	0.100	71	7
Ras Hashafa	0.029	71	2
Ras Hawala	0.029	71	2

The data analysis revealed that Koan, Rhodian Early, LR4, AE3 Late/ AE3T-2, Variant B and Greco-Italic/ Will Form A2 amphorae types have the highest centrality degree. All these types demonstrate that the underwater site at Marsa Bagoush is the most central node in this network with 0.386 % centrality degree and 27 ties. In terms of the illustrated graph in Figure 7.1, it is worth stressing that the network is quite complex and diverse due to the significant number of different amphorae types and ties. Other nodes are all connected in some way to each other, except for Ras El-Hikma, which appears to be an isolated node with four unique

types of amphorae—it does not share any ties with any other node in the network. Despite the centrality degree of Ras El-Hikma (0.057) being higher than that for Ras Hashafa and Ras Hawala (0.029), the latter are considered as well and are more connected nodes in the network than Ras El-Hikma and are not considered isolated.

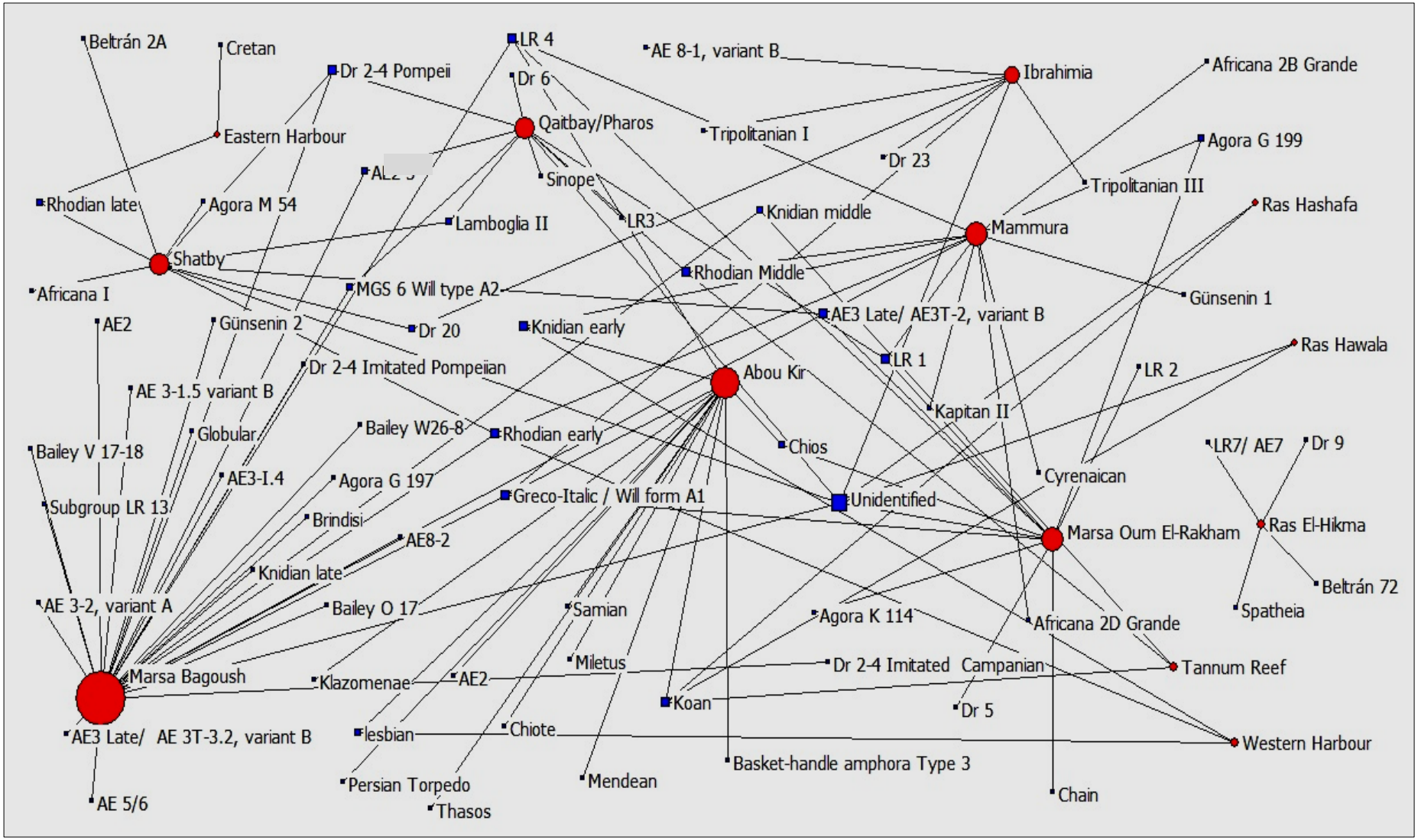


Figure 7.1 Undirected binary two-mode network graph representing the underwater sites and amphorae types.

7.1.1.2 Amphorae contents–underwater sites

Table 7.3 The centrality degree and the number of nodes and ties for each amphora content.

Amphora content	Centrality degree (%)	No. of nodes	No. of ties
		Total	
		22	39
		Breakdown	
Wine	1.000	14	13
Olive oil	0.538	14	7
Olive	0.154	14	2
Fish sauce	0.154	14	2
Fish products	0.231	14	3
Sesame oil	0.231	14	3
Dried food/fruit	0.077	14	1
Cereal	0.077	14	1
Unknown	0.538	14	7

Table 7.4 The centrality degree and the number of nodes and ties for each underwater site according to the amphorae contents.

Underwater site	Centrality degree (%)	No. of nodes	No. of ties
		Total	
		22	39
		Breakdown	
Marsa Bagoush	0.444	10	4
Aboukir	0.556	10	5
Mammura	0.556	10	5
Marsa Oum El-Rakham	0.444	10	4
Shatby	0.444	10	4
Qaitbay/Pharos	0.333	10	3
Eastern Harbour	0.111	10	1
Western Harbour	0.111	10	1
Tannum Reef	0.111	10	1
Ras El-Hikma	0.333	10	3
Ibrahimia	0.444	10	4
Ras Hashafa	0.222	10	2
Ras Hawala	0.222	10	2

According to the analysis for the amphora content aspect, wine captured the highest centrality degree with the most significant number of ties and olive oil is in the second place, while dried food/fruit and cereal are the lowest. In terms of the underwater sites, despite Marsa Bagoush being upper most on the amphora type aspect, Aboukir and Mammura are higher than the rest according to the content aspect. The graph below shows that the network is not as dense as the amphora type network, because there are only eight types of contents while there are in excess of 70 types of amphorae. Moreover, wine appears the most central node in the network while the number of isolated nodes includes mainly sites like the Western and Eastern Harbour, along with products like cereal and dried food/fruit (Figure 7.2). See Appendix 2, Section 11.2.1 .

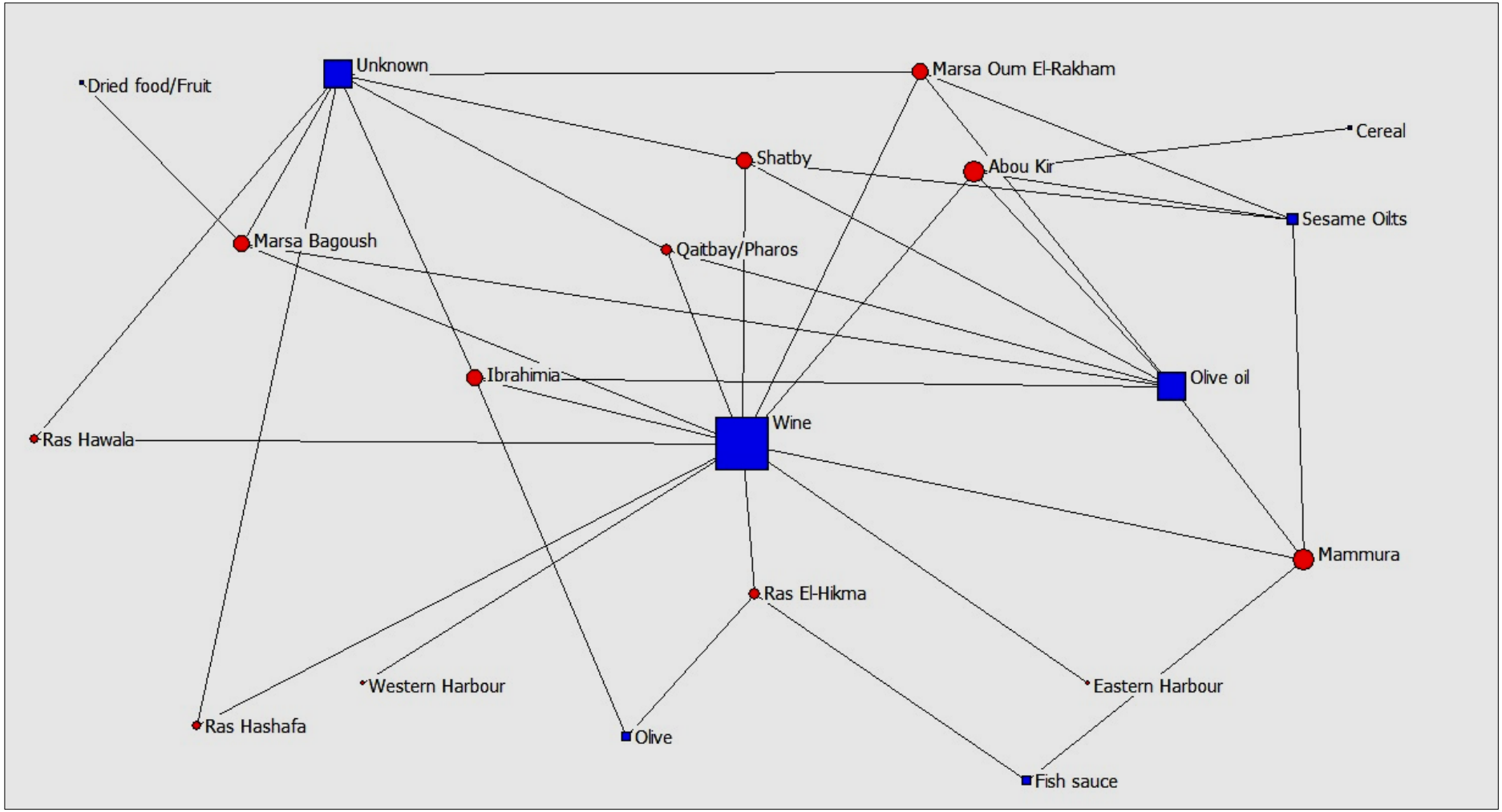


Figure 7.2 Undirected binary two-mode network graph representing the underwater sites and the amphorae contents.

7.1.1.3 Production regions–underwater sites

Table 7.5 The centrality degree and the number of nodes and ties for each production region.

Production region	Centrality degree (%)	No. of nodes	No. of ties
		Total	
		20	47
		Breakdown	
Egypt	0.692	14	9
Eastern Med.	0.462	14	6
Western Med.	0.462	14	6
Central Med.	0.615	14	8
Aegean	0.846	14	10
North Africa	0.000	14	0
Unidentified	0.538	14	6

Table 7.6 The centrality degree and the number of nodes and ties for each underwater site according to the production region.

Underwater site	Centrality degree (%)	No. of nodes	No. of ties
		Total	
		20	47
		Breakdown	
Marsa Bagoush	0.714	8	5
Aboukir	0.714	8	5
Mammura	0.571	8	4
Marsa Oum El-Rakham	0.714	8	5
Shatby	0.857	8	6
Qaitbay/Pharos	0.714	8	5
Eastern Harbour	0.143	8	1
Western Harbour	0.143	8	1
Tannum Reef	0.143	8	1
Ras El-Hikma	0.429	8	3
Ibrahimia	0.571	8	4
Ras Hashafa	0.571	8	4
Ras Hawala	0.429	8	3

The data analyses revealed that the Aegean as a production region and Shatby as an underwater site have the highest degree of centrality (0.846 and 0.857) and the largest number of ties (10 and 6 respectively). Furthermore, Figure 7.3 reveals several isolated nodes in the network, in particular: North Africa as a production region and Tannum Reef along with Western and Eastern Harbours as underwater sites. Also, this network is as dense as the amphora contents network and both are different from the amphora type network.

To sum up phase one results, Marsa Bagoush, Aboukir, Mammura and Shatby have the highest centrality degree and number of ties. The four Hellenistic amphorae, i.e., Koan, Rhodian Early and Greco-Italic/ Will Form A2 have the highest centrality degree along with the Late Roman amphora type (LR4) and the local AE3 Late/ AE3T-2, Variant B types. In terms of the amphorae contents and production regions, wine and the Aegean are the most prominent product and region respectively.

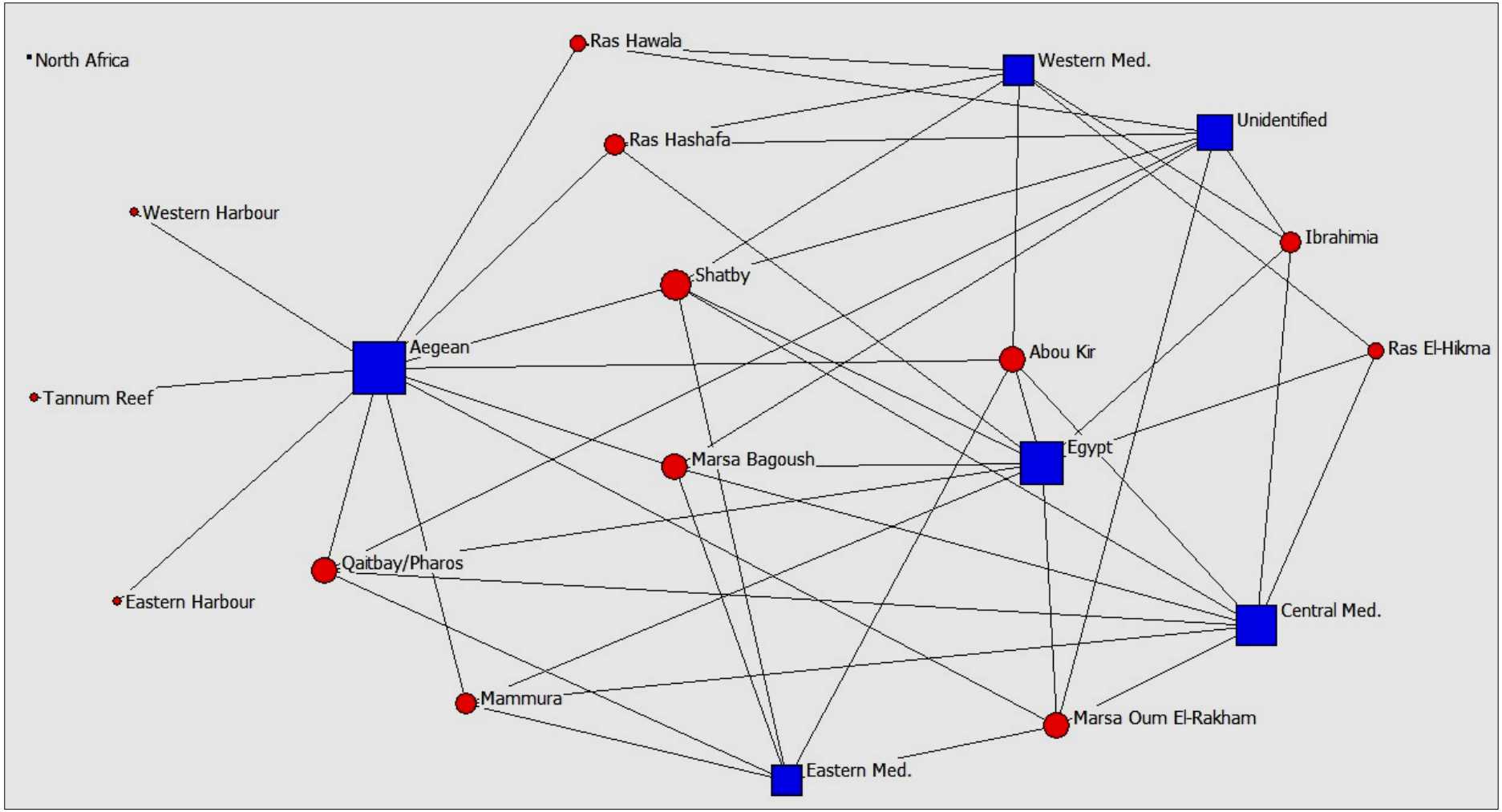


Figure 7.3 Undirected binary two-mode network graph representing the underwater sites and the production regions.

7.1.2 Phase 2 Results (Valued Data)

Phase 2 provides detailed results for Alexandria as one site—with all underwater sites combined—in terms of the tie strength between Alexandria and each amphora type, content and production region, along with the number of nodes and ties. The graphs for the amphora type aspect represent ego-centric networks (star shapes). The network is ego-centric because each period has specific or unique types of amphora. Hence, each period is a different network and there is no connectivity between the periods based on the amphora type aspect. As mentioned in the previous chapter, the network data for this phase is valued and not binary like phase 1. Consequently, the illustrating graphs for this phase represent the value through the variations in the link thickness, which indicates the strength of the tie according to the value. The stronger ties appear thicker and the weaker ties appear thinner.

7.1.2.1 Amphora Type Aspect

Table 7.7 The tie strength and the number of nodes and ties for each amphora type at each time period.

Period	Amphora type	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Mendean	1.0	11	9
	Klozomenai	2.0		
	Basket-handle (Type 3)	1.0		
	Chain	1.0		
	Chiote	1.0		
	Samian	1.0		
	Milesian	1.0		
	Thasos	1.0		
	Persian Torpedo	1.0		
Hellenistic	Cyrenaican I	1.0	16	15
	Rhodian early	107.0		
	Rhodian Middle	24.0		
	Knidian Early	4.0		
	Knidian Middle	2.0		
	Greco-Italic/ Will Form A1	5.0		

	Greco-Italic/ Will Form A2	6.0		
	Koan	4.0		
	Brindisi	1.0		
	Lamboglia II	496.0		
	AE2	2.0		
	AE2-3	11.0		
	Lesbian	2.0		
	Chios	2.0		
Early Roman	Agora G 199	1.0	20	19
	Rhodian Late	2.0		
	Knidian Late	1.0		
	Agora M 54	1.0		
	Agora K 114	1.0		
	Agora G 197	2.0		
	Tripolitanian I	2.0		
	Dressel 2-4 Imitated Pompeian	3.0		
	Dressel 2-4 Pompeii	8.0		
	Dressel 2-4 Imitated Campanian	1.0		
	Dressel 5	1.0		
	Dressel 6A	10.0		
	Dressel 9	1.0		
	Dressel 20	4.0		
	Cretan	1.0		
	Beltrán 2A	1.0		
	AE3/ AE 3-2, Variant A	2.0		
	AE3/ AE3-I.4	1.0		
Mid. Roman	Kapitain II	37.0	10	8
	Africana 2D Grande	1.0		
	Africana 2B Grande	1.0		
	Africana I	1.0		
	Tripolitanian III	1.0		

	Dressel 23	1.0		
	AE3/ AE 3-1.5 variant B	3.0		
	Sinope	5.0	11	9
Late Roman (Byz.)	LR1	53.0		
	LR 2	1.0		
	LR 3	2.0		
	LR 4	3.0		
	LR 5/6–AE5/6	1.0		
	LR7–AE7	1.0		
	AE3 Late/ AE 3T-2, Variant B	3.0		
	Spatheia	1.0		
	Beltrán 72	1.0		
Islamic	Günsenin 1	1.0	12	10
	Günsenin 2	1.0		
	AE3 Late/AE 3T-3.2, Variant B	3.0		
	AE 8-1, Variant B – Eglaff 766-767	1.0		
	Subgroup Late Roman 13 close to Peacock & Williams Class 54	1.0		
	AE8-2/ Imitations for LR7	1.0		
	Globular	2.0		
	Bailey O 17	1.0		
	Bailey V 17-18	1.0		
	Bailey W26-8	1.0		

Table 7.8 The prominent amphorae types across the periods.

Period	Prominent amphora type	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Klozomenai	2.0	11	9
Hellenistic	Lamboglia II	496.0	16	15
Early Roman	Dressel 6A	10.0	20	19
Mid Roman	Kapitain II	37.0	10	8
Late Roman (Byz.)	LR1	53.0	11	9
Islamic	AE3 Late/ AE 3T-3.2, Variant B	3.0	12	10

The data analysis of the amphorae types identified the most prominent amphora type for each period based on the amphorae recovered only from the underwater sites, as listed in Table 7.8. In general, Lamboglia II is the most prominent amphora type during the Hellenistic period and onwards; however, the densest network with various nodes is the Early Roman network with 20 nodes and 19 ties, while the Hellenistic one comes is second with 16 nodes and 15 ties (Figure 7.5 and Figure 7.6). See Figure 7.3 for the pre-Hellenistic period, Figure 7.7 for the mid-Roman period, and Figure 7.8 and Figure 7.9 for the Late Roman and Islamic periods respectively

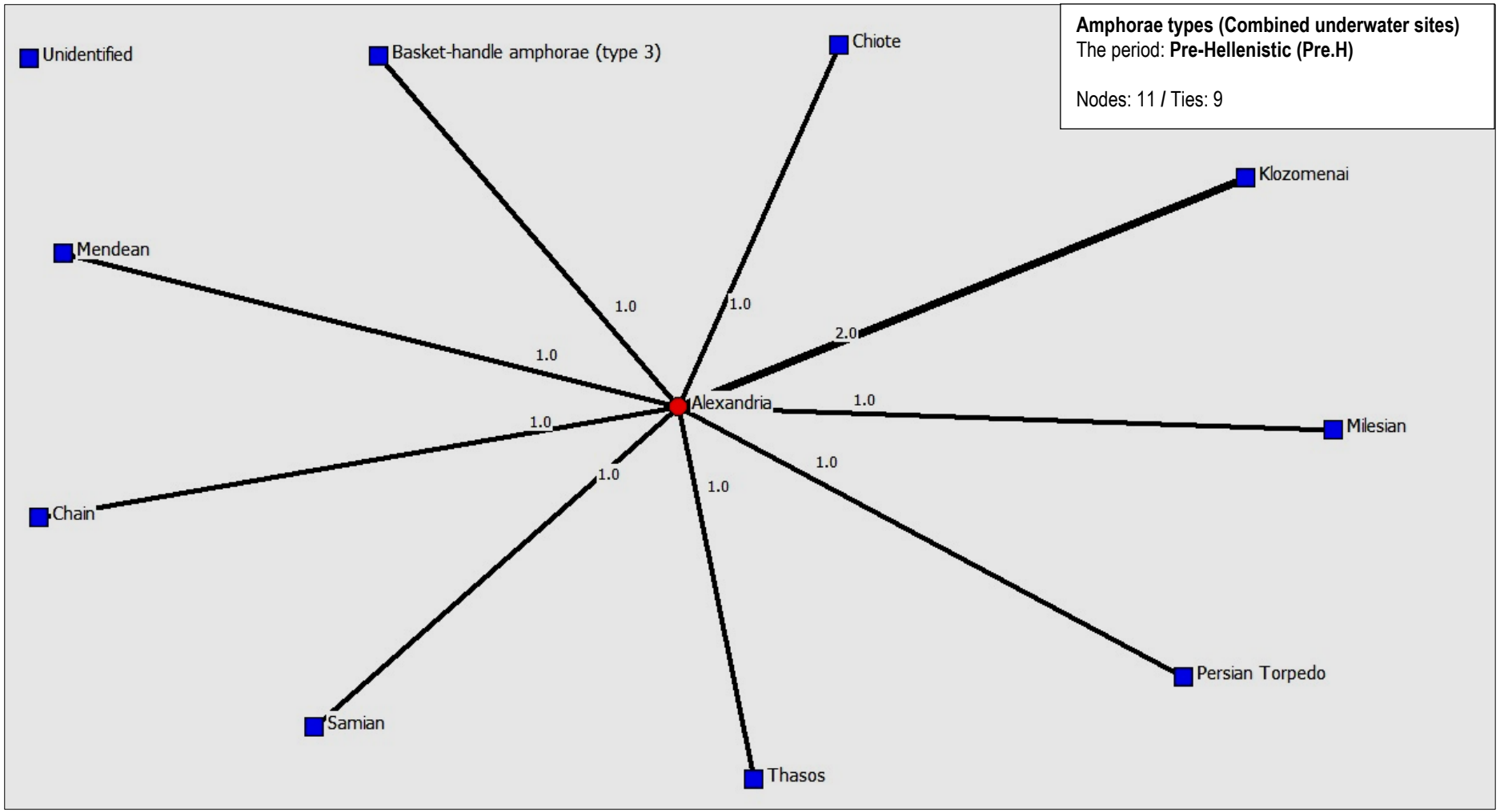


Figure 7.4 Valued ego-centric network based on the combined data from the underwater sites only for Alexandria in the pre-Hellenistic period and the amphorae types belonging to that period.

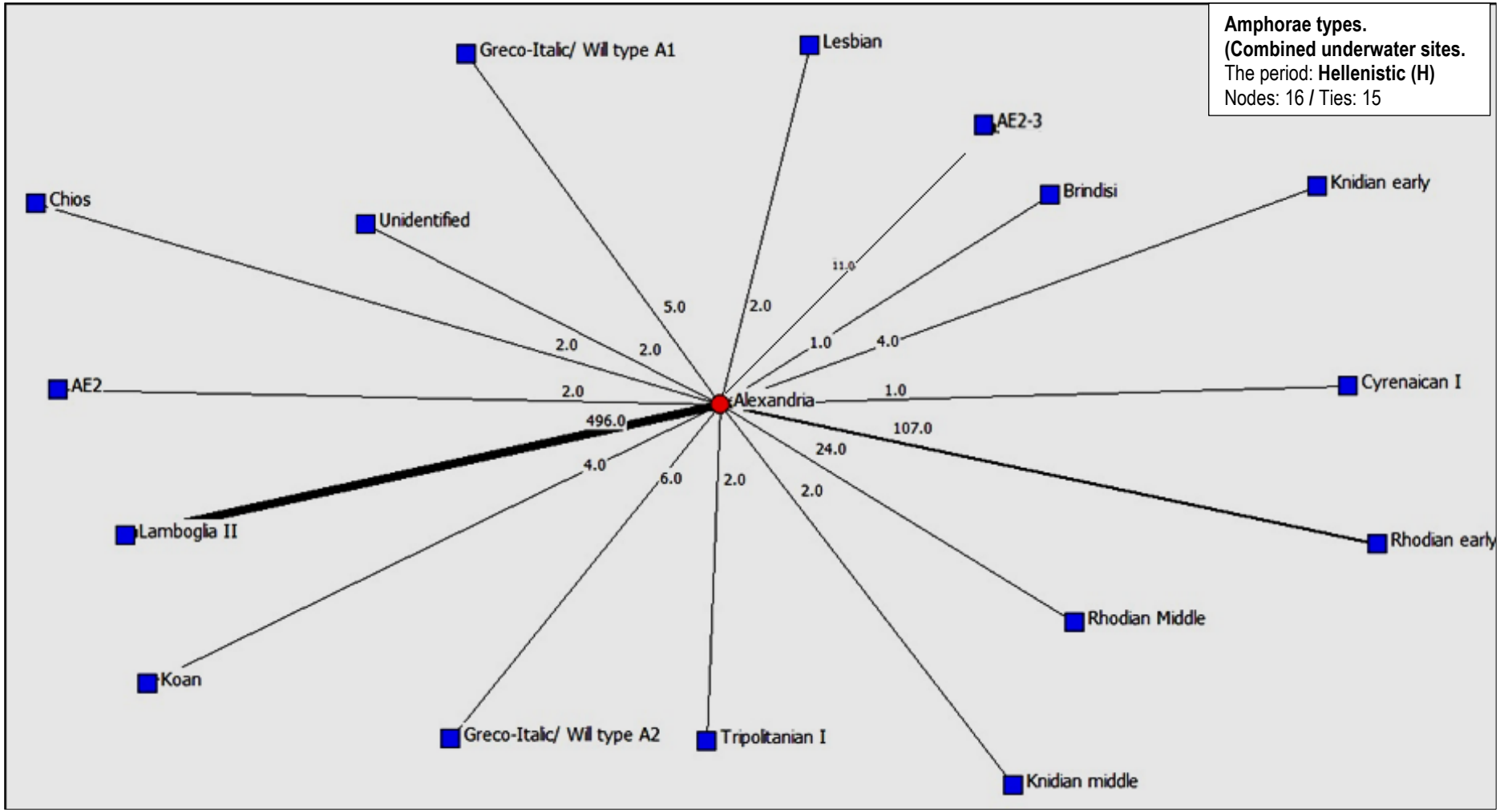


Figure 7.5 Valued ego-centric network based on the combined data from the underwater sites only for Alexandria in the Hellenistic period and the amphorae types belonging to that period.

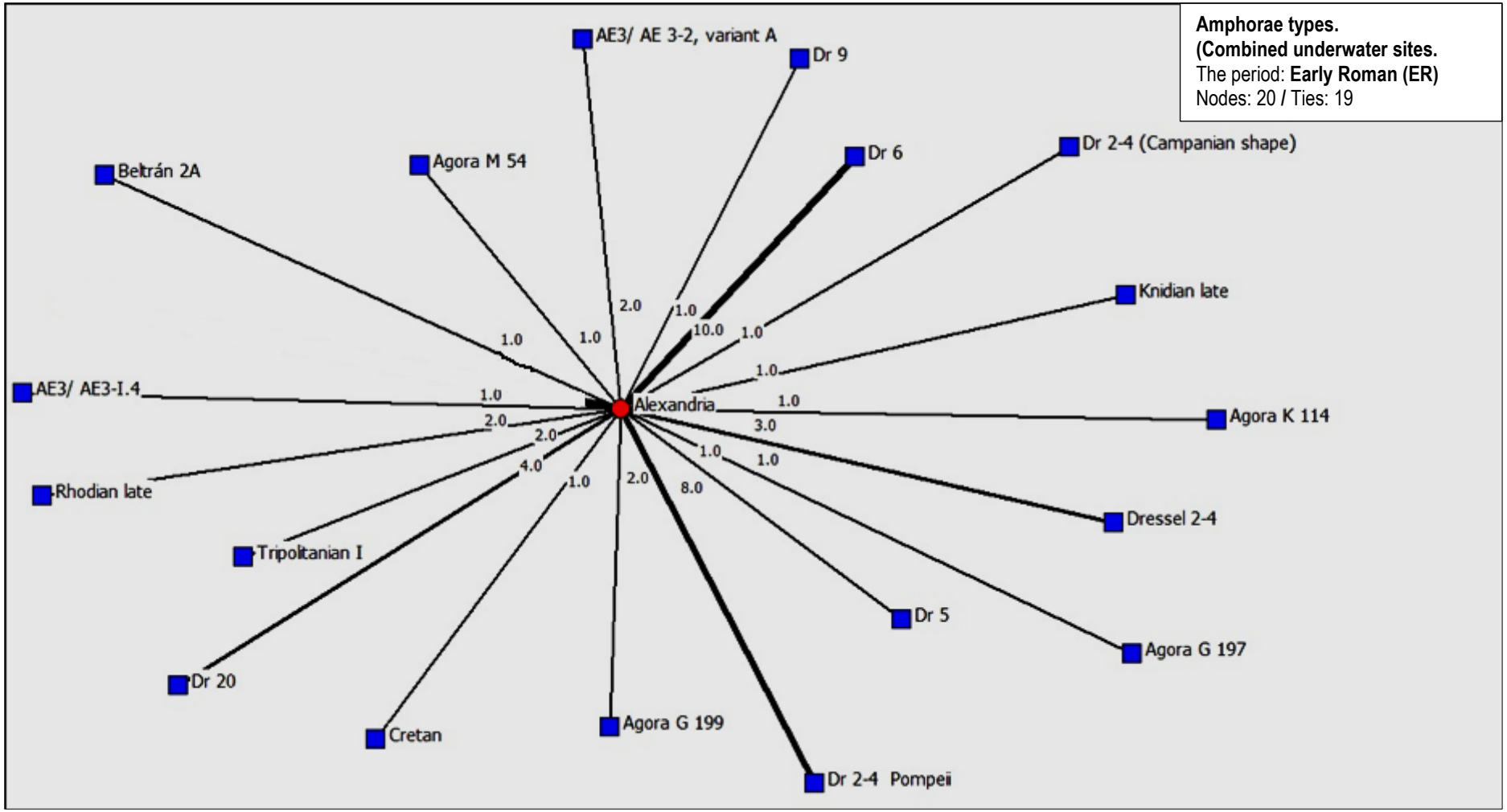


Figure 7. 6 Valued ego-centric network based on the combined data from the underwater sites only for Alexandria in the early Roman period and the amphorae types belonging to that period.

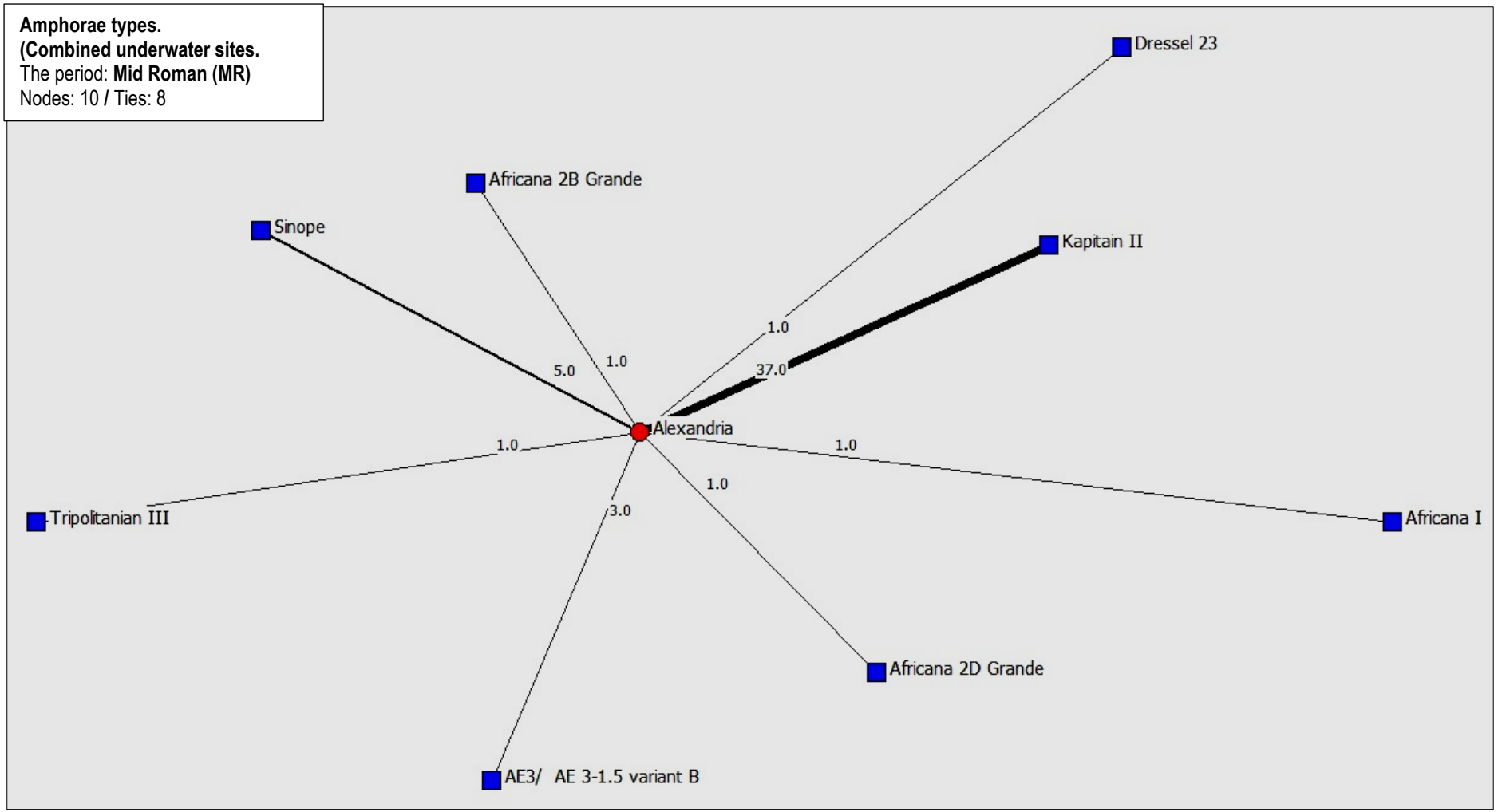


Figure 7.7 Valued ego-centric network based on the combined data from the underwater sites only for Alexandria in the mid-Roman period and the amphorae types belonging to that period.

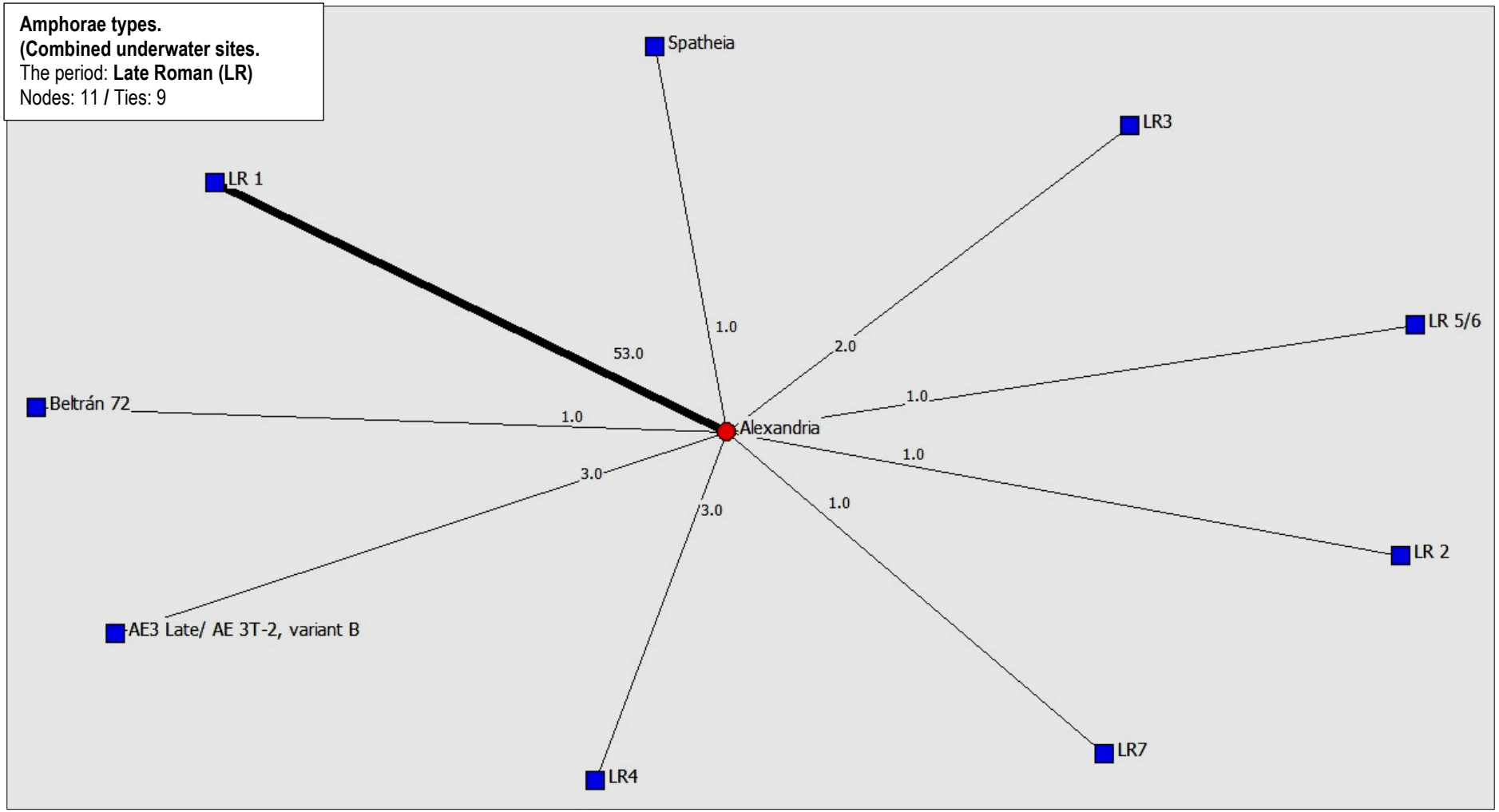


Figure 7.8 Valued ego-centric network based on the combined data from the underwater sites only for Alexandria in the late Roman period and the amphorae types belonging to that period.

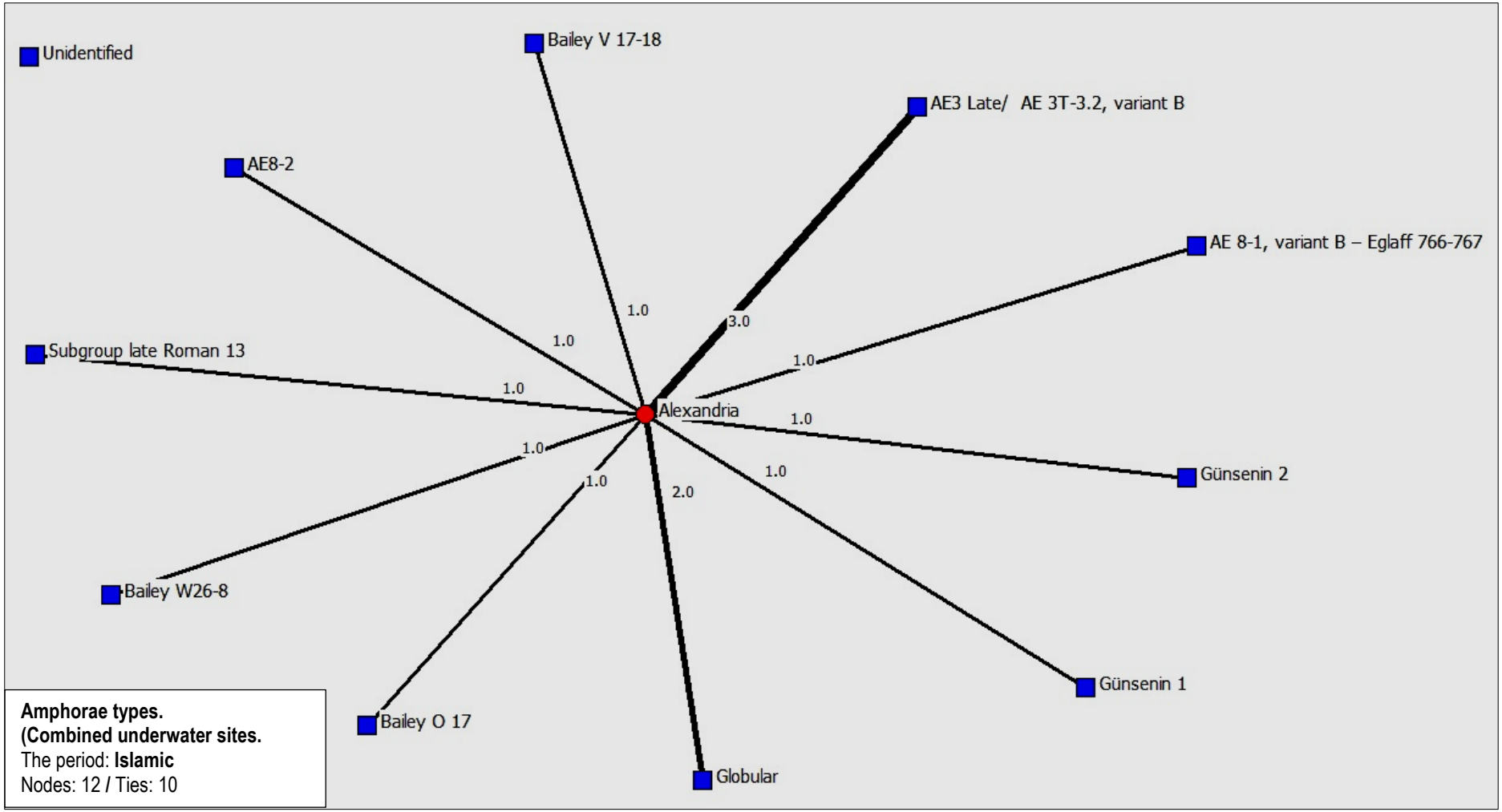


Figure 7.9 Valued ego-centric network based on the combined data from the underwater sites only for Alexandria in the Islamic period and the amphorae types belonging to that period.

7.1.2.2 Amphora Contents Aspect

Table 7.9 The tie strength and the number of nodes and ties for each amphora content at each time period.

Period	Amphora content	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Wine	5.0	10	1
	Olive oil	1.0		
	Olive	0		
	Fish sauce	0		
	Fish products	1.0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	3.0		
Hellenistic	Wine	168.0	10	4
	Olive oil	497.0		
	Olive	0		
	Fish sauce	0		
	Fish products	0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	5.0		
Early Roman	Wine	33.0	10	3
	Olive oil	6.0		
	Olive	0		
	Fish sauce	1.0		
	Fish products	1.0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	2.0		
	Wine	45.0		
	Olive oil	3.0		
	Olive	1.0		
	Fish sauce	1.0		

Mid-Roman	Fish products	0	10	4
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	0		
Late Roman (Byz.)	Wine	64.0	10	2
	Olive oil	0		
	Olive	0		
	Fish sauce	2.0		
	Fish products	0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	0		
Islamic	Wine	8.0	10	3
	Olive oil	0		
	Olive	0		
	Fish sauce	0		
	Fish products	0		
	Sesame oil	0		
	Dried food/fruit	1.0		
	Cereal	0		
	Unknown	4.0		

Table 7.10 The prominent amphorae contents across the periods.

Period	Prominent amphora content	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Wine	5.0	10	1
Hellenistic	Olive oil	497.0	10	4
Early Roman	Wine	33.0	10	3
Mid-Roman	Wine	45.0	10	4
Late Roman (Byz.)	Wine	64.0	10	2
Islamic	Wine	8.0	10	3

The analysis of the amphora contents aspect identified the most prominent cargoes carried in amphora from the underwater sites across the Hellenistic period until the Islamic period (Table 7.10). Olive oil is the most prominent cargo product from the Hellenistic period. In terms of the volume of connectivity, little difference can be observed but a higher number of ties are obvious in the Hellenistic and mid-Roman periods. Moreover, the graph in Figure 7.10 demonstrates that sesame oil and cereal are isolated nodes

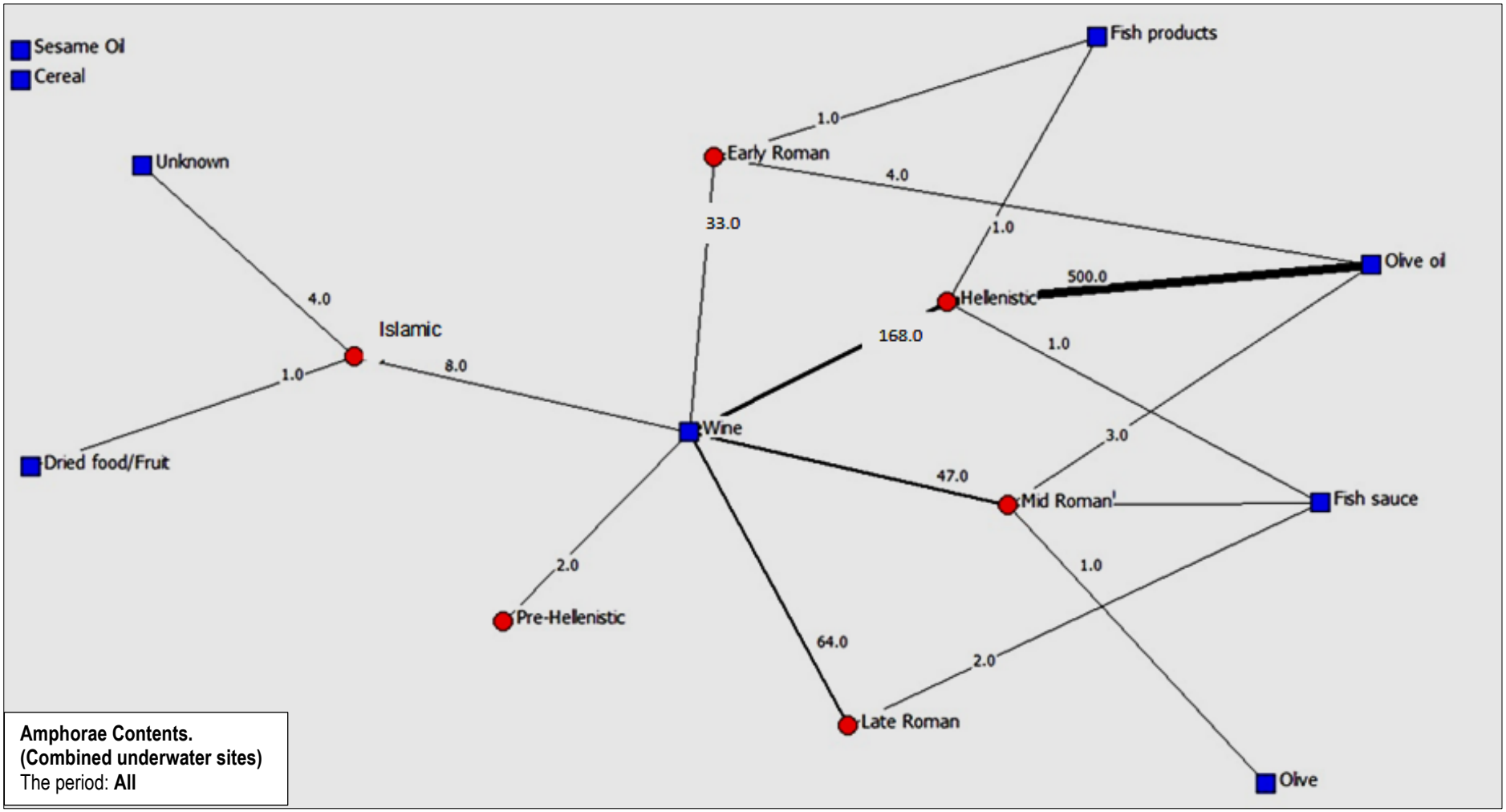


Figure 7.10 Valued two-mode network based on the combined data from the underwater sites only representing Alexandria across the six periods and the amphorae contents.

7.1.2.3 Amphora Production Regions Aspect

Table 7.11 The tie strength and the number of nodes and ties for each production region at each time period.

Period	Amphora production region	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Egypt	0	8	4
	Aegean	6.0		
	North Africa	0		
	Eastern Med. Levant	2.0		
	Western Med.	1.0		
	Central Med.	1.0		
	Unidentified	0		
Hellenistic	Egypt	13.0	8	4
	Aegean	147.0		
	North Africa	0		
	Eastern Med. Levant	0		
	Western Med.	2.0		
	Central Med.	509.0		
	Unidentified	0		
Early Roman	Egypt	3.0	8	6
	Aegean	6.0		
	North Africa	0		
	Eastern Med.	3.0		
	Western Med.	6.0		
	Central Med.	23.0		
	Unidentified	2.0		
Mid-Roman	Egypt	3.0	8	5
	Aegean	5.0		
	North Africa	0		
	Eastern Med. Levant	37.0		
	Western Med.	1.0		
	Central Med.	4.0		
	Unidentified	0		
	Egypt	5.0		

Late Roman (Byz.)	Aegean	5.0	8	5
	North Africa	0		
	Eastern Med.	54.0		
	Western Mediterranean	1.0		
	Central Med.	1.0		
	Unidentified	0		
Islamic	Egypt	8.0	8	4
	Aegean	2.0		
	North Africa	0		
	Eastern Med.	1.0		
	Western Med.	0		
	Central Med.	0		
	Unidentified	2.0		

Table 7.12 The prominent production regions across the periods.

Period	Prominent production region	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Aegean	6.0	8	4
Hellenistic	Central Med.	509.0	8	4
Early Roman	Central Med.	23.0	8	6
Mid-Roman	Eastern Med.	37.0	8	5
Late Roman (Byz.)	Eastern Med.	54.0	8	5
Islamic	Egypt	8.0	8	4

The analysis of the amphora production regions identified the most prominent production region during each period based on the data retrieved only from the underwater sites (Table 7.12). The central Mediterranean clearly is the most prominent production region from which products are transported in amphorae to Egypt from the Hellenistic period onwards. However, the early Roman period network is slightly denser than the Hellenistic period network with stronger ties between the nodes. Furthermore, the graph in Figure 7.11 illustrates that North Africa is the only isolated node in this well-connected network.

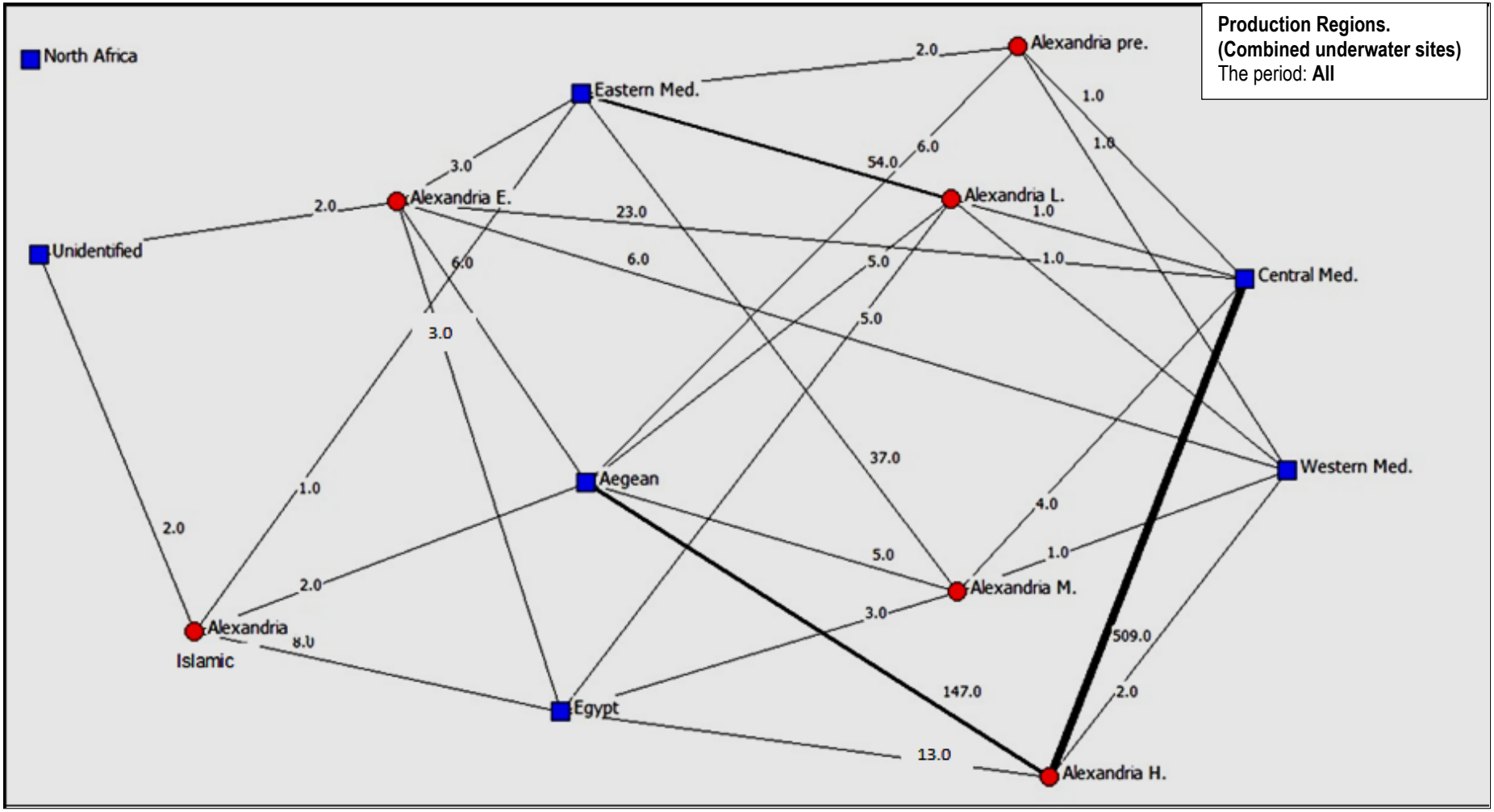


Figure 7.11 Valued two-mode network based on the combined data from the underwater sites only representing Alexandria across the six periods and the production regions.

7.2 The Combined Valued Data Analysis Results

The results generated from combining the amphora collections' valued data (the underwater, terrestrial collections and the Greco-Roman Museum collection), provides information on the ties' strength and the number of nodes and ties for each period in terms of each aspect—type, content and production region.

7.2.1 Amphora Type Aspect

Table 7.13 The ties strength for each amphora type and the number of nodes and ties for each period network.

Period	Amphora type	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Mendean	1.0	11	9
	Klozomenai	2.0		
	Basket-handle (Type 3)	1.0		
	Chain	3.0		
	Chiote	1.0		
	Samian	1.0		
	Milesian	1.0		
	Thasos	3.0		
	Persian Torpedo	1.0		
Hellenistic	Cyrenaican I	1.0	16	15
	Rhodian H.	2544.0		
	Knidian H.	475.0		
	Greco-Italic	34.0		
	Koan	734.0		
	Brindisi	2.0		
	Lamboglia II	537.0		
	AE1	1847.0		
	AE2	9.0		
	AE2-3	11.0		
	Lesbian	9.0		
	Chios	5.0		
	Dr 1A	46.0		
	Tripolitania	6.0		
	Mana	1.0		
	Agora G 199	13.0		

Early Roman	Rhodian L.	2.0	30	29
	Knidian L.	4.0		
	Agora M 54	12.0		
	Agora K 114	1.0		
	Agora G 197	1.0		
	Tripolitanian I	2.0		
	Dr 1B	1.0		
	Dr 1C	1.0		
	Dr 2-4 Imitated Pompeian	3.0		
	Dr 2-4 Pompeii	8.0		
	Dr 2-4 Imitated Campanian	1.0		
	Dr 2-4 Campania	7.0		
	Dr 2-4 Cilicia	1.0		
	Dr 5	1.0		
	Dr 6	16.0		
	Dr 6A	10.0		
	Dr 7/11	3.0		
	Dr 9	1.0		
	Dr 20	4.0		
	Cretan	35.0		
	Beltrán 2A	1.0		
	AE3	2698.0		
	AE4	704.0		
	Pompeii V	10.0		
	MC 2/12	1.0		
	MC 22/3	229.0		
	Pseudo-Cos	2.0		
Mid-Roman	Kapitain II	46.0	14	12
	Africana Grande	23.0		
	Africana I	346.0		
	Africana III	11.0		
	Tripolitanian II	11.0		
	Tripolitanian III	1.0		
	Dr 23	1.0		
	Dr 30	13.0		
	Dr 36	1.0		

	Dr 43	1.0		
	AE3 mid. Roman	3.0		
	Sinope	5.0		
Late Roman (Byz.)	LR1	2080.0	17	15
	LR 2	31.0		
	LR 3	51.0		
	LR 4	2300.0		
	LR 5/6–AE5/6	527.0		
	LR7–AE7	143.0		
	AE3 Late	8.0		
	Spatheia	11.0		
	Beltrán 72	1.0		
	Keay 8B	6.0		
	Keay 25	16.0		
	Keay 35	1.0		
	Keay 36	1.0		
	Keay 45	1.0		
	Egloff 169	28.0		
Islamic	Günsenin 1	1.0	12	10
	Günsenin 2	1.0		
	AE3 Late/ AE 3T-3.2, Variant B	3		
	AE 8-1, Variant B – Eglaff 766-767	1.0		
	Subgroup Late Roman 13 close to Peacock & Williams Class 54	1.0		
	AE8-2/ Imitations for LR7	1.0		
	Globular	2.0		
	Bailey O 17	1.0		
	Bailey V 17-18	1.0		
	Bailey W26-8	1.0		

Table 7.14 The prominent amphora type across the six periods along with the tie strength and the network nodes and ties.

Period	Prominent amphora type	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Thasos and Chain	3.0	11	9
Hellenistic	Rhodian H.	2544.0	16	15
Early Roman	AE3	2698.0	30	29
Mid-Roman	Africana I	346.0	14	12
Late Roman (Byz.)	LR4	2300.0	17	15
Islamic	AE3 Late/AE 3T-3.2, Variant B	3.0	12	10

The data analysis of the amphora types identified the prominent type for each time period based on the combined data, as listed in Table 7.14. The table clearly demonstrates that the Egyptian amphora AE3 is the most prominent type across the time periods in the best-connected network (i.e., early Roman period). Also, two amphora types have the same tie strength in the pre-Hellenistic period, i.e., Thasos and Chain amphora types (Figure 7.12). According to the graph in Figure 7.13, Koan amphora and the Egyptian amphora AE1 have stronger ties along with the Rhodian Hellenistic type. The Egyptian amphora AE3 in general is the main feature of the Early Roman period with a tie strength of 2698.0. Also, the Egyptian amphora AE4 and Mons Claudianus amphora Type 22/3 have stronger connectivity with a tie strength of 704.0 and 229.0 respectively (Figure 7.14). As for the mid-Roman period, the African I amphora was the most prominent type with a tie strength of 346.0 (Figure 7.15). By the late Roman period, Late Roman 4 amphora was the main feature with a tie strength of 2300.0; however, Late Roman 2 amphora also has strong connectivity with a tie strength of 2080.0 (Figure 7.16). Despite a significant decline in local production in the mid-Roman period, the Egyptian amphora return in the Islamic period with the Late Roman amphora AE3 late (Figure 7.17).

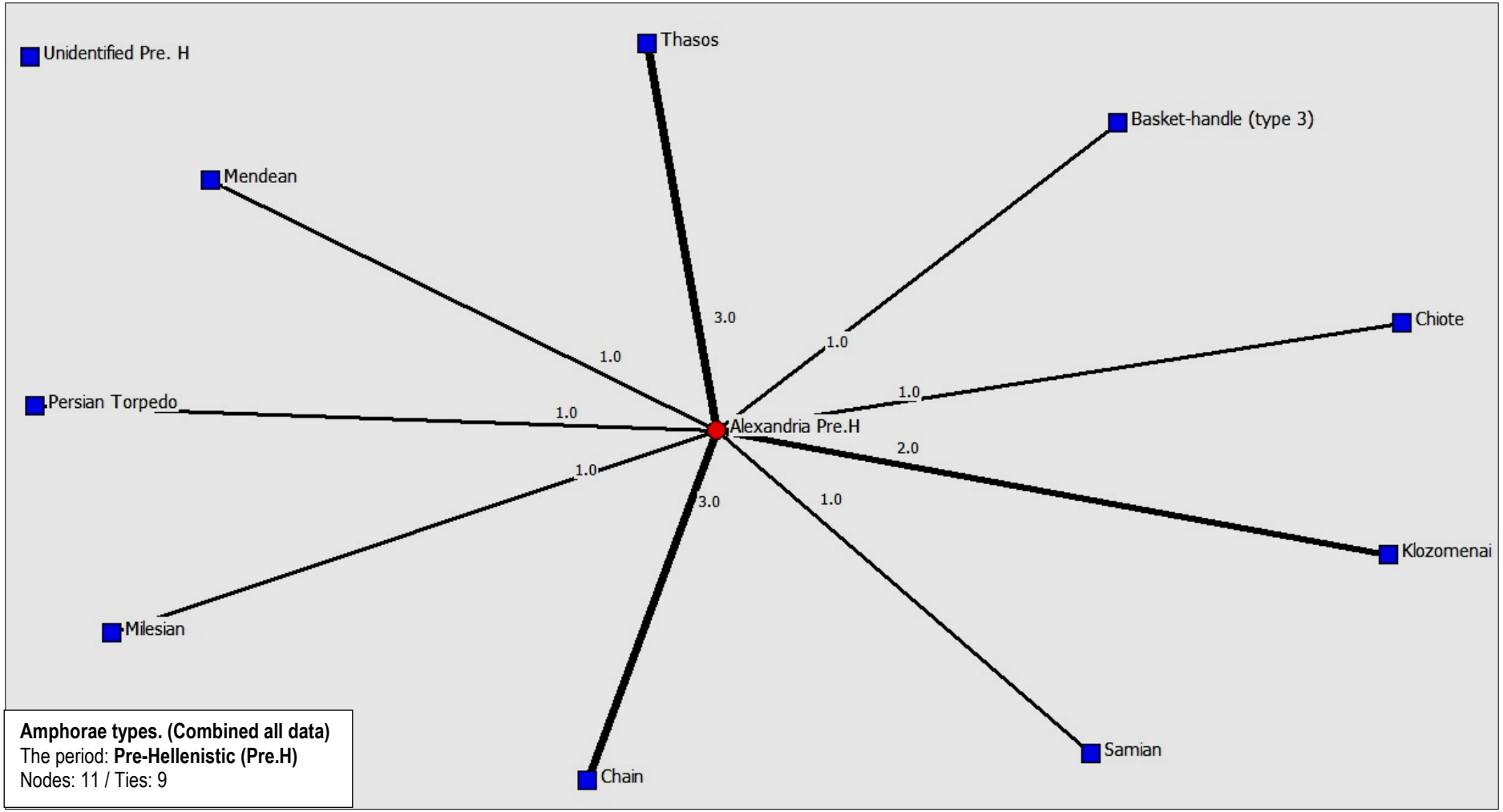


Figure 7.12 Valued ego-centric network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria in the pre-Hellenistic period and the amphorae types belonging to that period.

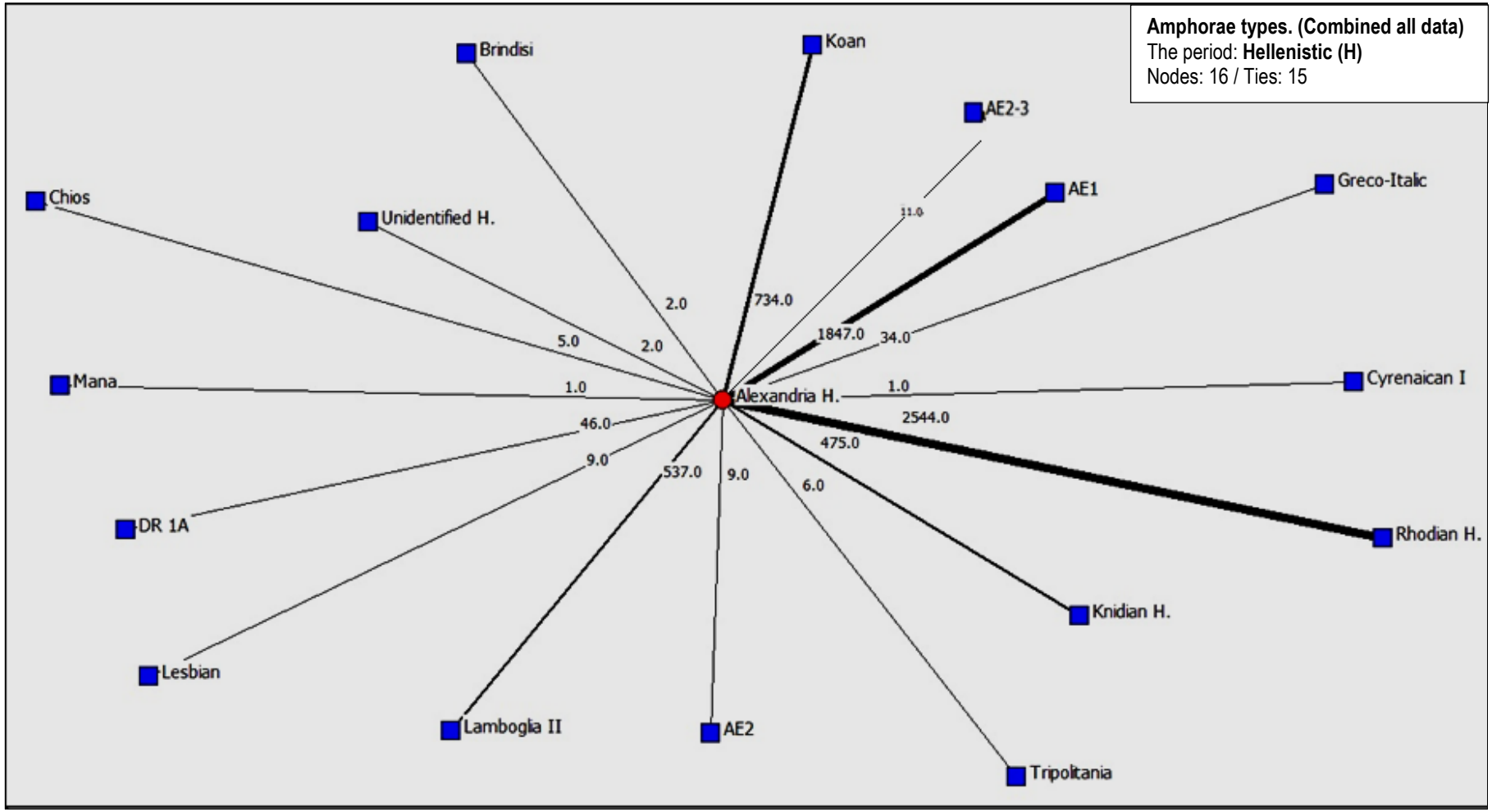


Figure 7.13 Valued ego-centric network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria in the Hellenistic period and the amphorae types belonging to that period.

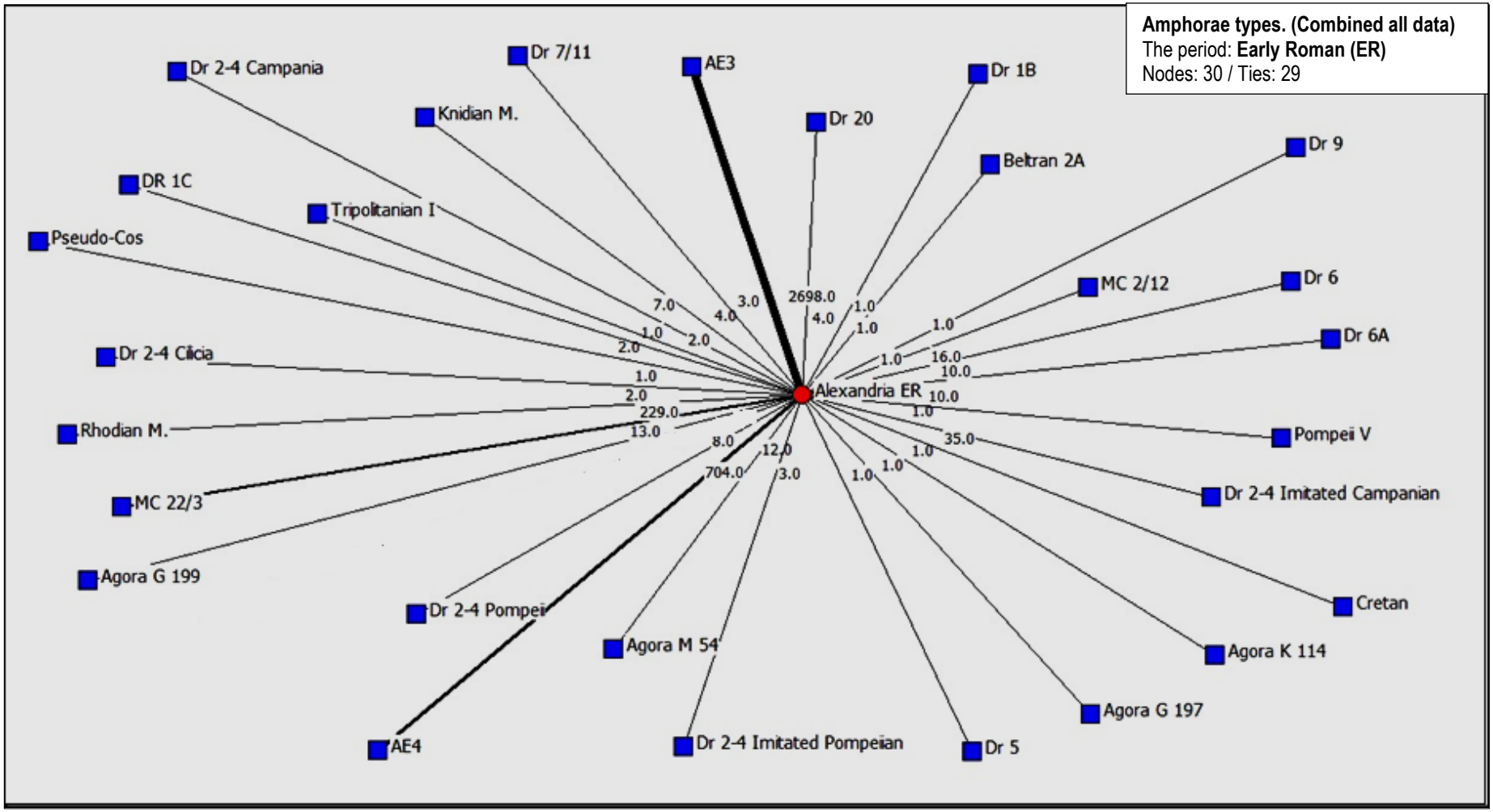


Figure 7.14 Valued ego-centric network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria in the early Roman period and the amphorae types belonging to that period.

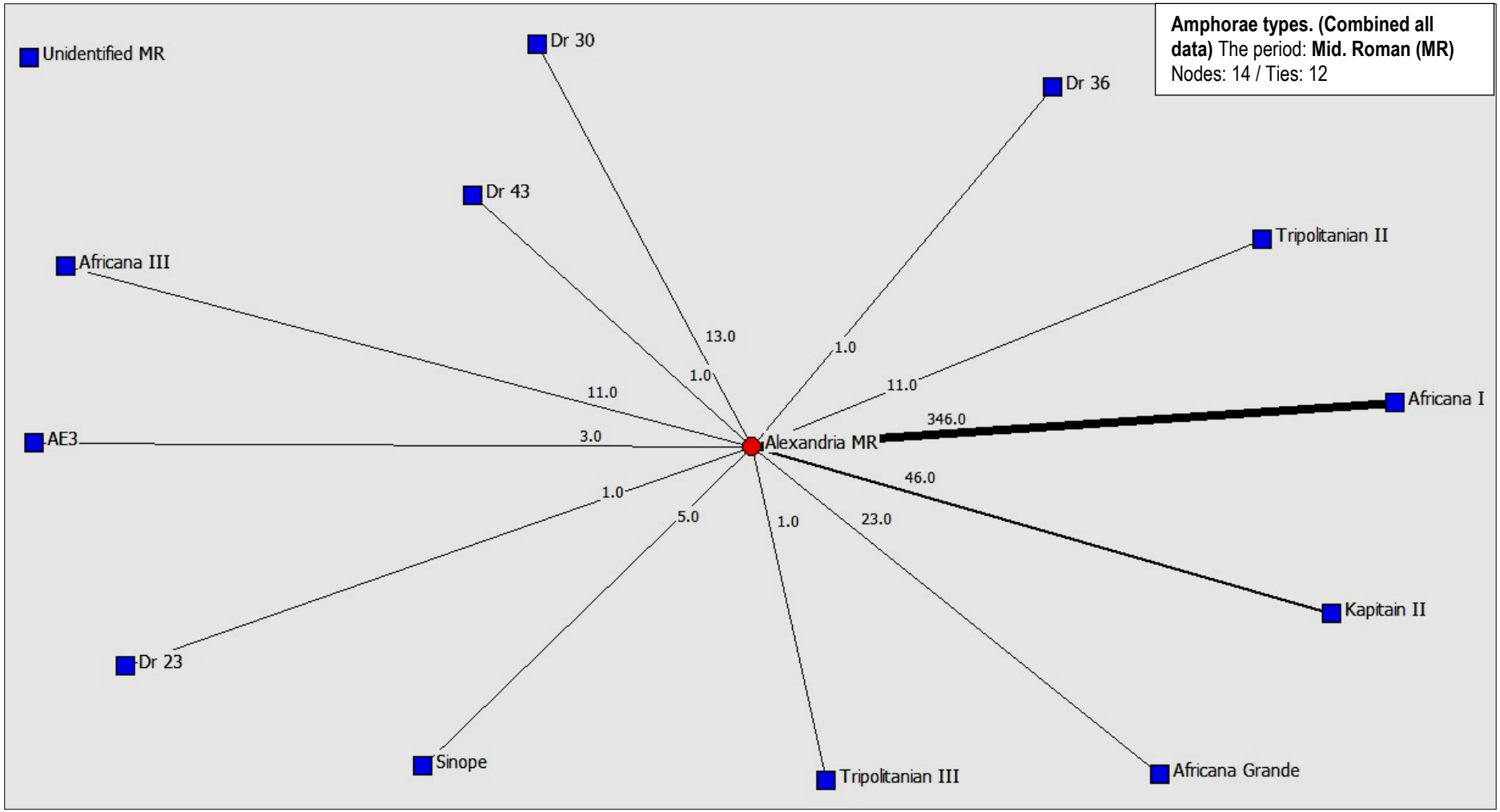


Figure 7.15 Valued ego-centric network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria in the mid-Roman period and the amphorae types belonging to that period.

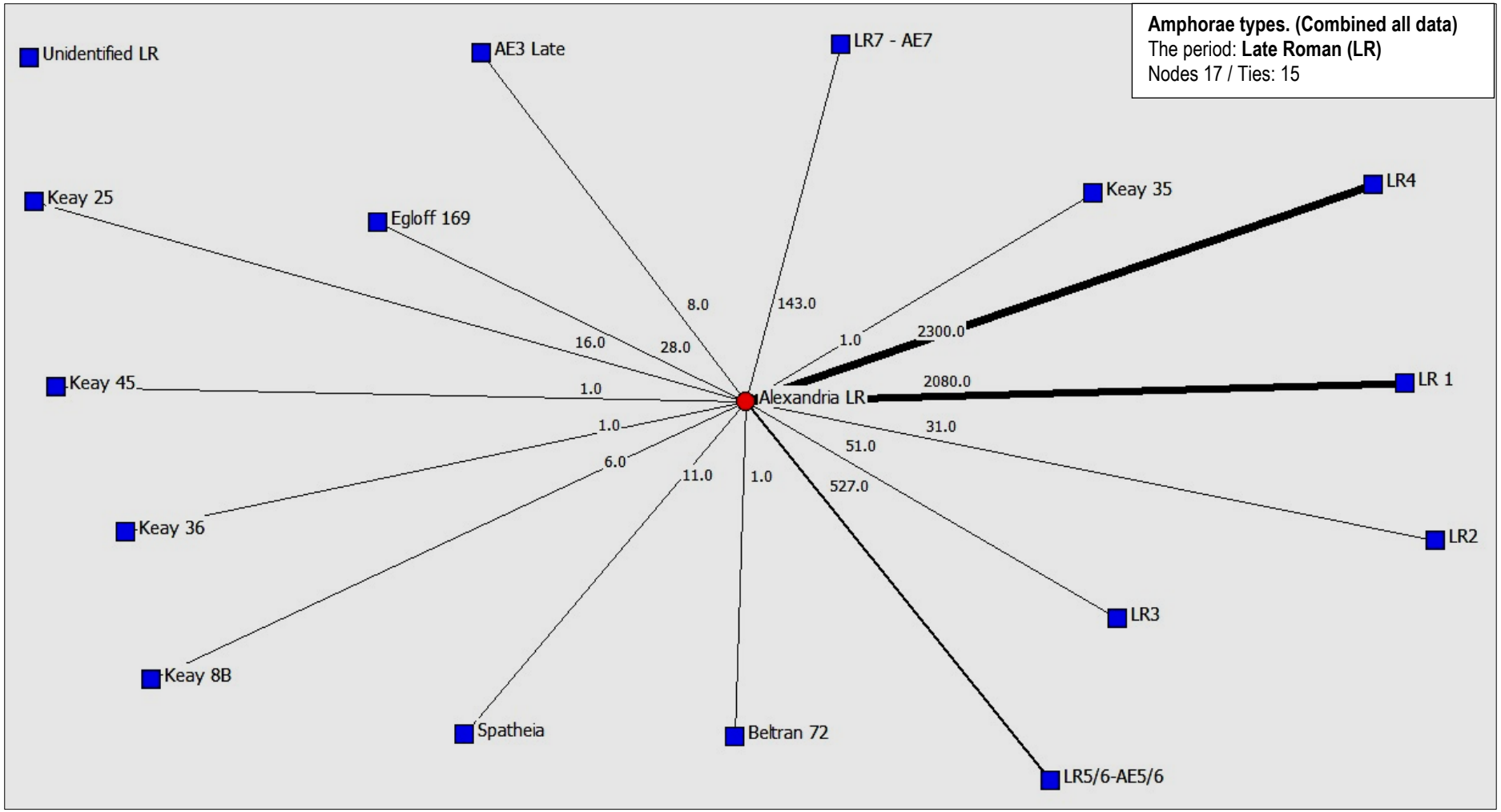


Figure 7.16 Valued ego-centric network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria in the late Roman period and the amphorae types belonging to that period.

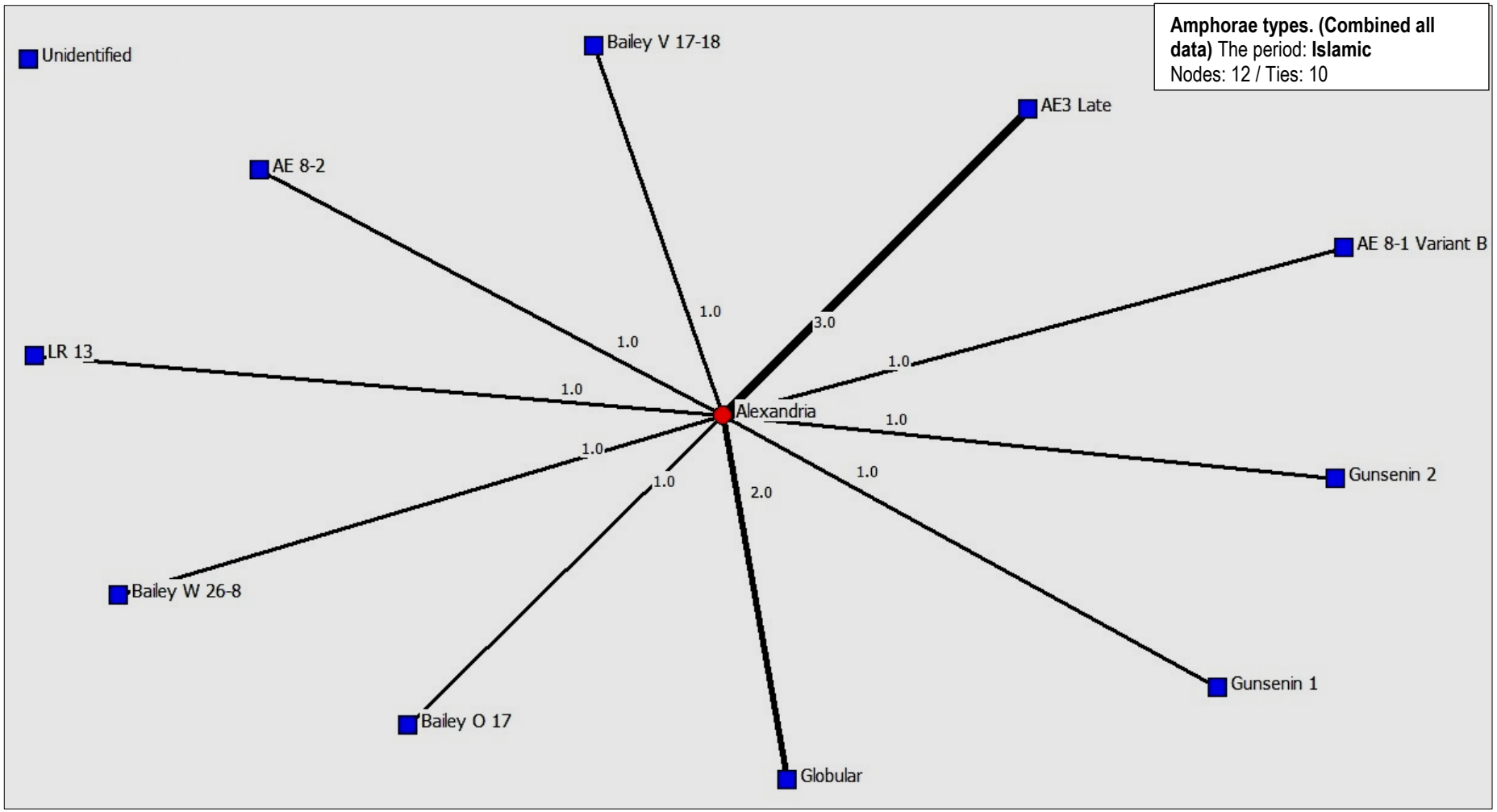


Figure 7.17 Valued ego-centric network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria in the Islamic period and the amphorae types belonging to that period.

7.2.2 Amphora Contents Aspect

Table 7.15 The ties strength for each amphora content and the number of nodes and ties for each period network.

Period	Amphora content	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Wine	9.0	10	4
	Olive oil	1.0		
	Olive	0		
	Fish sauce	0		
	Fish products	1.0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	3.0		
Hellenistic	Wine	6445.0	10	4
	Olive oil	544.0		
	Olive	0		
	Fish sauce	1.0		
	Fish products	0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	5.0		
Early Roman	Wine	942.0	10	5
	Olive oil	6.0		
	Olive	0		
	Fish sauce	4.0		
	Fish products	1.0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	232.0		
	Wine	81.0		

Mid-Roman	Olive oil	364.0	10	4
	Olive	1.0		
	Fish sauce	18.0		
	Fish products	0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	0		
Late Roman (Byz.)	Wine	3064.0	10	5
	Olive oil	2075.0		
	Olive	16.0		
	Fish sauce	2.0		
	Fish products	0		
	Sesame oil	0		
	Dried food/fruit	0		
	Cereal	0		
	Unknown	49.0		
Islamic	Wine	8.0	10	3
	Olive oil	0		
	Olive	0		
	Fish sauce	0		
	Fish products	0		
	Sesame oil	0		
	Dried food/fruit	1.0		
	Cereal	0		
	Unknown	4.0		

Table 7.16 The prominent amphora content across the six periods along with the tie strength and the network nodes and ties.

Period	Prominent amphora content	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Wine	9.0	10	4
Hellenistic	Wine	6445.0	10	4
Early Roman	Wine	942.0	10	5
Mid-Roman	Olive oil	364.0	10	4
Late Roman (Byz.)	Wine	3064.0	10	5
Islamic	Wine	8.0	10	3

The analysis of the amphora contents identified the most prominent content for each period basing on the data retrieved from the combined dataset, as listed in Table. 7.16. According to the results, wine is the most transported product across all periods, except in the mid-Roman period, when olive oil appears more prominently than wine. Despite wine being the most traded good in the Hellenistic period, a significant decline followed in the Early Roman period, although it then bounced back in the Late Roman period. As shown in the graph illustrated in Figure 7.18, the network is well connected with some isolated nodes like dried food/fruit, sesame oil and cereal.

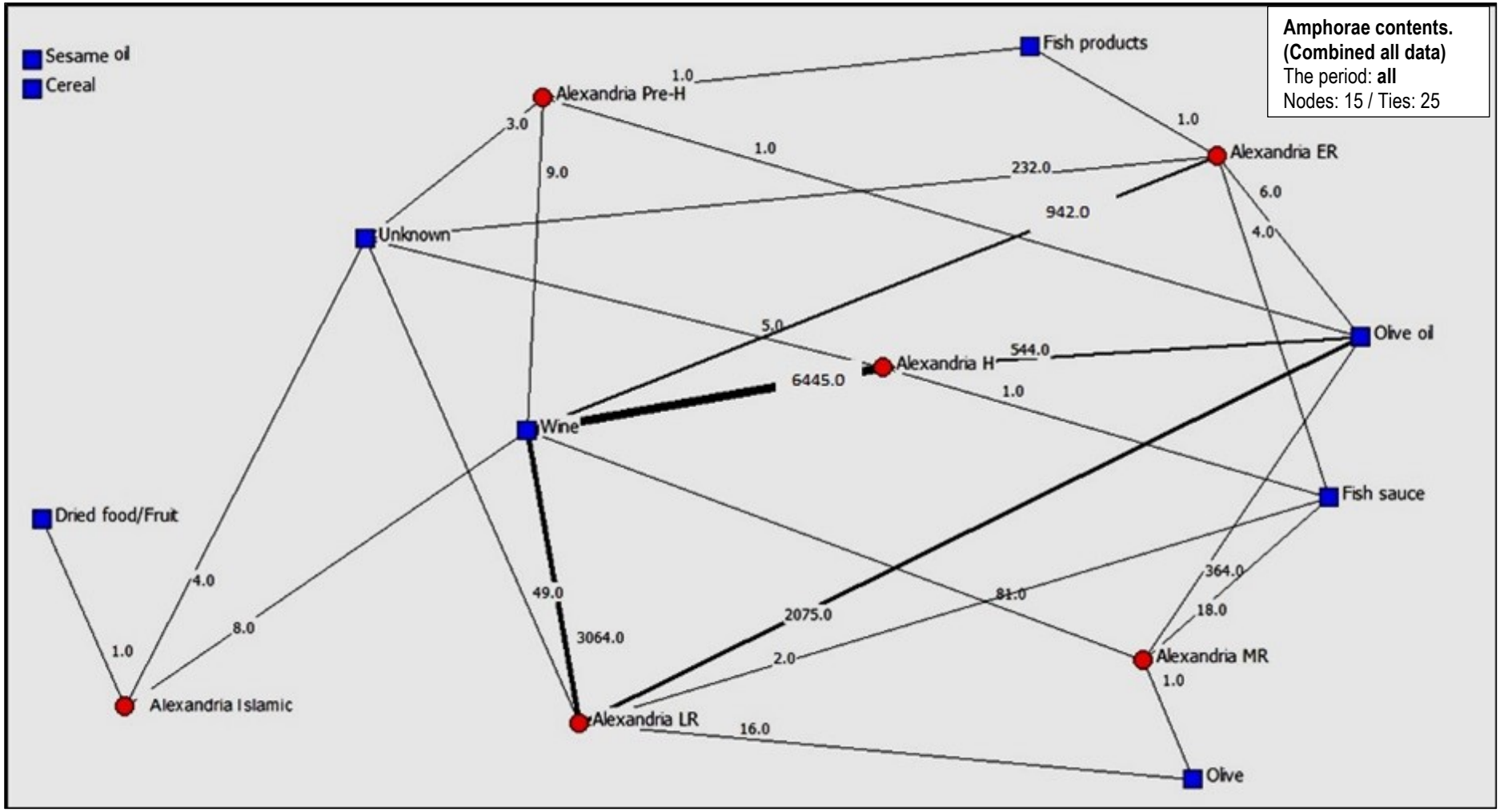


Figure 7.18 Valued two-mode network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria across the six periods and the amphorae contents.

7.2.3 Amphora Production Regions Aspect

Table 7.17 The ties strength for each production region and the number of nodes and ties for each period network.

Period	Amphora production region	Tie strength	No. of nodes	No. of ties
Pre-Hellenistic	Egypt	0	8	4
	Aegean	10.0		
	North Africa	0		
	Eastern Med.	2.0		
	Western Med.	1.0		
	Central Med.	1.0		
	Unidentified	0		
Hellenistic	Egypt	2613.0	8	5
	Aegean	3755.0		
	North Africa	0		
	Eastern Med.	1.0		
	Western Med.	2.0		
	Central Med.	625.0		
	Unidentified	0		
Early Roman	Egypt	1037.0	8	6
	Aegean	44.0		
	North Africa	0		
	Eastern Med.	36.0		
	Western Med.	9.0		
	Central Med.	49.0		
	Unidentified	4.0		
Mid-Roman	Egypt	3.0	8	6
	Aegean	5.0		
	North Africa	13.0		
	Eastern Med.	39.0		
	Western Med.	1.0		
	Central Med.	397.0		
	Unidentified	0		
	Egypt	678.0		
	Aegean	79.0		
	North Africa	0		
	Eastern Med.	4412.0		

Late Roman (Byz.)	Western Med.	1.0	8	5
	Central Med.	36.0		
	Unidentified	0		
Islamic	Egypt	8.0	8	4
	Aegean	2.0		
	North Africa	0		
	Eastern Med.	1.0		
	Western Med.	0		
	Central Med.	0		
	Unidentified	2.0		

Table 7.18 The prominent production region across the six periods along with the tie strength and the network nodes and ties.

Period	Prominent production region	Tie strength	No. of nodes	No. of nodes
Pre-Hellenistic	Aegean	10.0	8	4
Hellenistic	Aegean	3755.0	8	5
Early Roman	Egypt	1037.0	8	6
Mid-Roman	Central Med.	397.0	8	6
Late Roman (Byz.)	Eastern Med.	4412.0	8	5
Islamic	Egypt	8.0	8	4

The analysis of the amphora production regions identified the prominent area for each period based on the combined data, as listed in Table 7.18. The fluctuations are the highlight of these results; as the production line started in the pre-Hellenistic period with the Aegean region and continued through the Hellenistic period, then local production rises across the Early Roman period. After that, the Central and Eastern Mediterranean appear in the Mediterranean market (Figure 7.19).

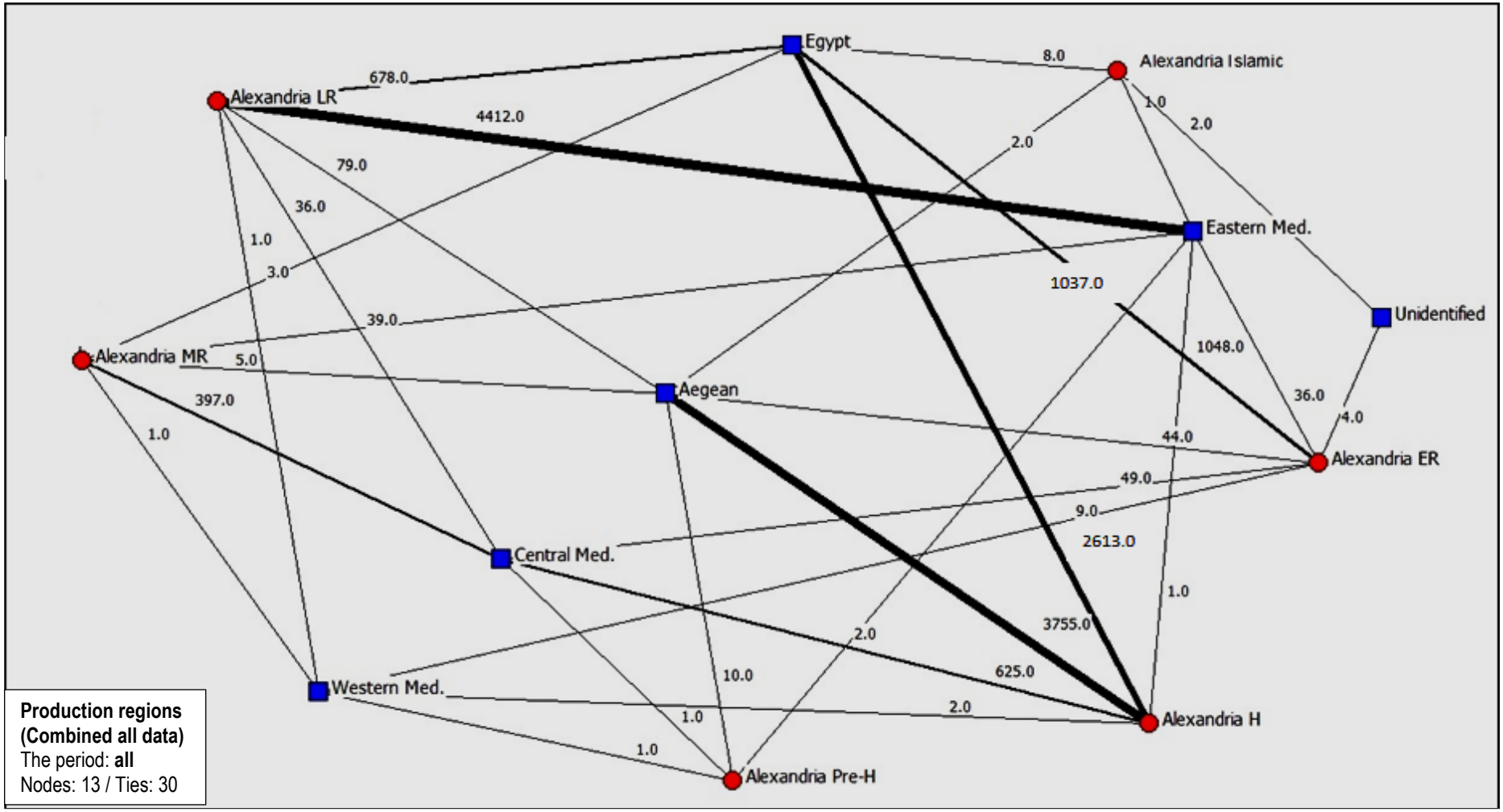


Figure 7.19 Valued two-mode network based on the combined data from the underwater, terrestrial and museum collections representing Alexandria across the six periods and the production regions.

7.3 Amphorae Production Regions Across Time

It is worth stressing that the production region aspect is significant in the investigation of the connectivity and relationships between Alexandria and the rest of the Mediterranean basin. Shedding more light on each production region would give a more complete image of the movement and connectivity patterns in the Mediterranean. For example, the Aegean as a production source fluctuated between the periods, as shown in Table 7.19 below. It reached its peak during the Hellenistic period and a massive decline occurs in the mid-Roman and Islamic periods. Eastern Mediterranean started to join the market with considerable production during the early and mid-Roman periods until it reached a peak during the late Roman period. The central Mediterranean was foremost of the production regions during the Hellenistic period and continued in the mid-Roman period after a massive decline during the early Roman period. Then, the Western Mediterranean and North Africa have modest participation in the maritime trade market; both have the lowest degree amongst the other production regions, with slightly high degrees during the early Roman for the Western Mediterranean. As for the local production, the data show that Egypt had the highest degree during the Hellenistic period and continued in the early Roman; however, a significant decline during the mid-Roman period and was arrested in the late Roman period (Table 7.19 and Figure 7.20).

Table 7.19 The fluctuations of the production regions across the periods.

Production Regions						
Periods	**Egypt**	**Aegean**	**Eastern Med.**	**Central Med.**	**Western Med.**	**North Africa**
Pre-Hellenistic	0	10.0	2.0	1.0	1.0	0
Hellenistic	2613.0	3755.0	1.0	625.0	2.0	0
Early Roman	1037.0	44.0	36.0	49.0	9.0	0
Mid-Roman	3.0	5.0	39.0	410.0	1.0	0
Late Roman (Byz.)	678.0	79.0	4412.0	36.0	1.0	0
Islamic	8.0	2.0	1.0	0	0	0

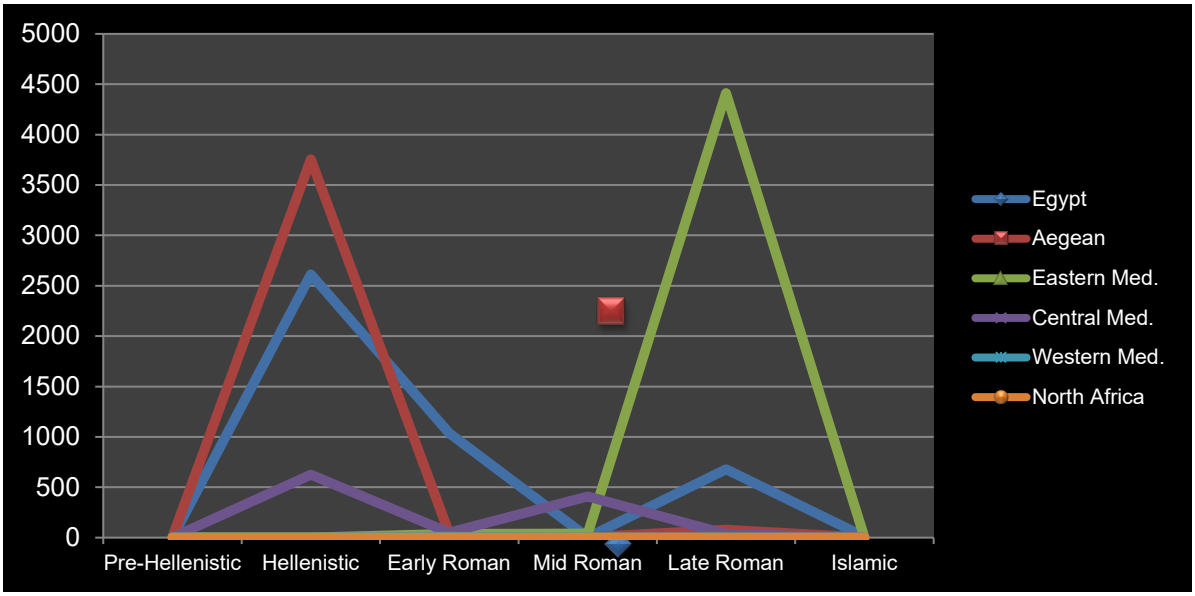


Figure 7.20 The fluctuations of the production regions across the periods.

7.4 Transported Products Across Time

Of the amphora contents or transported products, wine and olive oil were the main products with the highest degrees across the six periods. Wine reached its peak during the Hellenistic period, while olive oil did so in the Late Roman period. A modest presence is seen in fish sauce/products and dried food/fruit while records for sesame oil and cereal are completely absent (Table 7.20 and Figure 7.21).

Table 7.20 The fluctuations of the amphorae contents across the periods.

	Contents							
Periods	**Wine**	**Olive Oil**	**Olive**	**Fish sauce**	**Fish products**	**Sesame Oil**	**Dried food/fruit**	**Cereal**
Pre-Hellenistic	9.0	1.0	0	0	1.0	0	0	0
Hellenistic	6445.0	544.0	0	1.0	0	0	0	0
Early Roman	942.0	6.0	0	4.0	1.0	0	0	0
Mid-Roman	81.0	364.0	1.0	18.0	0	0	0	0
Late Roman (Byz.)	3064.0	2075.0	16.0	2.0	0	0	0	0
Islamic	8.0	0	0	0	0	0	1.0	0

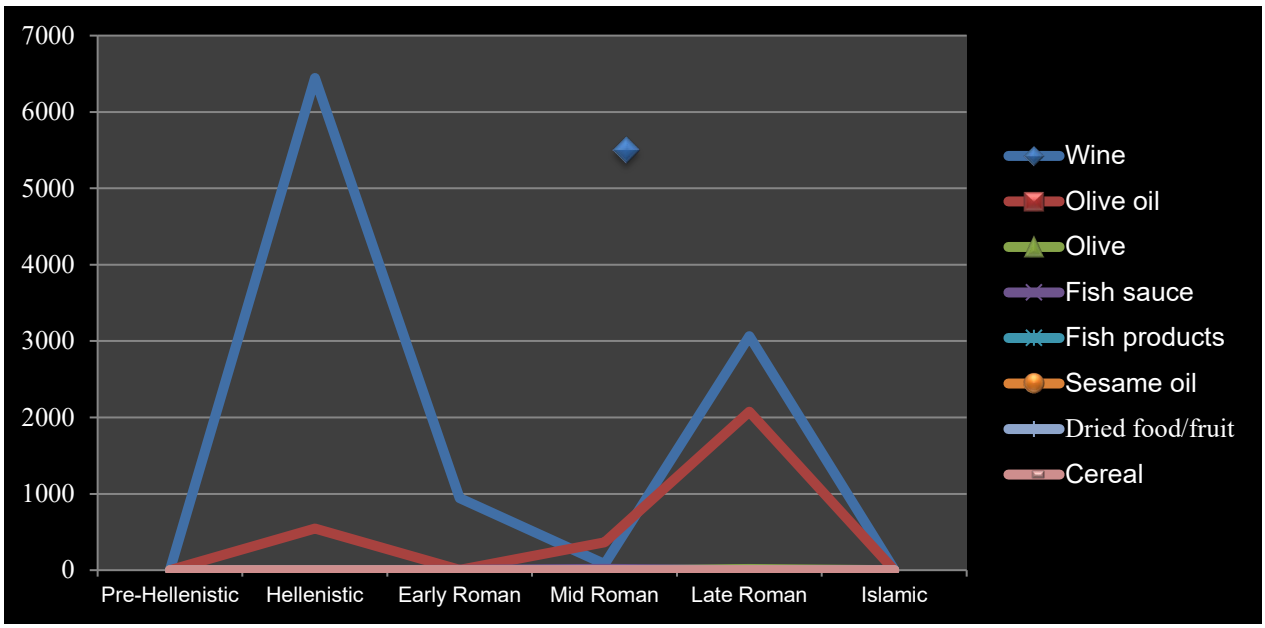


Figure 7.21 The fluctuations of the contents across the periods.

7.5 Centrality Degree Results

This section presents the Alexandria centrality degree results across six periods based on the amphora types, contents and production regions. The data were generated from the combined amphora collections binary data together—the underwater, terrestrial collections and the Greco-Roman Museum collection (Table 7.21 and Figure 7.22).

Table 7.21 The centrality degree for Alexandria across the periods according to the amphora types, contents and the production regions.

Alexandria across the periods	Centrality degree		
	Amphora type (1)	Amphora content (2)	Production region (3)
Pre-Hellenistic	0.101	0.444	0.571
Hellenistic	0.169	0.444	0.714
Early Roman	0.315	0.556	0.857
Mid-Roman	0.135	0.444	0.857
Late Roman (Byz.)	0.169	0.556	0.714
Islamic	0.112	0.333	0.571

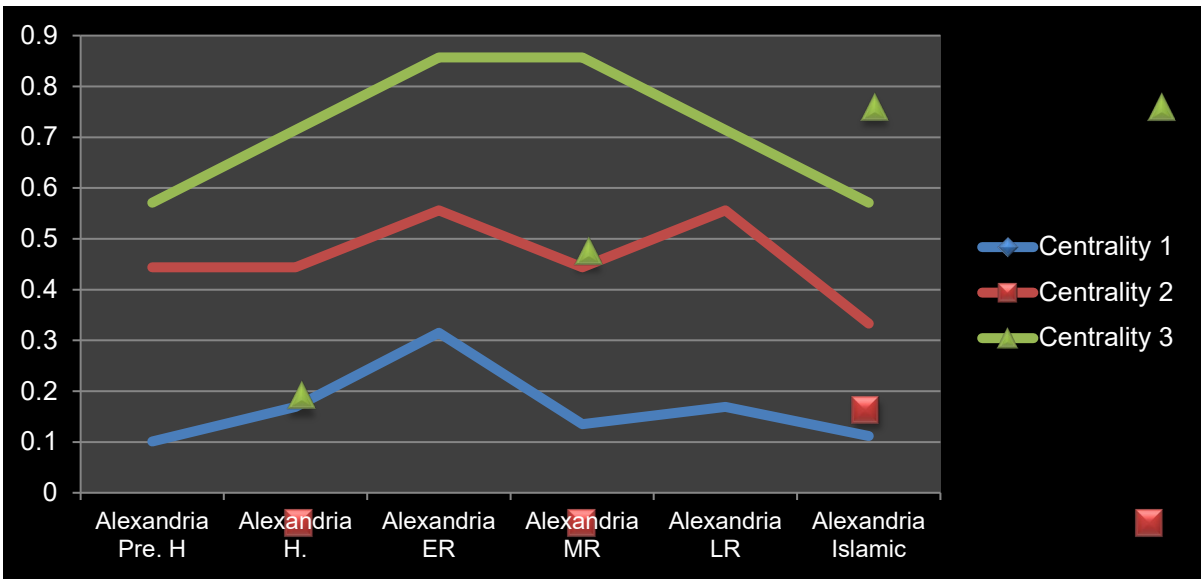


Figure 7.22 The fluctuation of Alexandria's centrality degree across the periods according to the amphorae types, contents and production regions.

According to the centrality degree results, Alexandria has fluctuated between the periods and in different ways in terms of the amphora types, contents and production regions. Alexandria had the highest centrality degree during the early Roman period according to the three aspects with variations in the centrality degrees. At the same time, the highest centrality degree occurred in Alexandria during the Late Roman based on the amphora contents aspect, but during the mid-Roman period highest centrality degree was in the production regions aspect.

7.6 Pearson Correlation Coefficients Results

This section presents the Pearson correlations for Alexandria across all periods according to the amphora type, content and production region. No Pearson correlation measurements were undertaken for the amphora types individually because every type belongs to a particular time period. However, the production regions and amphora contents overlapped across all the periods. Consequently, measuring the similarly patterns for the production regions and transported products gives a better understanding of the most prominent production region and transported product in general. It is worth noting that Pearson correlation measurements ignored the chronology of the production regions and transported products and provided a general overview for the similarity patterns.

7.6.1 Alexandria

Pearson correlation coefficients were calculated for Alexandria across all six periods according to the data generated from the amphora types, contents and the production regions. The same two-network matrices (valued combined data) were processed through UCINET and then converted

from two-mode into one-mode. Reading across each period row identifies how similar its pattern is to other periods and enables the investigation of patterns of change over time.

7.6.1.1 Amphora Type Aspect

Table 7.22 shows the results of Pearson correlation coefficients for Alexandria in terms of the amphora types indicate that all six periods are dissimilar to each other as all have measurements of -1.00, which means the inconsistency and dissimilarity types of ties and relations between the nodes as discussed in Chapter 6, section 6.4.2.4.

Table 7.22 The Pearson correlation measurements for Alexandria across the periods according to the amphora type data.

	Alexandria pre-Hellenistic	Alexandria Hellenistic	Alexandria Early Roman	Alexandria Mid-Roman	Alexandria Late Roman	Alexandria Islamic
Alexandria pre-Hellenistic	1	-0.060	-0.042	-0.041	-0.052	-0.092
Alexandria Hellenistic	-0.060	1	-0.030	-0.029	-0.036	-0.065
Alexandria Early Roman	-0.042	-0.030	1	-0.020	-0.026	-0.046
Alexandria Mid-Roman	-0.041	-0.029	-0.020	1	-0.025	-0.044
Alexandria Late Roman	-0.052	-0.036	-0.026	-0.025	1	-0.056
Alexandria Islamic	-0.092	-0.065	-0.046	-0.044	-0.056	1

7.6.1.2 Amphora Content Aspect

The results of Pearson correlation coefficients for Alexandria in terms of the amphora contents indicate consistency and similarity between most of the nodes (Table 7.23). The pattern of Alexandria in the Hellenistic period is similar to that of the pre-Hellenistic and early Roman periods, somewhat similar to the late Roman and the Islamic periods and strongly dissimilar with the mid-Roman period (r = 0.175). The early Roman pattern reveals similarity with the pre-Hellenistic, Hellenistic and Islamic periods with a slightly different value in the late Roman period. There is a significant dissimilarity with the mid-Roman period (r = 0.058). The mid-Roman period pattern is the main feature, despite the low value of similarity, although a high similarity degree is identified with the late Roman period and a recognisable dissimilarity degree with the Islamic

period (r = -0.008). The similarity is the main feature also for the late Roman and Islamic periods with slightly variations in the values; however, a dissimilarity degree is identified between the Islamic period and the mid-Roman period as aforementioned (r = -0.008).

Table 7.23 The Pearson correlations for Alexandria across the periods according to the amphora content data.

	Alexandria pre-Hellenistic	Alexandria Hellenistic	Alexandria Early Roman	Alexandria Mid-Roman	Alexandria Late Roman	Alexandria Islamic
Alexandria pre-Hellenistic	1	0.943	0.988	0.130	0.792	0.965
Alexandria Hellenistic	0.943	1	0.964	0.175	0.853	0.872
Alexandria Early Roman	0.988	0.964	1	0.058	0.768	0.966
Alexandria Mid-Roman	0.130	0.175	0.058	1	0.662	-0.008
Alexandria Late Roman	0.792	0.853	0.768	0.662	1	0.667
Alexandria Islamic	0.965	0.872	0.766	-0.008	0.667	1

7.6.1.3 Amphora Production Region Aspect

Alexandria's Pearson correlation coefficients results for this aspect fluctuated between the similarity and dissimilarity degrees across the periods. As demonstrated in table 7.24, the pre-Hellenistic pattern is only similar with the Hellenistic period (r= 0.724) but dissimilar with the other periods as **r** is ranging between -0.216 and -0.065. Low similarity degrees were observed between the Hellenistic period, early Roman and Islamic periods and dissimilarity degrees with the mid- and late Roman periods (r= -0.124 and -0.205). High similarity degrees were observed between the early Roman and Islamic period with low values for the Hellenistic and late Roman periods and considerable dissimilarity degrees with the pre-Hellenistic and mid-Roman periods (r= -0.216 and -0.149). In fact, dissimilarity is the main highlight for the mid-Roman period. The same is true with the late Roman period but with a slight similarity degree with the Islamic period (r= 0.012). The Islamic period pattern shows considerable similarity with the early Roman period, with low similarity values with the Hellenistic and late Roman periods and dissimilarity with the pre-Hellenistic and mid-Roman periods (r= -0.065 and -0.298).

Table 7.24 The Pearson correlations for Alexandria across the periods according to the amphora production data.

	Alexandria pre-Hellenistic	Alexandria Hellenistic	Alexandria Early Roman	Alexandria Mid-Roman	Alexandria Late Roman	Alexandria Islamic
Alexandria pre-Hellenistic	1	0.724	-0.216	-0.114	-0.022	-0.065
Alexandria Hellenistic	0.724	1	0.486	-0.124	-0.205	0.583
Alexandria Early Roman	-0.216	0.486	1	-0.149	-0.003	0.950
Alexandria Mid- Roman	-0.114	-0.124	-0.149	1	-0.101	-0.298
Alexandria Late Roman	-0.022	-0.205	-0.003	-0.101	1	0.012
Alexandria Islamic	-0.065	0.583	0.950	-0.298	0.012	1

7.6.2 Amphora Contents

This section observes the Pearson correlation coefficients for the amphora contents and to what extent the contents are similar or dissimilar to each other. According to the Pearson correlation coefficients, wine has low similarity degrees with olive oil and olives and a strong dissimilarity degree with fish sauce, fish products and dried foods or fruit (Table 7.25). The olive oil pattern is quite different, as similarity is found with olives (r=0.964) and dissimilarity with fish sauce, fish products and dried foods or fruit (r= -0.043, -0.476 and -0.303 respectively). Finally, strongly dissimilar Pearson correlation coefficients are associated with fish sauce, fish products and dried food/fruit[15].

[15] No Pearson correlation coefficients results were recorded for sesame oil and cereal because their values in the matrix are (0) (see Appendix 2, Section 11.2.4.2.2).

Table 7.25 The Pearson correlations for the amphora contents.

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/fruit	Sesame oil	Cereal
Wine	1	0.447	0.231	-0.292	-0.385	-0.332	NA	NA
Olive oil	0.447	1	0.964	-0.043	-0.476	-0.303	NA	NA
Olive	0.231	0.964	1	-0.093	-0.340	-0.215	NA	NA
Fish sauce	-0.292	-0.043	-0.093	1	-0.242	-0.294	NA	NA
Fish products	-0.385	-0.476	-0.340	-0.242	1	-0.316	NA	NA
Dried food/fruit	-0.332	-0.303	-0.215	-0.294	-0.316	1	NA	NA
Sesame oil	NA	NA	NA	NA	NA	NA	1	1
Cereal	NA	NA	NA	NA	NA	NA	1	1

7.6.3 Amphora Production Regions

This section observes the Pearson correlation coefficients for the production regions and to what extent the regions are similar or dissimilar to each other. These results show a high similarity degree between Egypt and the Aegean (r=0.912) with low similarity degrees with the Western and Central Mediterranean (r=0.301 and 0.662) and high dissimilarity degrees with the Eastern Mediterranean (r=-0.024) (Table 7.26). It is interesting to note that dissimilarity is the main feature for the Eastern Mediterranean. As for the Western Mediterranean pattern, there is low similarity with Egypt (r=301). The Central Mediterranean has similarity degrees with Egypt and the Aegean (r=0.662 and 0.804) and dissimilarity degrees with the Eastern and Western Mediterranean (r=-0.278 and -0.108 respectively). Despite the Aegean having similar patterns with the Central Mediterranean (r=0.804), it has clear dissimilarity degrees with the Eastern and the Western Mediterranean (-0.188 and-0.043).[16]

[16] No Pearson correlation coefficients results were recorded for North Africa because their values in the matrix are (0), (see Appendix 2, Section 11.2.4.2.3).

Table 7.26 The Pearson correlations for amphorae production regions.

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa
Egypt	1	-0.024	0.301	0.662	0.912	NA
Eastern Med.	-0.024	1	-0.191	-0.278	-0.188	NA
Western Med.	0.301	-0.191	1	-0.108	-0.043	NA
Central Med.	0.662	-0.278	-0.108	1	0.804	NA
Aegean	0.219	-0.188	-0.043	0.804	1	NA
North Africa	NA	NA	NA	NA	NA	1

7.7 Summary

Chapter 7 presents the results of network analyses of the data generated from the amphorae evidence found on underwater and terrestrial sites and the amphorae collections at the Greco-Roman Museum. The results include three different centrality degrees for the underwater sites according to the three aspects selected in this thesis—amphorae types, contents and production regions. Also, centrality degrees were provided for each amphora type, content and production region regardless of the period as a result of phase 1. Phase 2 provided the tie strength for each amphora type, content and production region across the six periods, which start from the pre-Hellenistic until the Islamic period, based on the amphorae recovered from the underwater sites. Then three different centrality degrees were measured for Alexandria as one large site across all the periods using the binary combined data. After that, tie strength was provided for each amphora type, content and production region during each period using the valued combined data. Graphs were provided for each network to visualise the connectivity and the fluctuations across all periods.

Investigating the production regions and the transported products gives greater insight to the movement patterns of the materials culture—amphorae—and the strengths of the connectivity and relationships between Alexandria and the Mediterranean neighbours. Hence, a detailed section was provided for both the production regions and the transported products to shed light on the fluctuations across all periods. The last section of this chapter presented the Pearson correlation coefficient results for the valued combined data that revealed three different correlations for Alexandria according to three aspects selected. The next chapter discusses archaeological interpretations of these results and how they tell us about trade networks and the economic history of the region from Alexandria's foundation in the fourth century BC to the fifth century AD.

CHAPTER 8. DISCUSSION

This chapter discusses the results of the network analyses and provides detailed insight to the hypothesises formulated in this thesis using a comparative framework. The chapter is divided into five parts. The first discusses the production regions and their fluctuations over a long period, i.e., from the pre-Hellenistic until the Islamic period. The second part is dedicated to the amphorae types and the most prominent types found in the archaeological record for each period. Furthermore, it focusses on amphorae re-use and recycling as a common practice in ancient times. The third part discusses the products transported by the analysed amphorae. It details the transported products and highlights and considers carefully the debate around the transport of grain in amphorae. Then the fourth part discusses the significance of the underwater sites in the light of the network analysis results. Finally, the fifth part addresses Alexandria as one large site across all periods based on measurements of the centrality degree measurements and Pearson correlation coefficients.

It is worth reiterating that this research aims to draw meaningful conclusions about the region's maritime trade networks from the fourth century BC to the fifth century AD through the study the transport amphorae from underwater and related terrestrial sites along the Alexandria littoral using a network analysis approach. Furthermore, this study has concentrated on tracking the movement of materials and the fluctuations across time, focussing on transported products, amphorae types and production regions.

8.1 Comparative Analysis

As presented in the previous chapter, the binary and valued data allow for the formulation of different hypothesises relating to the occurrence of fluctuations between amphorae types, production regions and transported products in the Mediterranean along with the trade scale and the strength of Mediterranean maritime connectivity. Additional hypothesises are based on the valued combined data. The following section provides a detailed discussion of these hypothesises in comparison with measurements of Pearson correlation coefficients. This comparison considers the following aspects:

- Production regions
- Amphorae types
- Transported products
- Shipwrecks and amphorae underwater sites
- Alexandria as one large site across all time periods.

8.1.1 Production Regions

Connectivity patterns between Alexandria and the Mediterranean Sea shed new light on amphorae production regions in the Mediterranean. It discusses each production region individually along with the fluctuations that occurred in the production lines across all time periods. As mentioned in Chapter 5, Section 6.4.2.1, the amphorae production regions include the Aegean, Egypt, and the Eastern, Central and Western Mediterranean along with North Africa.

8.1.1.1 The Aegean region

The Aegean production compared to other production regions

The binary data from the amphorae collections recovered from the underwater sites shows that the Aegean had the most prominent status in comparison to the rest of the production regions in general. This hypothesis is a generalised one because the chronological aspect does not apply to this analysis (see Chapter 7, Section 7.1.1.3).

According to the valued data (Chapter 7, Section 7.1.2.3), amphorae production during the pre-Hellenistic period was modest among all the Mediterranean production regions. In contrast, based on the valued combined data (Chapter 7, Section 7.3), Aegean production was noteworthy across the entire Mediterranean during the pre-Hellenistic and Hellenistic periods.

Aegean production over time

Tracking Aegean production separately through the valued data hypothesis demonstrates that this region enjoyed its peak in the Hellenistic period (Figure 8.1). This hypothesis is consistent with that provided by the valued combined data. By the early Roman period, a sharp decrease occurred, which remained at a low level until late antiquity with a slightly higher scale during the late Roman period (Figure 8.2).

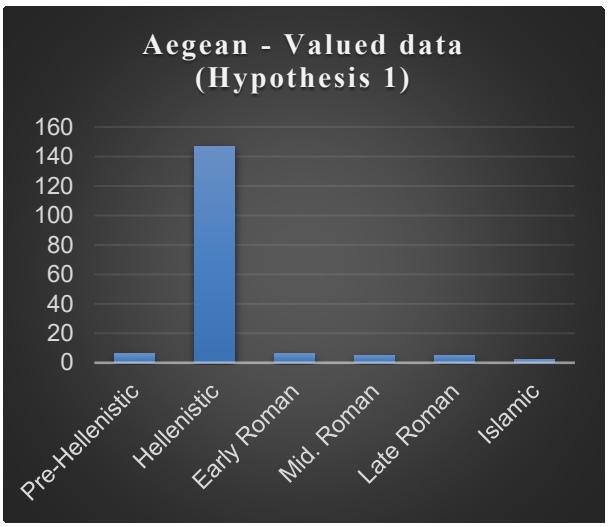


Figure 8.1 The Aegean region production over time based on the valued data.

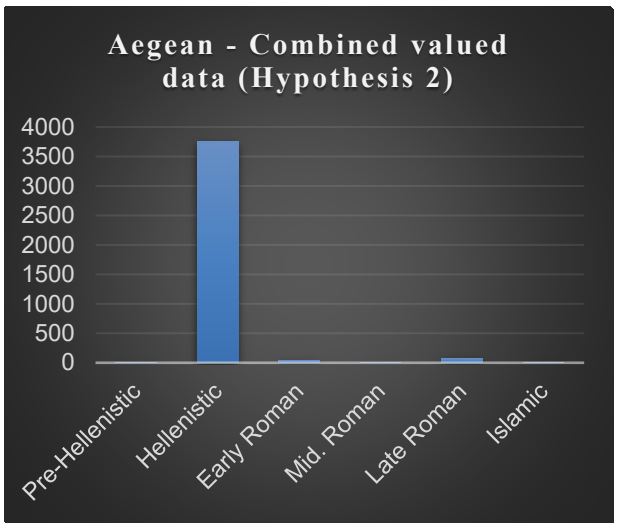


Figure 8. 2 The Aegean region production over time based on the combined valued data.

Based on the data, hypothesises can be formulated that provide new perspectives on the Mediterranean maritime trade network. The Aegean region—specifically Greece, Rhodes, Kos, Thasos, Knidos, Chios and Samos—was the main source of wine and olive oil in the Mediterranean from the eighth until the fifth century BC (Alpözen, Berkaya and Özdaş1995:53 –54; Zemer 1977:102–103). Aegean wine was cheap but high quality, which probably was the main reason why it was so popular in Egypt, Cyprus and the Levant. This would have accounted for the increase in trade between the Aegean and the aforementioned countries and region (Alpözen, Berkaya and Özdaş 1995:53–54; Zemer 1977:102–103). Furthermore, Senol (2013:375) highlights that the Aegean region had a noticeable effect on the marketplace in Alexandria because of the established Greek population of Alexandria during the Hellenistic period.

Further, Alpözen, Berkaya and Özdaş (1995:53–54) state that Greek wine production flourished and reached its peak during the Hellenistic period. Their observation matches the hypotheses provided by the valued and combined valued data in the thesis. Then, by the second century BC, Egyptian authorities commenced taxing all wine imported from the Aegean region to protect local production. This led to a significant reduction in wine export from the Aegean to Egypt. However, Rhodian exports to Egypt continued until the beginning of the Roman period when Greece became subject to the Romans (Alpözen, Berkaya and Özdaş1995:53–54; Zemer 1977:102–104). According to Diamanti (2016:691–698), amphorae production in Aegean region did continue from the Roman period until late antiquity; however, the trade relationship between the Aegean and Egypt was depressed, mainly due to the strengthened exchange rate with the Eastern, central and Western Mediterranean, as will be discussed later in this chapter.

8.1.1.2 Egypt

Local amphorae production compared to other production regions

Despite the decrease in amphorae production in the Islamic period across all production regions, Egypt seems to have been the most prevalent in his period based on the valued data (see Chapter 7, Section 7.1.2.3). The trade with foreign countries or regions was less during the Islamic period. The valued combined data hypothesis shows that the local production had a prominent value across the early Roman period (see Chapter 7, Section 7.3). This is concomitant with the protection of local production and the taxation of imports from the Aegean at the beginning of the Roman period. This hypothesis is also supported by the dating range of the kilns located in the Mareotic region as no kiln dates to the pre-Hellenistic period. All Mareotic kilns range from the Hellenistic period until the late Roman period (Dixneuf 2011:100–101; Empereur 1998a:217–218; Rodziewicz 1998c:245–260). It is worth stressing that the largest kiln in the Mareotic region dates to the Roman period. A considerable number of Egyptienne 3 (AE3) amphorae were found here, which seems to have been the first Roman amphora produced in Egypt.

Local production over time

There is a modest contribution of local amphorae production across the six periods based on the valued data (Figure 8.3). In the Hellenistic period, a slight increase is evident in the local production followed by sharp decrease in the early Roman period. Then, a gradual increase occurs from the late Roman period to the Islamic period. The combined valued data also demonstrates that local production increased significantly in the Hellenistic period, and then decreased from the early Roman period onwards (Figure 8.4). Despite the different values between Hypothesis 1 and 2, correlated patterns occur in the middle of the Roman and Islamic period, showing the lowest rate of local production. Hypothesis 2 on the other hand shows that local production flourished in the late Roman period.

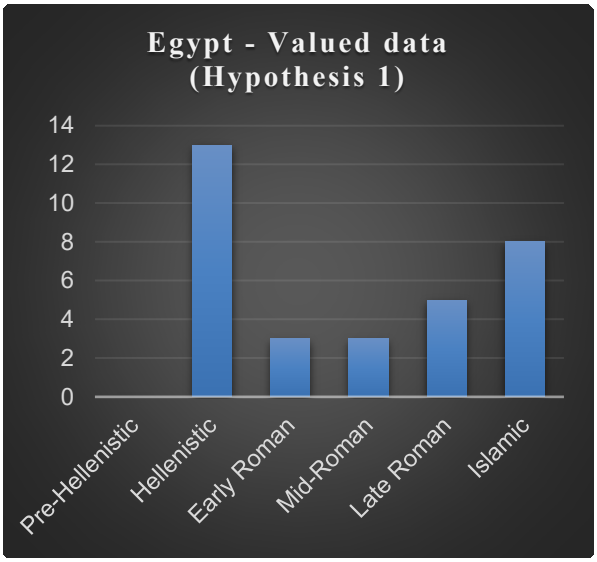


Figure 8.3 Egyptian production over time based on the valued data.

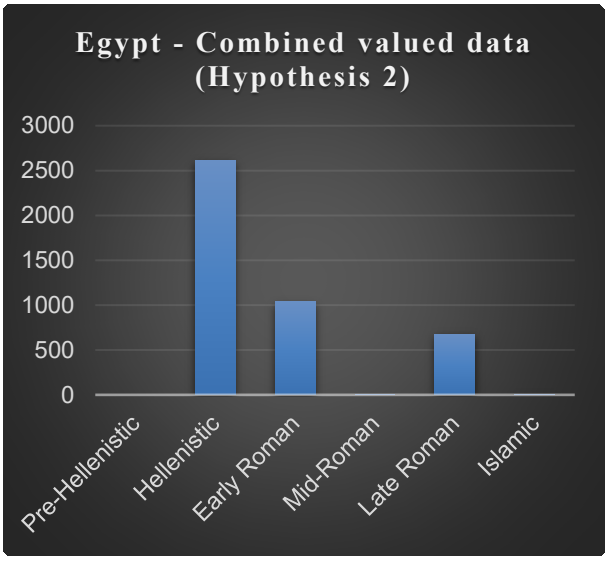


Figure 8. 4 Egyptian production over time based on the combined valued data.

It is worth noting that the Mareotic region, Nile delta and middle Egypt were the main amphorae production regions in Egypt—all regions associated with the agricultural and industrial activities (Hayes 1996:157–160). Lake Mareotis and its hinterland were the main source of essential products that satisfied local demands and trading intentions. Many of the production centres, workshops, kilns, grape presses, olive presses, vineyards and olive groves were located along the shores of Lake Mareotis (Dixneuf 2011:218–219). The Mareotic region had fertile lands, availability of abundant water sources and a suitable climate for cultivating a variety of agricultural crops. Consequently, the Mareotic region is rich with archaeological evidence for ceramic kilns, glass workshops and wineries, along with water wells and basins (Empereur and Picon 1998:76–77; Rostovtzeff 1957:74–75).

Mareotic wine was known to be of high quality in the Roman period (Dzierzbicka 2010:127–133). After harvesting, the grapes were pressed by bare feet on a cloth to produce a clear juice, free of any grape seeds or other impurities. Then the juice was packed into amphorae for fermentation—this process sets in quite quickly with the warm and dry Egyptian weather. The production in the Mareotic region was relatively fast and the regional trading cycle was frequent (Khalil 2005:147–148). Empereur (1998a:217–218) highlights the size of the local Mareotic wine production through the study of a substantial number of amphorae from this region that were carried on the ship that wrecked at the Golfe de Fos in France.

By the late Roman period, local production increased due to the unstable political situation, which led to a decrease of foreign imports in Egypt (Kaplow 2005:2–4; Kristensen 2010:158–175) (see Chapter 2). Furthermore, in the twelfth century AD, all canals that connected Lake Mareotis with the Nile were blocked as a result of river silting. Consequently, the fresh water used for agricultural and industrial activities became unavailable, which led to a decline of the Mareotic region as a production centre (De Cosson 1935:62; Warne and Stanley 1993:58).

8.1.1.3 Eastern Mediterranean

Eastern Mediterranean production compared to other production regions

Based on the valued data, the proposed hypothesis for consideration is that the Eastern Mediterranean was the most prominent production region found on the Egyptian market in the mid- and late Roman periods (see Chapter 7, Section 7.1.2.3). The combined valued data hypothesis is concomitant with the valued hypothesis in the late Roman period. However, the two datasets are at odds in the mid-Roman period (Chapter 7, Section 7.3).

The Eastern Mediterranean production over time

The valued data shows that the production regions in the Eastern Mediterranean were flourishing in the mid-Roman period and reached their peak during the late Roman period (Figure 8.5). In contrast, a modest contribution in the amphorae production is evident for the eastern Mediterranean from the pre-Hellenistic period until the mid-Roman period based on the combined valued data. In this case, a significant increase in the production scale occurred in the late Roman period; however, it disappeared entirely in the Islamic period (Figure 8.6).

According to Zemer (1977:78–102) the Levant coast was known for its wine production in the Hellenistic period; however, the network analysis hypothesises report only modestly recognisable amphorae production activity for the Eastern Mediterranean until the late Roman period. It is interesting to note that the late Roman period was witness to a rapid increase in the Eastern Mediterranean amphorae production. It is worth noting also that the rate of production of amphorae dating to the early Roman period was 36.0 and 39.0 for the mid-Roman period; however, it increased rapidly to reach 4412.0 during the late Roman period. What validates this hypothesis is that mentioned by Fantuzzi, Cau-Ontiveros and Reynolds (2013:1025) and Reynolds (2010:106) that the importation activities at the Eastern Mediterranean flourished during the late Roman period.

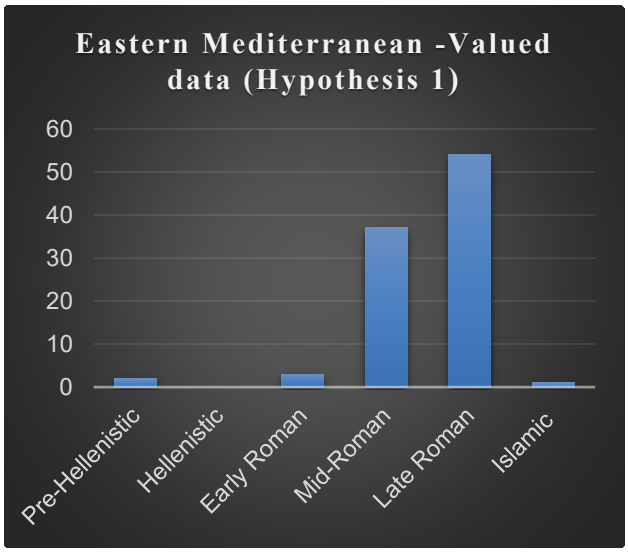


Figure 8.5 Eastern Mediterranean production over time based on the valued data.

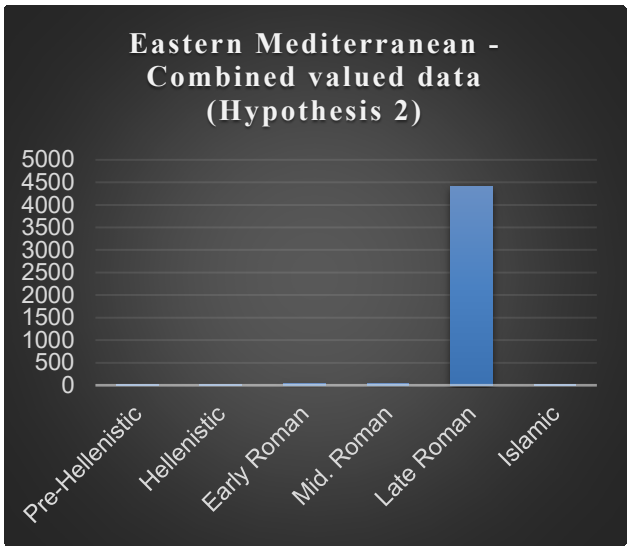


Figure 8.6 Eastern Mediterranean production over time based on the combined valued data.

Furthermore, Öniz (2016:18–30) states that Eastern Mediterranean is distinguished by a considerable number of amphorae kilns in addition to the adjacent areas of wine and olive cultivation. Also, after the division of the Roman Empire into eastern and western regions in the fourth century AD, the trade patterns between Alexandria and the Eastern Mediterranean became stronger from the fourth to sixth century AD, while those with the west flourished much less (Keay 1984b:414–428; Peacock and Williams 1986:57; Reynolds 1995:70, 109).

8.1.1.4 Central Mediterranean

Central Mediterranean production compared to other production regions

The central Mediterranean reached its peak of amphorae production and transported products in the Hellenistic and early Roman periods based on the valued data hypothesis (see Chapter 7, Section 7.1.2.3). On the other hand, Hypothesis 2 suggests that this peak period was the mid-Roman period in comparison with other Mediterranean production regions (see Chapter 7, Section 7.3).

Central Mediterranean production over time

According to Hypothesis 1, the amphorae production in the Central Mediterranean reached its peak during the Hellenistic period and decreased significantly from the early Roman period onwards (Figure 8.7). Similarly, Hypothesis 2 supports the notion that the Hellenistic period was the most prosperous for the Central Mediterranean (Figure 8.8). Nevertheless, a considerable decline occurred in the early Roman period followed by a sharp increase during the mid-Roman period. Another decrease occurred in the late Roman period and continued until the Islamic period.

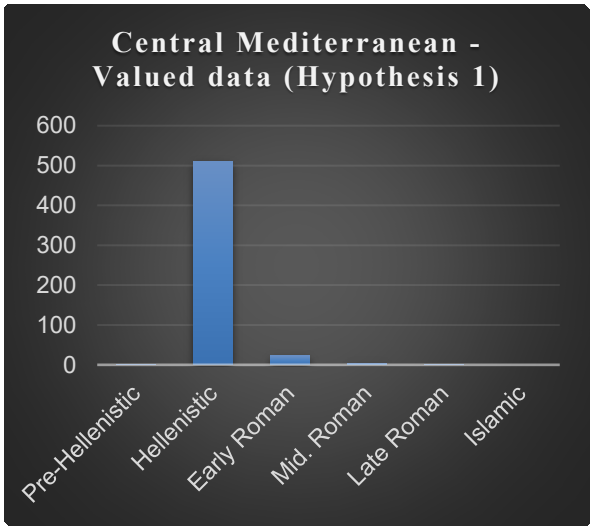


Figure 8.7 Central Mediterranean production over time based on the valued data.

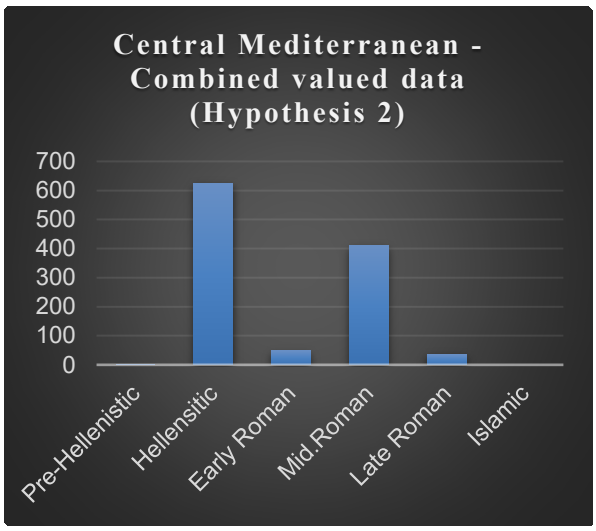


Figure 8.8 Central Mediterranean production over time based on the combined valued data.

The Central Mediterranean, i.e., Italy, the Adriatic coast, Libya and Tunisia, and Spain, was the foremost producer of olive oil and wine in the Roman period (Khalil 2005:164–165; Peacock and Williams 1986:54–60; Zemer 1977:104–105). Parallel patterns between both hypotheses are consistent with data provided by Lund (2000:86) and confirm a similar distribution of the Italian amphorae in the Eastern Mediterranean in the Hellenistic period (see Chapter 4, Section 4.4).

According to Lund (2000:86), the number of Italian amphorae imported to the eastern Mediterranean was modest in the early part of the second century BC but had slowly increased by 180 BC. This import volume had increased significantly in number by the end of the Hellenistic period and the beginning of the Roman period. The reasons for this growth include the establishment of new ports, such as Delos for example, which facilitated an increase in import and export operations around 167 BC. As a consequence, this led to a surge in the number of merchants and traders by the middle of the second century BC (Alpözen, Berkaya and Özdaş 1995:55).

Reynolds (1995:42–45) states that Libya was well known for its olive and grain cultivation alongside the olive oil production, which had started by the early Roman period, likewise the Tunisian production of amphorae, olives and grain. By the middle of the Roman period, the amphorae and cultivation activities of olives flourished in Tunisia, Libya and Mauretania. This development coincided with the period directly after the division of the Roman Empire in the fourth century AD (Peacock and Williams 1986:57; Peacock, Bejaoui and Belazreg 1989:179–222; Reynolds 1995:49,109). According to Keay (1984b:408), Tunisia became the main source of olive oil and grain to feed the locals and the armies in the Roman Empire. This is consistent with the

hypothesis extracted from the valued combined data that shows the rapid increase in the amphorae evidence dates to the mid-Roman period.

8.1.1.5 Western Mediterranean

Western Mediterranean production compared to other production regions

The valued data analysis revealed modest amphorae production in the western Mediterranean across all six periods; however, a slight increase occurred in the early Roman period (see Chapter 7, Section 7.1.2.3). Similarly, the valued combined data demonstrates a modest production scale of the Western Mediterranean in comparison with the amphorae scales of other Mediterranean regions, reaching its peak in the early Roman period (see Chapter 7, Section 7.3).

Western Mediterranean production over time

Corresponding patterns can be observed between Hypothesis 1 and 2 regarding the production scale since the Pre-Hellenistic period until the mid-Roman period despite the slight increase of production during the late Roman period (Figures 8.9 and 8.10).

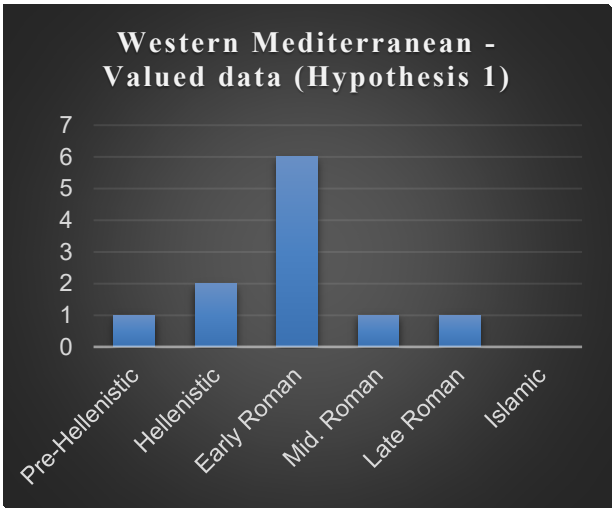


Figure 8.9 Western Mediterranean production over time based on the valued data.

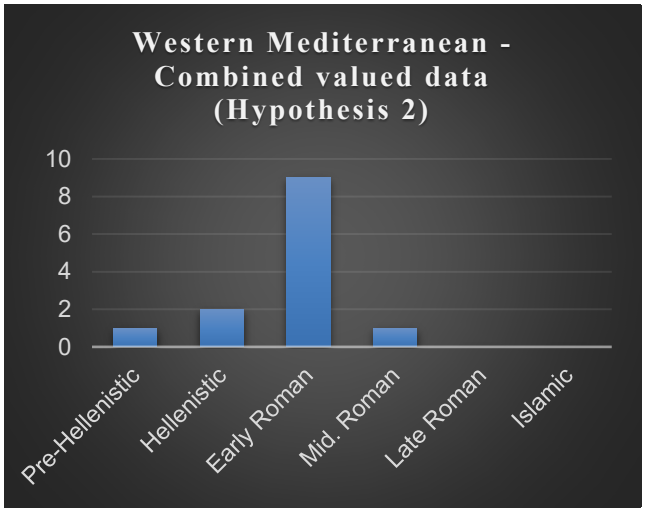


Figure 8.10 Western Mediterranean production over time based on the combined valued data.

These hypothesises are concomitant with the works of Keay (1984b:400–401) and Alpözen, Berkaya and Özdaş (1995:55) who all stress that by the end of the first century BC, wine production in Spain started to flourish. A substantial number of the amphorae kilns found in the Tarraconensis region date to that period and they were in use until the second century AD. Tarraconensis was best known in the ancient world for its high-quality wine (Keay 1984b:400–401). Spanish products such as wine, olive oil and fish were transported to Italy and are found in archaeological contexts dating to the early Roman period in a large region stretching from the Central to Eastern Mediterranean

(Alpözen, Berkaya and Özdaş 1995:55). Furthermore, Keay (1984b:402) and Reynolds (1995:61) discuss the recognisable increase in the export of these products to Rome in the early Roman period. According to Keay (1989b: 404), Baetica was the main source of olive oil in the Roman Empire in the early Roman period.

According to Keay (1984b:401–404) and Reynolds (1995:61), amphorae production continued in Spain from the mid-Roman to the late Roman period, but on a modest scale. By the mid-Roman period, the main source of olive oil that made its way into the Mediterranean basin came from Libya and Tunisia—this again was a direct result of the division of the Roman Empire. Production declined by the late Roman period and was limited to some places in the Western Mediterranean. This correlates with the hypothesises from the valued and combined valued data that confirm a decline in the trade patterns between Alexandria and Western Mediterranean during the middle Roman period until late antiquity.

8.1.1.6 North Africa

Based on the classification of the Mediterranean basin in this thesis, the North African region includes only Western Algeria and Morocco, known in ancient times as Mauretania. According to the valued and combined valued data, amphorae remains from Algerian or Moroccan are absent in Alexandria (Chapter 7, Sections 7.1.2.3 and 7.3). According to Keay (1989b:431–434), olive oil exported to Rome in Mauritanian amphorae are found alongside the Libyan and Tunisian amphorae from the fourth century AD until late antiquity. This is consistent with the Empire's division.

The amphorae produced in Mauritania include the Dressel 30 amphora, which was also manufactured in Tunisia and Libya from the second century AD until the fourth century AD (Naciri, Widemann and Sabir 1986:129–140; Peacock and Williams 1986:171–172). The Dressel 30 amphora is also known as the Keay I and it has several subtypes like the Keay IA and Keay IB amphorae (Peacock and Williams 1986:171–172; Reynolds 1995:40–42).

Reynolds (1995:40–42) sheds light on the distribution pattern of the Dressel 30 type and states that it reached Ostia and Rome by the third and fourth centuries and Spain, France and Italy later. Peacock and Williams (1986:171) mention that this amphora type was also transported to Alexandria. Despite the lack of Dressel 30 amphora from underwater and terrestrial sites in the Alexandria region studied in this thesis, terrestrial excavations conducted by CEAlex team do report 0.124% of Dressel 30 among the amphorae recorded. This report details the only Mauritanian amphorae located in Alexandria to date (Senol 2007:65). It is thus a confirmation that Alexandria had some connection with Mauretania in the mid-Roman period, albeit at a low scale.

Pearson correlation coefficients measurements for the Mediterranean production regions

This section details the results of the Pearson correlation coefficients measurements where the period division is purposely ignored. The Pearson correlations here provide a general perspective of every production region similar to the results provided by the binary data analysis. Based on the Pearson correlation coefficients measurements, similar patterns emerge between the Aegean, Egypt, the Central and Western Mediterranean. Nevertheless, these measurements are invalid according to the previous discussion provided for each production region (see Chapter 7, Section 7.6.3).

8.1.2 Amphorae Types

The comparison scale for the amphorae types was expanded to include prominent ones recorded at the Old Diana Theatre and Kom El Dikka. The amphorae types listed in Table 8.1 are the most prominent types recorded for network analysis and are compared with those of previous studies undertaken at the Old Diana Theatre (Senol 2007:57–75) and Kom El Dikka site (Majcherek 2004:229–237) (see Chapter 4, Section 4.3.2).

Table 8.1 A comparison between the prominent amphorae types identified using a network analysis and previous studies conducted at the Old Diana Theatre and Kom El Dikka sites.

Prominent amphora type	Underwater sites		Underwater and terrestrial sites	Old Diana Theatre	Kom El Dikka
	Binary	Valued	Combined valued		
Klozomenai					
Thasos					
Chain					
Koan					
Rhodian H.					
AE3					
Greco-Italic/ Will form A2					
Lamboglia II					
Dressel 6A					
Kapitän II					
Africana I					
LR1					
LR4					
AE3 late/ AE3T-2, variant B					
AE3 Late/ AE 3T-3.2, variant B					

Prominent amphora type	Underwater sites		Underwater and terrestrial sites	Old Diana Theatre	Kom El Dikka
	Binary	Valued	Combined valued		
AE5/6					
AE7					

Table 8.1 provides the comparison between the different data analyses. This comparison reveals correlations between the different hypothesises provided by the binary, valued, combined valued data regarding prominent amphorae types across all periods. For example, correlations between Koan and Rhodian amphorae appear in the Hellenistic period. Furthermore, corresponding patterns relate to Amphora Egyptianne 3 (AE3) for the early Roman period and Africana I amphora for the mid-Roman period. In the late Roman period, Late Roman 1 (LR1), Late Roman 4 (LR4), the Egyptianne 5/6 (AE 5/6) and Egyptianne 7 (AE7) amphorae were the most prominent types. Finally, the Egyptianne 3 Late/ AE 3T-3.2 variant B amphora was prominent in the Islamic period. It is worth noting that no corresponding patterns exist between the following amphorae types: Klozomenai, Thasos, Chain, Greco-Italic/ Will form I, Lamboglia II, Dressel 6A, Kapitän II and AE3 late/ AE3T-2, variant B. The following section discusses the most prominent amphorae types along with the non-corresponding ones in terms of origin, chronology and distinctive features.

8.1.2.1 Pre-Hellenistic Amphorae

Amphorae from Klozomenae, Chios and Thasos

Klozomenai amphorae were produced in Klozomenae and its hinterland in the eastern Greek Aegean region. Production started in the late seventh century BC and this type existed until the late sixth century BC. Klozomenae was famous for its high-quality wine (Atila and Okan 2016:58; Sezgin 2004:169–183). Sezgin (2004:178) states that this wine was the foremost merchandise carried in Klozomenai amphorae and he suggests that seawater was used as an additive to this wine. The Klozomenae region also exported garum and olive oil.

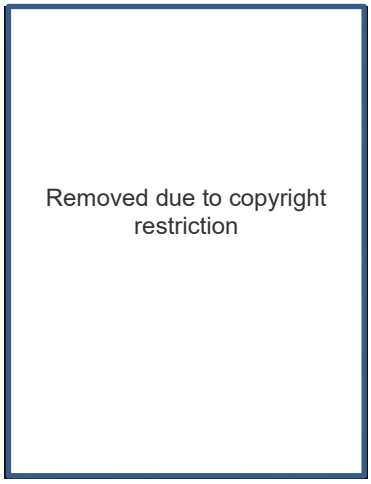


Figure 8.11 Klozomenai amphora. Photograph by Christoph Gerigk from Goddio and Fabre 2006:215, fig 364.

The Klozomenai amphora has a cylindrical neck, a distinct oval body and two curvy handles attached to the neck and the shoulder. The base is flat; however, some of the subtypes have a tall base and more oval body (Figure 8.11) (Cook and Dupont 1998:152–155). The only evidence for Klozomenai amphora in Egypt comes from AbouKir Bay along the Alexandrian coast (see Appendix 2, Section 11.2.1.2.1.1.1).

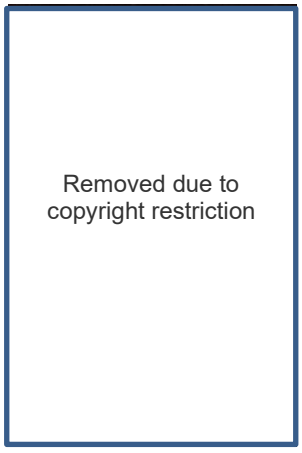


Figure 8.12 Chian amphora (Alpözen, Berkaya and Özdaş 1995:82).

Chios which was the production centre for Chian amphorae in the eastern Aegean Sea (Whitbread 1995:138). Production of Chian amphorae started during the seventh and sixth centuries BC and continued until late first century BC (Göransson 2007:146; Whitbread 1995:135). This type of amphora was used mainly for wine (Whitbread 1995:138). The shape of Chian amphorae changed throughout the centuries. The earliest form of the Chian amphora has round handles attached to a bulbous neck (Figure 8.12). The body is oval and ends with a cylindrical toe. By the fifth century BC, the neck became straight and the handles later became longer (Whitbread 1995:136–137). According to Alpözen, Berkaya and Özdaş (1995:82), Chian amphorae were distributed throughout the Eastern Mediterranean and Aegean regions. It is worth noting that Klozomenae and Chios were the most important production centres in the Aegean region during the pre-Hellenistic period (Denker and Öniz 2015:86).

The third production centre is Thasos, a Greek island located in the Northern Aegean Sea (Whitbread 1995:167). The production of the Thasos amphora type commenced in the late sixth and the beginning of the fifth centuries BC (Whitbread 1995:40, 165). Again, this type was one that mainly carried high-quality wine (Grace 1979:11, 18). It was best known for its high price (Tzochev 2016:89). Like the Chian amphora, this type had a variety of shapes: the earliest contained long arched handles with an extended neck and narrow oval body that terminated with a long base (Figure 8.13). Later the body became larger with a small toe and slightly arched long handles (Whitbread 1995:165–166). This type of amphora was widely distributed throughout Athens, Alexandria and the Aegean colonies along the Black Sea coast (Alpözen, Berkaya and Özdaş 1995:79; Tzochev 2016:90). The presence of amphorae from Klozomenai, Chios and Thasos in Alexandria confirms that relationships existed between Egypt and the Aegean Region as early as the late seventh century BC.

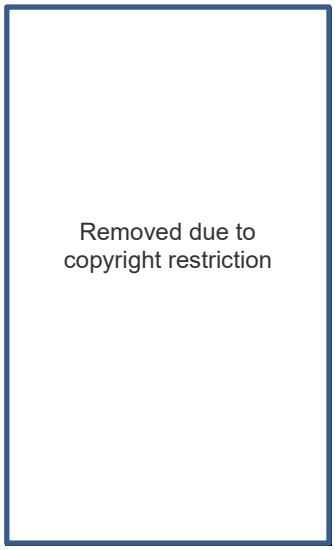


Figure 8.13 Thasos amphora (Alpözen, Berkaya and Özdaş 1995:79).

8.1.2.2 Hellenistic Amphorae

Amphorae from Kos

Koan amphorae were another prevalent storage container for the transport of wine from the Greek island Kos. Located west of the modern-day Turkish town of Bodrum, the island had a productive agricultural and industrial community in ancient times. Koan amphora production started in the fourth century and continued until the first century BC (Göransson 2007:152; Whitbread 1995:83).

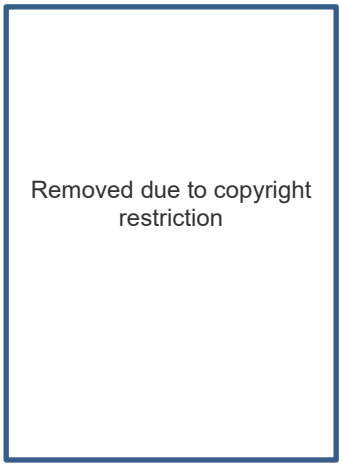


Figure 8.14 Koan amphora (Alpözen, Berkaya and Özdaş 1995:96).

Like the wine from Klozomenae, winemakers in Kos used seawater to make wine which gave it its distinctive taste. Seawater was specifically used as a preservative for the wine. It was good quality and sold cheaply, which, along with its distinctive taste, resulted in it being a widespread and popular commodity in the Eastern and Western Mediterranean (Göransson 2007:152; Hein et al. 2008:1049; Johnsson 2004:134; Strauss 2006:149; Whitbread 1995:81–85). Strabo, for example, describes wine from Kos as excellent: ‘the island, Cos. The city is not large, but beautifully built, and a most

pleasing sight to mariners who are sailing by the coast. The … island is fertile, and produces, like Chios and Lesbos, excellent wine' (1903:14.2.19).

The amphorae that carried Koan wine had long double-barrelled handles attached to their necks, directly below the inverted rims and the shoulders (Figure 8.14). The necks are short, and the bodies are conical and narrow down to the small toe bases (Alpözen, Berkaya and Özdaş1995:96). It is worth noting that the Koan amphora was the prototype of the Dressel 2-4 amphora which emerged after the aforementioned disappeared (Göransson 2007:153).

As for its distribution, Johnsson (2004:133–151) examined Koan exports to the southern and eastern Mediterranean and concludes that most Koan amphorae handles have been found in several locations in Egypt, including Alexandria. To date, 1,480 Koan amphorae handles have been accounted for in Egypt which, when compared to its occurrence in other places in the Eastern Mediterranean, demonstrates the popularity of Koan wine in Egypt as only 54 such amphorae handles have been found in Palestine and 14 in Cyprus. Alexandria had thus the largest market where Koan wine was popular in the Hellenistic period. This confirms a strong connectivity and trade relationship between Alexandria and Kos in the Hellenistic period.

The strong connectivity between Egypt and Kos is also confirmed by the grave inscriptions that belong to two Alexandrians on tombs in Kos (Johnsson 2004:135). Also, the Ptolemies maintained a good relationship with Kos by the end of the third century and throughout the second century BC. Evidence of this relationship is written down in a decree found in Kos, which contains information about sending Egyptian gifts to Kos as thanks for the good service of one of its doctors in Egypt. In return for Koan wine, Kos received cereal from Egypt (Johnsson 2004:135).

Rhodian H.

The Greek island of Rhodes was the producer of wine which was transported in its well-known Rhodian amphora (Bezeczky 1998: 233). The island was rich with vineyards and had many amphora production centres. To date, about twenty amphorae production centres have been located—all in close vicinity to ancient vineyards (Rauh 2003:71). Rhodian winemakers also used seawater as a preservative, like those on Klozomenae and Kos (Göransson 2007:160).

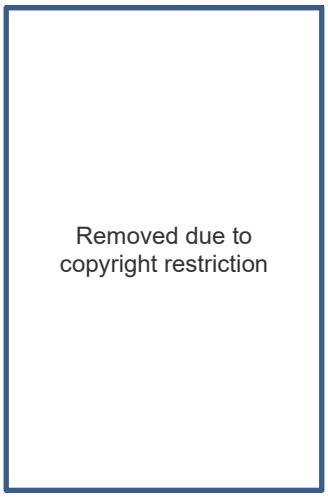


Figure 8.15 Rhodian Hellenistic amphora (Alpözen, Berkaya and Özdaş1995:92).

The earliest Rhodian amphora type was produced at the end of the fourth century BC and its manufacture continued until the second century BC, as its distribution increased at the end of its production period (Göransson 2007:160). Rhodian amphorae types changed shape drastically from the Hellenistic period to the early Roman period. The earliest form contains mushroom-shaped rims, and long handles attached to extended necks and shoulders (Figure 8.15). The handles rise to the same level as the rims. The bodies are oval in shape and end with short bases. By the Roman period, these handles became much sharper in angle and higher than the rims (Göransson 2007:160; Monachov 2006:69–95; Sciallano and Sibella 1994:89).

According to Rauh (2003:65–66), Rhodes' location was the main reason behind its success as a 'prominent maritime power' in the Hellenistic period. It was an important stopover for vessels from the Eastern Mediterranean sailing to the Northern Aegean—the island is located at the south-eastern entrance of the Aegean Sea. The island's trade with Egypt provided its main source of income due to the strong relationship between Rhodes and the Ptolemies in the Hellenistic period (Rauh 2003:66; Williams, K. 2004:29–31). In this period, Rhodes transported wine in large quantities across the Mediterranean, especially to Alexandria (Rauh 2003:67–68; Strauss 2006:146). This is confirmed by the huge number of amphorae handles in the collection of Alexandria's Greco-Roman Museum: 80,000 out of 91,136 have been identified as Rhodian amphorae handles (Johnsson 2004:141).

Greco-Italic/ Will form A

Greco-Italic amphorae were produced in Italy, Spain and Marseille in Southern France between the late fourth century and second century BC (Caravale and Toffoletti 1997:97; Moore 1995:11; Sciallano and Sibella 1994:30–31; Keay and Williams 2005).The earliest production centres for this amphora type have been found on Sicily and Ischia, especially form I.

According to Will (1982:338–356), Greco-Italic amphorae have a number of forms and sub-types that are related to the different production centres. This section will focus only on the two variants of the first form, which date to the late fourth to the third centuries BC (Göransson 2007:115). The first variant has a short neck and round short handles attached to the neck just below its concave rim. The body is oval and ends in a small toe (Figure 8.16). The second variant has an extended cylindrical neck and longer handles (Figure 8.17). The body is narrower than the first variant and ends in longer toe or base (Will 1982:341). Nevertheless, the general shape has an angled triangular rim and long handles attached to cylindrical neck. The body is tapered and ends with a spiked base (Peacock and Williams 1986:84). The main contents for the Greco-Italic amphorae was also wine (Lund 2000:80; Will 1982:338–356).

In general, Greco-Italic amphorae were widespread in the Western and Central Mediterranean, while the existence of this form in the Eastern Mediterranean was modest due to the dominance of the Aegean types like the Rhodian, Knidian, Koan and Chios amphorae (Lund 2000:80; Moore 1995:11; Peacock and Williams 1986:84–85). The Dressel 1A amphora type, for example, was developed from the final Greco-Italic amphora shape. Due to the continuous changing of the Greco-Italic amphora shape, it looked very different from the original shape by the second century BC (Moore 1995:11; Peacock and Williams 2005).

Lamboglia II

The Lamboglia II amphorae came from the Adriatic coast of Italy and was produced from the second century BC until the late Hellenistic period (Adkins and Adkins 2004:354–355; Caravale and Toffoletti 1997:104; Carre, Monsieur and Mattioli 2014:417–428; Lund 2000:83–84; Sciallano and Sibella 1994:35). The main product carried in the Lamboglia II amphorae was olive oil; however, some of the Lamboglia II amphorae from the Madrague de Giens shipwreck carried a cargo of wine (Moore 1995:18; Peacock and Williams 1986:100). As for its distribution pattern, this amphora type was transported to Greece, Egypt and Turkey along with several places around the Western and Central Mediterranean and Black Sea (Bezeczky 1998:228; Lund 2000:83–84; Peacock and Williams 1986:100). The Lamboglia II amphora has a cylindrical neck with oval and thick handles (Figure 8.18). The body has a bag-shaped form that terminates in a rounded base (Peacock and Williams 1986:99; 2005).

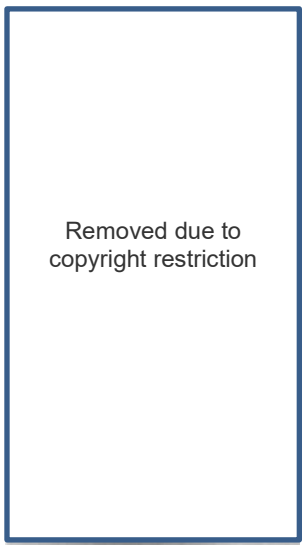


Figure 8.16 Will from A variant 1 (Will 1982:357, Fig. b).

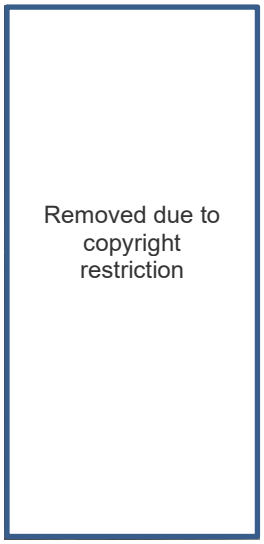


Figure 8.17 Will from A, variant 2 (Will 1982:357, Fig, a).

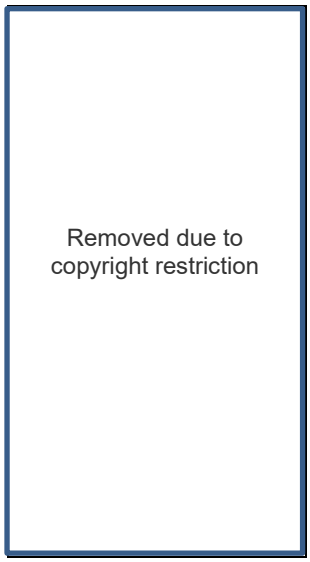


Figure 8.18 Lamboglia II amphora (Sciallano and Sibella 1994:35).

8.1.2.3 Early Roman amphorae

Dressel 6A

The Dressel 6A amphora is similar in shape to the Lamboglia II amphora (Bezeczky 1998:228–230; Peacock and Williams (1986:98–99). It has round thick rim, long thick handles attached to the cylindrical neck and a carinated shoulder (Figure 8.19). The ovoid body ends in a tapered and sometimes round base (Marie-Brigitte 1985:209; Sciallano and Sibella 1994:36; Keay and Williams 2005).

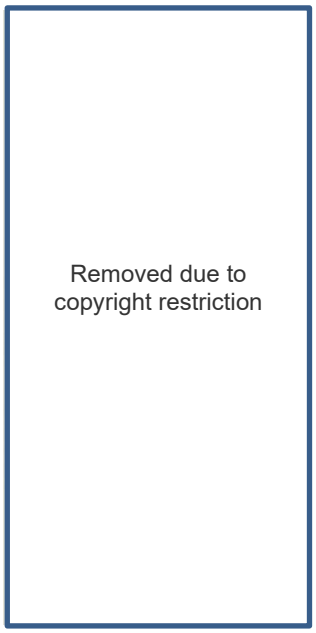


Figure 8.19 Dressel 6A amphora (Sciallano and Sibella 1994:36).

It was produced along the Adriatic coast and in North Italy and distributed widely in the Central, Western and Eastern Mediterranean (Bezeczky 1998:230; Buchi 1971:547–550; Marie-Brigitte 1985:211–212; Peacock and Williams 1986:100). The production of Dressel 6A started in late first century BC and continued until the mid-first century AD (Buchi 1971:545–546). Based on the inscriptions found on some of Dressel 6A amphorae, it is known that wine and olive oil were the main products carried in this type (Bezeczky 1998:230; Paterson 1982:153). Furthermore, Buchi (1971:550) suggests that garum might have been carried in Dressel 6A amphorae.

Amphorae Égyptienne 3 (AE3)

AE3 is abbreviations of Amphora Égyptienne 3 and it is also known as the Bitronconique amphora (Dixneuf 2011:97; Empereur and Picon 1989:234–235; Peacock and Williams 1986:206). According to Khalil (2005:157), this type of amphora was purely Egyptian and the first locally produced wine amphora dating to the Roman period. Three main production centres around Egypt have been identified for the production of the AE3 amphora; Middle Egypt, Fayoum and Mareotic region. It is worth mentioning that 19 amphora-making workshops in Mareotic region produced AE3. Here, the amphora was used for local wine from the Mareotic vinyards (Ballet and Dixneuf 2005:67–72; Dixneuf 2011:97; Khalil 2005:157–158; Senol 2003:200; Tomber and Williams 2000:45; Tomber 2007:525-536). According to Senol (2003:200), most of AE3 found at the Gabbari Necropolis are made of Mareotic clay. Further, Senol believes that the production of this type ceased by the fifth century AD.

Figure 8.20 The AE3 amphora type. Photograph by A.K Senol (CEAlex). © Copyright 2020, with permission from Centre for Alexandria Studies.

There are many sub-groups of this type, but in general it has a triangular shaped rim, long neck (wide grooved/plain), small round handles (sometimes below the rim or attached directly to the rim) and a pointed sharp base (Figure 8.20) (Alpözen, Berkaya and Özdaş1995:72 ; Dixneuf 2011:202; Empereur and Picon 1998:77; Peacock and Williams 1986:206–207; Scillano and Sibella 1994:87; Tomber and Williams 2000:43).

Despite the frequent occurrence of the AE3 amphora in the Mediterranean, such as the Italian coast, Greece and Israel, and even as far as Britain, France and the Gulf of Aden, this type is considered to have been used solely for local consumption and not for trading or commercial purposes (Khalil 2005:157–162; Tomber and Williams 2000:46–52). The AE3 amphora type is found at the terrestrial excavations in Alexandria in large quantities, which dwarf the quantities of amphorae types such as the Amphorae Égyptienne 4 (AE4) or Egyptian Dressel 2-4 in the city excavations (Figure 8.21).

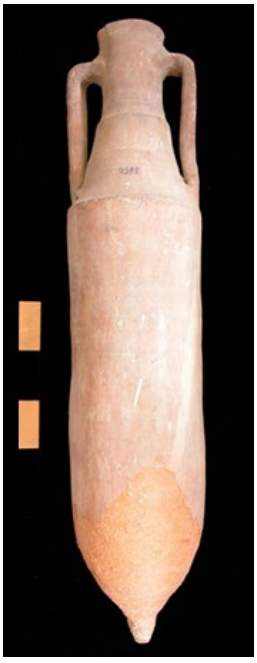


Figure 8.21 AE4. Photograph by A.K Senol (CEAlex).© Copyright 2020, with permission from Centre for Alexandria Studies.

The Egyptian Dressel 2-4 was an imitation of the original type from Italy (Bailey 1998:135–136: Bezeczky 1998:232; Dixneuf 2011:129; Peacock and Williams 1986:106). However, Senol (2003:195) believes that there was a relationship between Egyptian and the Koan potters that affected the shape of the Egyptian Dressel 2-4. It was produced from the Hellenistic period until the mid-third century AD in the Mareotic region—it was produced alongside the AE3 amphora. The Mareotic region was the main production centre for this type and substantial dumps of this type have been located there. The AE4 amphora was made of two different fabrics: one of them is a Mareotic clay while the other is a Nile silt (Bailey 1998:135–136: Dixneuf 2011:129–133; Empereur and Picon 1986:103–125; Khalil 2005:158; Tomber and Williams 2000:43).

The AE4 amphorae were mainly containers for export wine, rather than a container for products for local consumption, as consumers valued this container for its high-quality contents. People were familiar with this type in the Roman Empire (Khalil 2005:162; Tomber and Williams 2000:43). The original Italian Dressel 2-4 is found often in the Eastern and Western Mediterranean and its contents were in a high demand. The Egyptian Dressel 2-4 has also been found frequently in this region. Khalil (2005:160–161) stresses that its distribution extended to different parts of Italy, such as Ostia, Pompeii and Campania, and as far as France, Turkey, Greece, Libya, Tunisia and Yemen. Data providing the exact amount of AE4 amphorae from the archaeological record is still lacking; however, it is known that the amphorae occur in low amounts. Only 10% of the recovered amphorae from the ancient Red Sea harbours, such as Myos Hormos and Berenike, for example, represent the Egyptian Marotic Dressel 2-4 amphora (Khalil 2005:158).

Khalil (2005:158–161) applied statistical analysis to the amphorae recovered from the Gabbari Necropolis and the amphora collection at the Greco-Roman Museum in Alexandria, to trace evidence of the existence of the AE4 in Egypt. It is worth noting that Gabbari Necropolis revealed around 4,000 amphorae of different amphorae types. Half of them are local production; 80% of them are AE3, only 1% is AE4 ranging between Mareotic clay and Nile clay, 15% LR5-6 and 3% LR7. Further, the collection at the Greco-Roman Museum supports the hypothesis of the low amount of AE4 in Egypt (see Chapter 3, Section 3.3). Consequently, this supports the hypothesis of the use of AE4 mainly for commercial purposes and not for local consumption. Despite the low amount of AE4 in Egypt, it has been located outside Egypt in modest amounts as well (Tomber and Williams 2000:43).

Khalil (2005:162) suggests that there are several reasons behind the lack of AE4 located around the Mediterranean, like the misidentification of Mareotic clay among the huge amount of Dressel 2-4 located and the failure of the researchers or scholars to identify it. The reason behind the difficulties

of identifying the Mareotic clay is the common mixture of Nile clay and Marl clay (desert), which was used to produce local ceramics during the Roman Period.

Tomber and Williams (2000:46–48) agree with Khalil (2005:162) and highlight that there are a considerable number of unidentified Egyptian sherds located at the Western Mediterranean, as follows:

- Unidentified Egyptian sherds located at Rome, Southern Spain, Switzerland and Lyon datable to the early Roman period (late first century AD to the second century AD).
- Unidentified Egyptian sherds located at Britain (York, Poundbury Dorset) datable to the Mid-Roman period (second century AD).
- Unidentified Egyptian sherds located at Punta Secca south-east Sicily, datable to the late Roman period (fifth century AD).

Hence, further study of these unidentified sherds would confirm if AE4 were used mainly locally of for export.

8.1.2.4 Mid-Roman amphorae

Kapitän II

The Kapitän II type is also known as the hollow foot, Niederbieber 77 or Agora K 113 amphora (Dundar 2013:53; Peacock and Williams 1986:193; Sciallano and Sibella 1994:99). No evidence is available to establish the exact origin of the Kapitän II amphora; however, it occurs at a considerable number of production centres in the Aegean region (Dundar 2013:53). Keay (1984a:137) states that identifying the exact origin of the Kapitän II amphora is difficult due to the lack of stamps or inscriptions in this type. Keay and Williams (University of Southampton 2014) suggest the Greek Islands of Kos, Samos and Ephasus as the most likely origin for the type based on the analyses of its fabric. The fabric of this amphora type is similar to that of the Koan amphora (Keay 1984a:137).

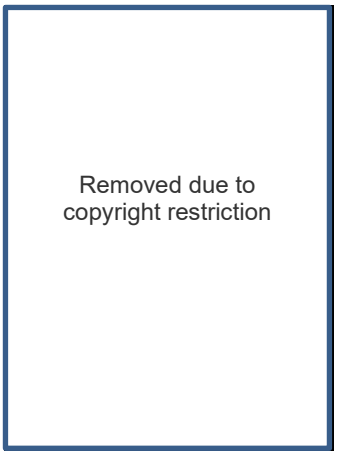


Figure 8.22 Kapitän II amphora. Photograph from Elsayed 2012. Reproduced by the author.

The Kapitän II amphora dates mainly to the second and third centuries AD, and the type lasted until the fourth century AD (Keay 1984a:137; Peacock and Williams 1986:194). The main content carried in the Kapitän II amphora is uncertain (Peacock and Williams 1986:194); however, Keay (1984a:137) posits that the content

could be wine based if its production centre would be Kos, but this claim is unsupported by content analyses.

The morphology of the Kapitän II amphora shows long-arched handles that are higher than its round rim (Figure 8.22). The handles are attached to a conical neck that has some grooves, i.e. it has a ribbed surface. The body is tapered and terminates in a hollow long base (Keay 1984a:137; Peacock and Williams 1986:193). The Kapitän II amphora is distributed across the Aegean, Eastern and Western and Central Mediterranean in large numbers during the Roman period (Peacock and Williams 1986:193).

Africana I

The Africana I amphora was produced in northern Tunisia from the second century AD to the third century AD (Keay 1984b:408; Peacock and Williams 1986:153–154; Zevi and Tchernia 1969:173–214). Its main contents was probably olive oil as north Tunisia was famous for its olive cultivations areas. It is worth noting that the production of grain in the first and second centuries AD created much wealth in the region and made Tunisia prosperous. Furthermore, evidence for the cultivation of olives and the production of olive oil back dates to the second century AD and this coincides with the appearance of this amphora type.

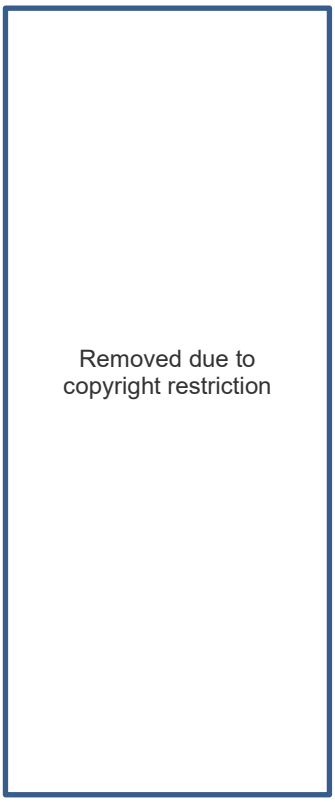


Figure 8.23 Africana I amphora (Sciallano and Sibella 1994:80).

The Africana I type is found in archaeological context in the western and eastern Mediterranean. Evidence for the use of Tunisian olive oil in Rome and Ostia is attested by the significant number of Tunisian amphorae found in archaeological context (Keay 1984b:409). In the late Roman period, Tunisia was the main source of olive oil and grain for Rome (Fulford 1989:180).

As for the morphology of the Africana I amphora, it has an inverted rim with a short neck and small round handles, which are attached to the middle of the neck and to the shoulder. The body is cylindrical and terminates in a hollow short base (Figure 8.23) (Bailey 1998:120–121; Scillano and Sibella 1994:80; University of Southampton 2014).

8.1.2.5 Late Roman amphorae

Amphora Égyptienne 3 late (AE3) late/ AE3T-2, variant B

The AE3 late amphora is also known as the Egloff 172 or Late bitronconic type. It has a long neck with narrowly-spaced grooves. Two round handles are attached to the round rim, with a swollen belly and short base (Caravale and Toffoletti 1997:157; Peacock and Williams 1986:206–207). It was produced in the Nile Delta and Nile Valley and dates from the late fourth century AD to the sixth century AD (Bailey 1998:125–129; Dixneuf 2011:138–139; Peacock and Williams 1986:206).

Figure 8.24 The AE3 late/ AE3T-2, variant B amphora. Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.

According to Dixneuf (2011:139–142), the AE3 late amphora has some sub-types and variants, such as the AE3T-2, variant A and B. Variant A is distinguished by the lip concave rim and a rounded rim appears on variant B (Figure 8.24). It is distributed around the Eastern, Western and Central Mediterranean (Peacock and Williams 1986:206; Tomber and Williams 2000:46–48). The container mainly carried wine (Dixneuf 2011:140).

Late Roman 1 (LR1)

The late Roman 1 amphora was produced from the fourth century AD until the seventh century AD, primarily in Cilicia and Cyprus (Empereur and Picon 1989:236–239; Moore 2000:55–56; Opait 2009:283–289; Williams 2005:157–168). It is widespread across the Mediterranean and its distribution extends from its place of production to Egypt and other regions in North Africa, Palestine, Spain and even Britain (Arthur and Oren 1998:193–212). The LR1 amphora has a narrow neck with wide round handles attached to its shoulder (Figure 8.25). The body is cylindrical with a round base. It is distinguished by grooves around the shoulder and the body. Further, LR1 amphorae carried olive oil with traces of wine (Moore 2000:55–56; Piéri 2005:83–84; Keay and Williams 2005).

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Figure 8.25 Late Roman 1 amphora (Sciallano and Sibella 1994:100).

Late Roman 4 (LR4)

The Late Roman 4 (LR4) amphora is also known as Almargo 45. It was produced in Palestine and Gaza in the fourth century AD until the sixth century AD and was used to transport wine (Peacock and Williams 1986:198). It has a distinct narrow mouth, thin rim and no neck. The handles are small and round and attached to the shoulder (Figure 8.26). The body is cylindrical and ends with an oval base (Alpözen, Berkaya and Özdaş1995:66). It has been located in several places in the Eastern Mediterranean and Europe (Alpözen, Berkaya and Özdaş1995:66 ; Bailey 1998:123–125; Peacock and Williams 1986:198).

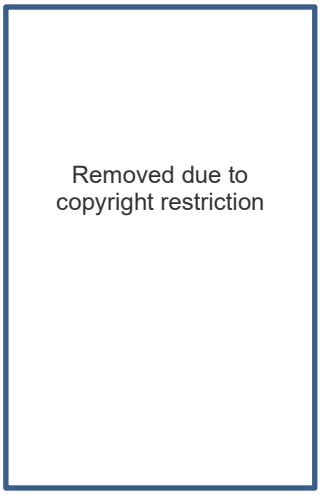

Figure 8.26 Late Roman 4 amphora (Alpözen, Berkaya and Özdaş 1995:66).

Amphora Egyptienne 5 (AE5)

The Amphorae Egyptienne 5 type is another locally produced container, also known as Late Roman 5/6. Its production commenced in the Mareotic region and several places in the Delta and Middle Egypt by the fifth century AD and continued until the seventh century AD. It is worth noting that LR 5/6 amphorae was produced in Palestine as well (Ballet and Dixneuf 2005:67–72; Dixneuf 2011:142–153; Empereur and Picon 1989:243; 1992:150–151; Khalil 2005:159). According to Keay and Williams (University of Southampton 2005), the Late Roman 5/6 has a number of sub-types, but the general features of this amphora include a bag-shaped grooved body with round rim and base and no neck. The handles are small, round and attached to the shoulder (Figure 8.27).

Figure 8.27 Amphora Egyptienne 5. Photograph by A.K Senol (CEAlex). © Copyright 2020, with permission from Centre for Alexandria Studies.

Amphora Egyptienne 7 (AE7)

The Amphora Egyptienne 7 is a well-known locally produced amphora. It is also classified as Late Roman 7 or Egloff 177. It was produced from the late fourth century AD until the seventh century AD (Alpözen, Berkaya and Özdaş1995:72 ; Dixneuf 2011:154–173; Empereur and Picon 1989:244; Peacock and Williams 1986:204; Tomber and Williams 2000:41–45). According to Khalil (2005:159–160), this type was produced in Middle Egypt and the Mareotic region. Khalil believes that it was mainly produced in Middle Egypt due to the enormous dump locations in this area, especially compared to the lesser amount of rejected amphora material found in the Mareotic Region.

Figure 8.28 Amphora Egyptienne 7. Photograph by A.K Senol (CEAlex).© Copyright 2020, with permission from Centre for Alexandria Studies.

According to Senol (2003:204), 1% of the amphorae excavated from sector 2 of the Gabbari Necropolis were Late Roman 7. In addition, huge amounts come from archaeological contexts in Alexandria—a result of rescue excavations (Senol 2000:369–396, 2002a:191–215, 2002b:467–484, 2007:57–75) and the Kom El Dikka site excavations (Majcherek 2004:229–237). Evidence for the export of the LR7 amphora is found in the Black Sea region, Italy and Carthage (Tomber and Williams 2000:46–48). It is worth stressing that LR7 amphorae have been located in different areas across the Mediterranean, similarly to the early Roman amphora AE3 (Tomber and Williams 2000:46–52). This is direct evidence for interrupted export activities of the local productions in late antiquity (Ballet and Dixneuf 2005:67–72; Khalil 2005:159–160).

As for the Amphora Egyptienne 7 morphology, it has a round rim with a long cylindrical neck. The handles are round and attached to the middle of the neck and shoulder. It has a carrot-shaped body that terminates in a long hollow base (Figure 8.28). The body also has grooves (Keay and Williams 2005). It is worth stressing that use of the AE7 continued into the ninth and tenth centuries AD (Dixneuf 2011:207).

8.1.2.6 Islamic amphorae

AE3 Late/ AE 3T-3.2, variant B

This amphora type, also known as Egloff 180, is classified as a local production from the Mareotics Region and Middle Egypt (Dixneuf 2011:140–141). It has a round lip and short and round handles attached to the rim (Figure 8.29). The neck is cylindrical, its body is tapered and terminates with conical base; however, variant B has a much wider base. This amphora type dates to the seventh and eighth centuries AD and mainly carried wine. No evidence for its distribution exists to date (Dixneuf 2011:140–141).

Figure 8.29 The neck of the AE3 Late/ AE 3T-3.2, variant B amphora. Photograph by © E. Khalil 2017.

The amphorae discussed in this chapter have in common that none were recorded from the pre-Hellenistic period, while Koan and Rhodian amphorae were prominent in the Hellenistic period. The AE3 was most prominent during the early Roman period. As for the mid-Roman period, Africana I amphora was the main highlight while four amphora types were present in the late Roman period as follows: LR1, LR4, AE5/6 or LR5/6, AE7 or LR7. Finally, AE3 Late/ AE 3T-3.2 variant B was the main feature of the Islamic period.

8.1.2.7 The re-use and recycling of amphorae

Factors directly related to political and economic situations played a critical role in the decline of some amphorae types and the emergence of new ones. These factors include amphorae prices, market fluctuations, competition, capacity, shape and content quality, and changes in local needs. Based on the network analyses results and the discussion, the production of a specific type of amphora may have been suspended at a certain time; however, this does not mean that the use or available of previously manufactured amphora of that type ceased as well. There is no abrupt falloff of any of the amphorae, as they continued to be used alongside subsequent production types. The prevailing theory is that it took some years for old amphorae types to be phased out, i.e. long after their production had stopped. It seems therefore likely that amphorae were stocked up in large quantities and were recycled or reused.

Parker (1990:343) stresses that the amphora is similar to the modern-day wine bottle; it comes in different shapes and sizes depending on its place of manufacture and consumption. Wine bottles are mainly recycled to save money and resources, and the same applies to the ancient amphora. More recently, evidence for the re-use of amphora has come from the archaeological excavations from shipwrecks in the Mediterranean and the analyses of amphorae that carried the cargoes in those

ships, which provided insight to the practices related to amphorae re-use and recycling (Abdelhamid 2013; Foley et al. 2012; Peña 2016). Evidence of re-use comes from amphorae on board a ship that carried more than one cargo or from repairs or overwritten graffiti on the storage containers, which will be discussed in more detail below.

The amphorae carried on the Grado ship, for example, provided evidence for re-use. The Grado shipwreck was located along the Italian coastline and dates to the early Roman period (Abdelhamid 2013:96; Parker 1992a:197; Peña 2016:6–7; Strauss 2006:132). Traces of fish were identified inside the amphorae and this cargo was mainly carried in Africana 1 (Keay 1984b:408; Peacock and Williams 1986:153–154) and Tripolitanian 1 amphorae (Peacock and Williams 1986:166–167). Both amphorae types were known as wine and olive oil containers and a cargo of a fish-related product thus indicates re-use of the containers (Scillano and Sibella 1994:90).

A powerful analytical tool discussed in Chapter 4 are the DNA studies of amphorae undertaken by Foley et al. (2012:389–397) and Hansson and Foley (2007:1–8). They confirmed the re-use of pre-Hellenistic and Hellenistic amphorae by identifying traces of more than one product in each amphora. By the same token, the chemical analysis conducted on Keay 62A amphorae (Keay 1984a:309–318) from the La Palud 1 shipwreck in France confirmed traces of pitch lining and olive oil (Peña 2016:4). Pine pitch lining is exclusively used for wine amphorae, which indicates that the storage containers aboard the La Palud 1 shipwreck were refilled with olive oil.

Whitbread (1995:23) also discusses the practice of amphorae re-use through the study of 52 Greco-Italic amphorae from the Capistello shipwreck on the Lipari Islands in Italy. Dating from the late fourth century BC to the beginning of the third century BC, some of the amphorae on the site were intact and still sealed with stoppers. Analyses of these amphorae revealed traces of grape and olive seeds, which again is direct evidence for reuse. The original cargo carried in these Greco-Italic amphorae was most likely wine (Scillano and Sibella 1994:30–31). Another example comes from the wine amphorae found on the Sud-Caveaux 1 shipwreck along the French coastline. Here, the Lamboglia II and Dressel 6A amphorae onboard, well known as wine-carrying containers, were filled with pine pitch (Formenti, Hesnard and Tchernia 1978:95–100; Lindhagen 2009:83–108; Peña 2016:4; Scillano and Sibella 1994:36).

Evidence for re-use is also found in ancient texts that discuss the practice in the Hellenistic, Roman and Late Roman periods (Pena 2016). The Zenon Papyrus Archive, for example, contains papyrus documents found at the Fayum suburb in Egypt (Edgar 1925; Westermann 1940). These papers were collected and stored by Zenon, one of the Ptolemy II employees. Two of these papyrus

documents detail the transport of local and imported amphorae to Fayum from a nearby town called Kerke (Attalus 2018 PCairZen. 4.59741; PSI. 8.859; Grace and Empereur 1981:425). The papyri contain no mention of amphorae types and only refer to their origins, such as Kourion and Paphos in Cyprus and the islands of Paros and Chios in Greece. The text also makes no mention of transport from these places to Fayum. This may, therefore, suggest the re-use of imported amphorae in addition to the local containers for domestic trading purposes.

Another papyrus document dating to the third century AD mentions the shortage of Italian and Sicilian wine, along with the imported wine from western Anatolia, at adjacent villages of Fayum. This document specifically mentions the refilling of the imported amphorae with local wine to cover the local needs (Pena 2016:11). Records from the late Roman period also exist for the purchase of empty and used amphorae by an owner of an Egyptian vineyard for the purpose of refilling with wine (Pena 2016:11). But, the re-use of amphorae also occurred elsewhere. For example, Pena (2016:11–12) discusses epigraphic evidence for the reuse of amphorae in Rome. An inscription dating to the second century AD mentions an amphorae trader involved in the purchase of empty containers for the sale to the wholesalers or local consumers for trading or daily purposes. Then, graffiti on the surface of amphorae from shipwreck sites has provided evidence for re-use. According to Van Doorninck (1989:247–257), modifications were made on the graffiti of some of globular amphorae from the 7-century AD Byzantine shipwreck at Yassi Ada, Turkey. The study of the graffiti revealed that it was overwritten to change the content or the ownership of the amphorae (Abdelhamid 2013:97).

Lawall's (2000:79–80) seminal work highlights that, in addition to amphorae graffiti, labels were added to some of the Chian amphorae types from the Athenian Agora as a sign or mark for the consumers that the containers were refilled with products other than wine. Peña (2016:4) also mentions that Dressel 2-4 amphorae from the Casa del Menandro in Pompeii had three different labels with content descriptors, which included wine, Alexandrian vinegar and an unidentified content belonging to a specific person (see also Bailey 1998:135–136).

In addition to shipwreck data and textual references, other evidence for amphorae re-use also comes from dumps that contain sherds and fragments of containers. Peacock and Williams (1986:13) discuss the practice of amphorae discards from the study of a large dump containing a significant number of broken pieces at Monte Testaccio in Rome. This dump indicates that the contents of the amphorae were transferred into smaller containers for easy carrying and distribution while the main transport container was discarded. The same practice is found at many other locations like Egypt. For example, dumps with ceramics sherds have been found near the amphorae production centres at

the Delta and Middle Egypt (Blue 2010:25–33; Blue and Khalil 2010; 2011; Khalil 2008:9–11). Also, the discard of amphorae occurred if the quality of the container was inferior, like the dump located at the Mareotic region (Figure 8.30) (Pichot and Şenol 2014:226–228). The quality of amphorae was a significant issue for the Romans, for example, who valued high-quality containers and had a disdain for defective amphorae. More evidence for the discard of poor-quality of faulty amphorae come from a study of 53 million amphorae from Baetica dating to the mid-Roman period (Strauss 2006:132). Strauss believes that this practice was deliberate and for a purpose.

Furthermore, in the archaeological record, the use of inappropriate materials as stoppers provides another evidence for the re-use of amphorae. Examples of this practice comes from the broken fragments of amphorae used as stoppers on the containers from the Culip D shipwreck in Catalonia or the random ceramic sherds used as stoppers for Dressel 20 amphorae from the Cala Culip 4/D shipwreck in north-eastern Spain. Both examples date to the early Roman period (Parker 1992:157, 344; Peña 2016:5; Nieto Prieto et al. 1989:61–74).

Figure 8.30 Amphorae dump at Mareotic region (Image from Pichot and Şenol 2014:234, fig.3. CEAlex Archives). © Copyright 2020, with permission from Centre for Alexandria Studies.

In Egypt, examples include the use of textiles or sherds from an Egyptian amphorae with plaster to seal the Italian Dressel 2-4 amphorae from the Myos Hormos (Quṣeir al-Qadīm) Harbour on the Red Sea coastline (Blue 2002:139–150; Bülow-Jacobsen, Fournet and Cuvigny 1994:27–42; Khalil 2005:162; Peña 2016:4; Thomas 2011:11–34; Whitcomb 1996:747–772). The practice of using

improper sherds rather than actual stoppers indicates that these amphorae were opened, refilled and stoppered several times (Parker 1992:157; Peña 2016:5; Nieto Prieto et al. 1989:61–74).

Amphorae had recognisable and familiar shapes for customers who associated a specific container with a known high-quality content (Strauss 2006:132). The reputation of some of these amphorae types allowed the sale of these containers at higher prices when refilled with other or lower-quality products. This may explain the widescale imitation of the famous and pricy Italian Dressel 2-4 amphorae across the Mediterranean Sea (Khalil 2005:162; Peña 2016:4).

Kaldeli (2013:265) also discusses the practice of reuse and imitation of amphorae by the low amount of the Spanish and Italian Dressel 2-4 across the Mediterranean, which is also the case in Alexandria. This is explained by the high quality and prices of these types, which were otherwise unaffordable by local people. The reuse of containers and production of imitations were also ways to cope with shortages of amphorae. Öniz (2016:15) highlights the dilemma of the copying process of some amphorae types around the Mediterranean. Amphorae types from Rhodes, Kos, Chios and Knidos were copied extensively in the third and the second centuries BC. Öniz (2016) suggests that this was due to 'the commercial competition' in producing low-cost containers without the need to buy the original ones, or due to the movement of potters from one production area to another to continue producing the same amphorae types as previously. This is an important addition to the recent theories around amphorae reuse and production.

In addition to the re-use of amphorae for consumables or food stuffs, Abdelhamid (2013:91–106) identified some unusual contents inside the Brindisi amphorae from the Maire A shipwreck at Marseilles, which dates to the late Hellenistic period. The amphorae were full of pozzolana and their stamps had been deliberately removed. The filling of amphorae with pozzolana could indicate that they were re-used as ship ballast. This is just one example of amphorae being recycled into use with another function in the ancient times. Kaldeli (2013:259) points out that amphorae were also used to build up drainage water pipes, bird nests and children's burials. However, Kaldeli did not provide any evidence or examples to substantiate his claims. Evidence of amphorae used in children's burials is nevertheless known from the Gabbari Necropolis in Alexandria (Empereur 1998a:196). Another use for amphorae included the Italian Dressel 2-4 and Amphorae Égyptienne 3 AE3 containers that were reused to build up one of the jetties at the Myos Hormos (Quṣeir al-Qadīm) Red Sea Harbour (Figure 8.31) (Tomber 2012:203–204). Amphorae must have been often re-used as construction material.

Figure 8.31 One of the Jetties at Myos Hormos (Image from Blue 2007:272, fig.8). Copyright 2020, with permission from John Wiley and Sons.

Another example is the North African olive oil Keay 35A amphorae reused in the construction of the San Lorenzo Maggiore ecclesiastical complex in Milan (Keay 1984a:199). These amphorae had Greek graffiti referring to a wine content; however, the main content for Keay 35A amphorae was olive oil. Also, the surface of one of the amphora had a Cristian 'slogan' which might link it with the San Lorenzo Maggiore ecclesiastical building (Peña 2016:4; 2007a:112). Lastly, Peña (2016:1) remarks that after amphorae had reached their final destination and their contents were consumed, they may simply have been reused by refilling them with other products and kept around as storage jars, or they were recycled by smashing them into pieces for other uses, or ground into powder as a raw material for ceramic or amphorae production.

Lund (2000:87) mentions that empty containers were unlikely to be returned to their place of origin due to the long trade distances. Strauss (2006:132) argues furthermore the reuse of amphorae was specific to individuals and not a result of a large-scale effort such as trade. For the purpose of trade, amphorae pass through a number of stages, such as cleaning, repairing and adding new marks or labels when re-used. Evidence confirming this theory comes from the amphorae located at a Pompeiian house where they were stacked upright, possibly for drying (Abdelhamid 2013:102).

Peña (2016) stresses the importance for amphorae to be checked for any defects along with removing previous marks and re-pitching the vessel from inside; this was followed by making new stoppers. The aforementioned discussion, however, demonstrates that re-pitching was not always undertaken or done effectively.

In addition to re-use and recycling, it should be highlighted that the practice of parallel production for some of the amphorae types occurred in specific regions. The synchronous production of AE3 and AE4 in the Mareotic region, for example, confirms this practice (Kahlil 2005:157–161). Furthermore, the production of the Late Roman 5/6 amphora continued until late antiquity in conjunction with the Late Roman 7 type (Dixneuf 2011:154–173; Empereur and Picon 1989:243; 1992:150–151).

Kaldeli (2013:258) points out that the context of the amphorae remains are important to understand social and economic aspects. Kaldeli advocates that using such evidence might lead to inaccurate results due to locating expensive and luxury amphorae in 'non-elite contexts'. The reasons behind that is the possibility that the local populace could afford buying these products occasionally, or the expensive amphorae was reused at the non-elite context. Also, it is worth noting that the production centre might not be the same as the source of the carried products. There is a possibility of transporting empty amphorae to other places that lack an appropriate clay to produce good quality amphorae.

8.1.3 Transported Products

Alexandria was exporting products like wine, papyrus, textiles and stone such as granite, limestone and sandstone from the Eastern Desert, along with the exotic or luxury goods like ivory, jewellery, spices and silk. Alexandria imported wine, olive oil, seeds, fish products and dried fruits for commercial purposes and to cover its local needs (Dixneuf 2011:215–216). The main export products in return were wine, grain, papyrus and textiles (Casson 1991:157–169). The most prominently transported products in the Mediterranean Sea to and from Alexandria are discussed below.

8.1.3.1 Wine

Wine compared to other maritime transported products

The binary data analysis illustrates that wine was the most important commodity based on the centrality degree (Chapter 7, Section 7.1.1.2). Similarly, the hypothesis generated from the valued data revealed that wine was prominent over all the periods, except during the Hellenistic period. Some correlations exist between this hypothesis and that generated from the valued combined data.

The latter clearly illustrates that wine was the prominent foodstuff transported in all the periods; however, the trade volume plunged sometime in the mid-Roman period in contrast with the valued data hypothesis (Chapter 7, Section 7.2.2).

Wine trade over time

Correlations between Hypothesis 1 (Figure 8.32) and 2 (Figure 8.33) demonstrate that wine trade in the Mediterranean was most prosperous in the Hellenistic period. This was followed by a sharp decline during the early Roman until mid-Roman period. During the late Roman period, the production increased but declined again by the Islamic period. These hypotheses support Dzierzbicka's (2015) work in which archaeological and written resources, including the 'Greek papyri and ostraca' are used for the study of foreign wine imports into Egypt in the Hellenistic and Roman periods. She credits the Greeks with creating a demand for Greek wine in Egypt. The Greeks travelled to Egypt in large numbers after Alexandria was founded by Alexander the Great and they brought with them their traditions and introduced their taste for wine in Egypt (Empereur 1977:198–201; Eyre 1994:58).

Wine and amphorae production in the Eastern Mediterranean started as early as the third millennium BC, but wine trade only commenced in the late Bronze age (1550 BC–1200 BC) (Zemer 1977:98–102). Schoff observes of the beginning of the wine drinking culture:

> 'The culture of the vine seems to have begun in Asia Minor and Syria, but within the period of written history it is almost universal. Its introduction was ascribed to the gods: by the Greeks to Dionysos, the Romans to Bacchus, the Egyptians to Osiris; or in the case of the Hebrews, to the patriarch Noah'(1912:76–77).

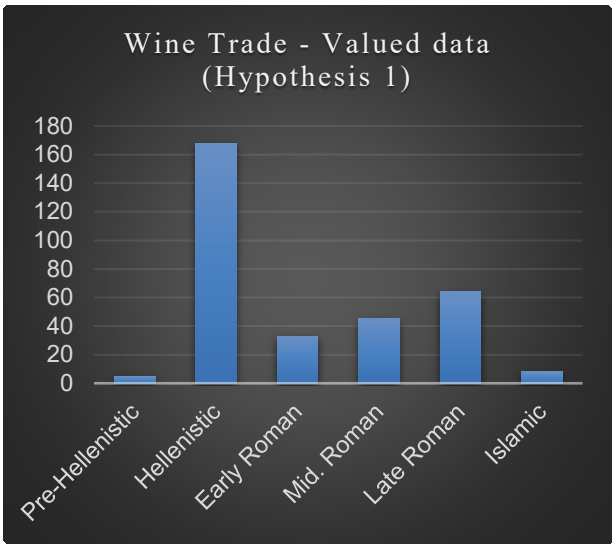

Figure 8.32 Wine trade over time based on the valued data.

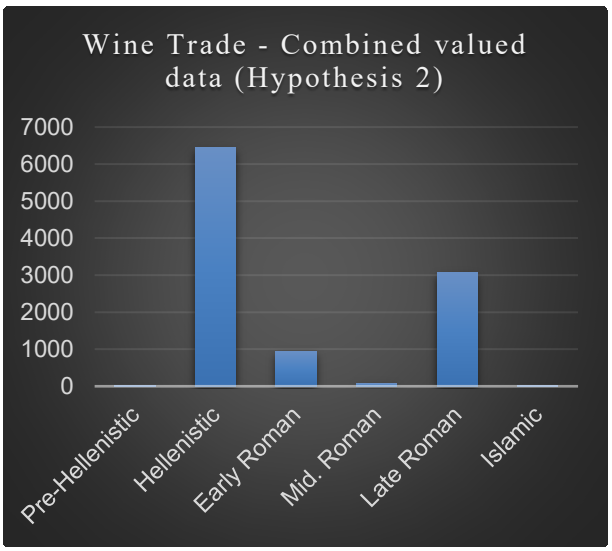

Figure 8.33 Wine trade over time based on the combined valued data.

Before Alexander the Great's conquests, beer was the traditional, mainstream drink for most Egyptians, while wine was limited to the gods and wealthy people. As soon as Alexandria was founded in the third century BC, wine exported from the Aegean region made its way into the city, but exclusively for the wealthy Greek population. It still took some time for wine to become the drink of the masses in Egypt. Wine from the Greek islands of Chios, Lesbos and Thasos had already been popular among wealthy Egyptians since the seventh century BC, but the demand from these imported wines waned by the Hellenistic period. It was the wines originating from Knidos and Rhodes that all of a sudden became widespread in Egypt, followed by the Italian wines (Bagnall 1976:159–169; Ballet 1995:11–13: Dzierzbicka 2015:203).

Then, the wine imported from the Levant also declined sharply in the beginning of the Hellenistic period due to the Syrian war. However, wine from the Syro-Palestine coast still made its way into Egypt but this trade volume too declined by the second century BC. Syro-Palestine wine did make a comeback into Egypt and the import volume regained traction by the beginning of the Roman period (Fraser 1972:175–177). In the early Roman period when the Romans controlled the trade routes across the Mediterranean Sea, new networks and markets opened in Egypt. The import of wine, for example, into Egypt increased and came from new production centres like Spain, Gaul and Cilicia (Curchin 1991:147; Şenol 2007:64).

By the mid-Roman period, some types of wine became absent from Egypt, such as Aegean wines from Knidos and Rhodes as well as those from Italy, Gallia and Crete. The reason behind this drop

was the ‘the Crisis of the Third Century’ in the Western Mediterranean, which divided the Roman Empire into the Gallic Empire, the Palmyrene Empire and other separated Roman Empires. At the same time, the wine produced at Cilicia, Cyprus and Palestine was still in demand in Egypt (Dzierzbicka 2015:205; Lawall 2003:187–188; Mark 2017).

After the Roman Empire division, the trade from the Western Mediterranean declined. This led to an increase in trade with the Eastern Mediterranean, which became the main source of wine to Egypt and beyond (Palombi, Fiorini and De Caprariis 1988:315). This wine was mainly consumed by wealthy and middle-class people in Egypt (Dzierzbicka 2015:205). The exchange of wine amphorae continued until the eighth century AD. Then, by the sixteenth century, despite alcohol being forbidden for Muslims, they were allowed to consume wine when cooking if it was reduced to two-thirds (Dixneuf 2011:207). Further, Horden and Purcell (2000:214) state that the wine trade was distinguished by its large scale across the Mediterranean history.

8.1.3.2 Olive Oil

Olive oil compared to other maritime transported products

According to the centrality degree results based on the binary data, olive oil was the second most transported product after wine (Chapter 7, Section 7.1.1.2). Based on the valued data, olive oil reached its peak during the Hellenistic period (Chapter 7, Section 7.1.2.2). This result is at odds with the valued combined data, which shows the olive oil trade flourished during the mid-Roman period (chapter 7, Section 7.2.2).

Olive oil trade over time

Based on hypothesis one, the olive oil trade was modest across the time periods except the Hellenistic period. As Figure 8.34 shows, the olive trade rose sharply during the Hellenistic period. Correlated patterns appear between this hypothesis and hypothesis two regarding the Hellenistic period (Figure 8.35). Nevertheless, hypothesis two indicates a considerable increase during the mid-Roman period, followed with another massive and sharp increase during the late Roman period. Further, similar patterns were observed between hypothesis one and two regarding the low scale of olive trade during the early Roman and Islamic periods.

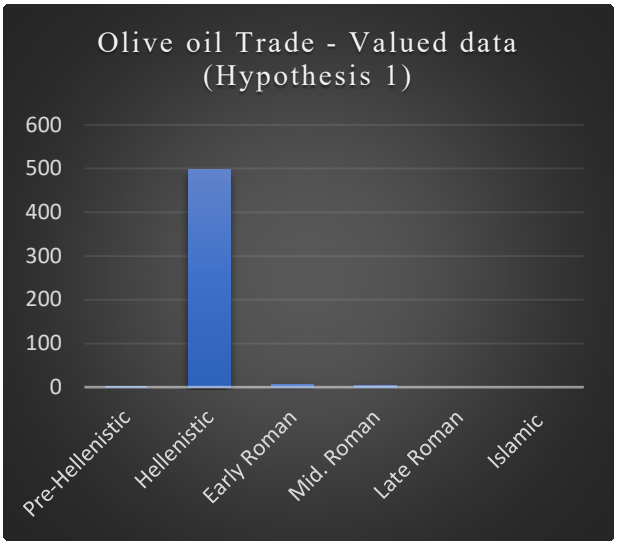

Figure 8.34 Olive oil trade over time based on the valued data.

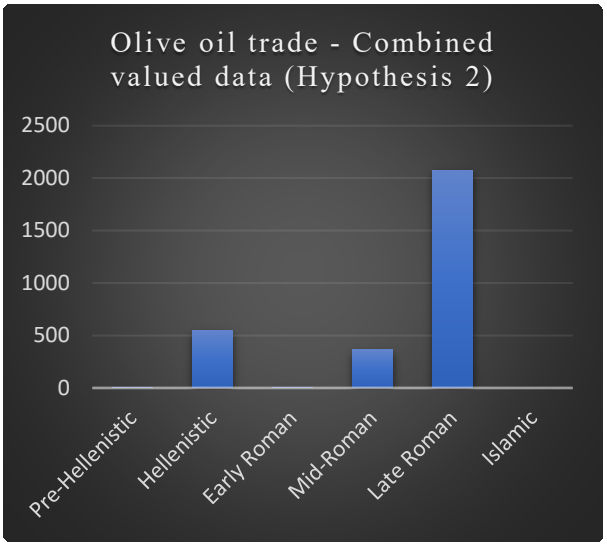

Figure 8.35 Olive oil trade over time based on the combined valued data.

Olive oil in the Mediterranean was one of the most important products as it used for preserving food along with its usage in cooking, lighting and for medical treatments (Alpozen, Berkaya and Ozdas 1995:28; Horden and Purcell 2000:209; Zemer 1977:107–108). Production centres, such as those in the Aegean, North Africa, Italy and Spain, were the most famous olive oil production and export centres to different destinations around the Mediterranean. As for Egypt, olive oil was one of the main imported products due to the limitation of appropriate cultivatable lands along with the low quality (Dixneuf 2011:208). This was confirmed by Strabo when he stated that 'the gardens near Alexandria, which are planted with olive trees, but do not furnish any oil. It produces wine in abundance, corn, pulse, and a great variety of other grains' Strabo (1903:17.1.35).

This is supported by the lack of archaeological remains for the oil production (oil press) located in Alexandria. Hence, no Egyptian amphorae carried olive oil (Bagnall 1993:30; Rownaldson 1996: 24). Moreover, the Aegean region was distinguished by high quality olive oil; however, the olive oil produced in Spain and the Central Mediterranean was preferred in Rome (Mattingly 1996:247). This supports hypothesis two regarding the increasing amount of olive oil amphorae originated from the Central Mediterranean during the mid-Roman and Late Roman periods.

8.1.3.3 Other products

Based on the network analysis hypotheses, modest trade existed for commodities like fish sauce, fish products, sesame oil, dried fruits and nuts. These products were not common and popular like wine and olive oil; however, the fish sauce and salty products were consumed in considerable amounts in Egypt during the Roman and Late Roman periods. As for the production regions, the Aegean and the Western Mediterranean were famous for producing fish. Also, Egypt exported

salted fish to Greece by the second and third centuries AD (Dixneuf 2011:208; Mattingly 1996:247). As for the fruits and nuts, the Aegean region was famous for producing and exporting a variety of fruits and nuts like grapes, figs, apples, cherries along with hazelnuts, almonds and chestnuts (Strauss 2006:142–143). Further, sesame oil was used among other types of oil like castor and safflower oil for some purposes like lighting (Dixneuf 2011:208).

It is worth noting that grain was the most famous and important transported product transported to Rome from Alexandria. This is because Egypt was the main wheat provider and supplier for Rome during the Roman Period (Husselman 1952:56; Peacock and Williams 1986:31–39). Up to 150,000 tons of wheat was transported on an annual basis from the Egyptian harbours to Rome (Casson 1984:70–88; Rickman 1980:231–235). Regarding the grain cultivations, Schoff states that:

> 'In the early Roman Empire vast quantities of wheat were raised in Sicily, Gaul, North Africa, and particularly Egypt, for shipment to Rome. Later a great wheat area was opened up in what is now Southern Russia, which finally supplanted Egypt in the markets of Constantinople, after Alexandria and Antioch fell into Saracen hands.' (1912:76)

Senol (2013:375) implies that Alexandria had a powerful commercial role through the eras and had an influence on the whole of Egypt in terms of its economy and trading connectivity with other Mediterranean countries. After Egypt became a Roman province, an obligation had been assigned regarding delivering a huge amount of its 'resources and agricultural production' to Rome in annual basis (Casson 1984:70–88).

It is worth stressing the grain was not carried in amphorae. This raises the question about if there were specific types of vessels produced especially for transporting grain and what the procedure was. Khalil (2005:137) summarises the debate about the way the grain was loaded into the vessels by highlighting Rougé (1981:74–75) who claims that the grain was loading directly into the vessel in loose condition and packed in sacks upon arrival for distribution. The other opinion says that the grain was loaded and transported using sacks from the beginning and this opinion is supported by Rickman (1980:132–134) and Casson (1995:200). In general, there is an agreement between the authors that the grain should not be loaded loosely into the vessels because it would be challenging and risky to maintain the vessel's stability as the grain would move with the movement of the vessel and the action of waves.

According to Casson, slow and humble merchant vessels were in use to transport the grain during the Hellenistic period, as mentioned below:

> ‘Throughout the course of ancient history, the Mediterranean came to know one type of ship above all others: the plodding merchantmen that carried thousands of sacks of grain from port to port. They unloaded on the beaches of tiny islands or the battered docks of minor towns or the spacious wharves of huge ports.’ (1954:168)

Further, the grain was loaded in the lower part of the vessel for stability which required a vessel with good sealing and caulking to prevent the ingress of water that would spoil the grain. However, this type of vessel could still carry different types of products along with their main one (Majcherek 2004:229–237; Peacock and Williams 1986:64).

The transport of grain had started to send ships to Constantinople instead of Rome as the new capital of the Empire after the division of the Roman Empire into eastern and western regions in the fourth century AD. Meanwhile, the grain cultivated in Tunisia started to be transported to Rome along with the olive oil (Keay 1984:414–428; Peacock and Williams 1986:57; Reynolds 1995:109). Further, Mauretania was a source for grain along with Libya and Tunisia after the division of the Roman Empire (Reynolds 1995:41–42).

Pearson correlation coefficients measurements for the transported products

As mentioned before, the results provided by the Pearson correlation coefficients measurements ignored the division of periods. It provides a general perspective about every transported product. Based on these measurements, there is low similarity between wine and olive oil (see chapter seven, section 7.6.2). These measurements correlate with the hypotheses provided based on the binary, valued and combined valued data. Wine was not the same as olive oil as it was ranked the second most important and prominent transported product.

8.1.4 Shipwreck/Amphorae Sites

The binary data provided three different hypothesises related to the historical significance of the underwater sites based on the amphorae types, production regions and transported products. As mentioned in the previous chapter, Marsa Bagoush, Aboukir, Mammura and Shatby have the highest centrality degree and number of ties based on the binary data. These sites are more prominent than the other underwater sites studied in this project. These results match with the significance of these sites. Marsa Bagoush was a significant port and shelter to the trading vessels across the periods. The network analysis revealed that this site was in use from the Hellenistic period until the Islamic period and the same applied to the Mammura and Shatby sites. Table 8.2 shows the periods recorded at each underwater amphora site based on the site attributes data (Appendix 2, Section 11.2.1.2.1). Also, see Appendix 4 for a combined record for the amphorae types located at each underwater site.

With every excavation season at Marsa Bagoush, more amphorae evidence is revealed and associated with wood fragments, anchors, metal and glass works (Khalil pres. comm. 2019). Aboukir is a massive site with 60 intact shipwrecks. Further examination of these shipwrecks is still needed and would provide valuable data about the trade network and could change the entire shape of the maritime trade network in the Mediterranean Sea. By the same token, Mammura and Shatby have more to tell.

Consequently, Marsa Bagoush, Aboukir, Mammura and Shatby are witnesses to the connectivity and interactions between Alexandria and its extension along the North-Western Coast with the rest of the Mediterranean. Such interactions started from the pre-Hellenistic period until the Islamic period, which is considered as direct evidence of the non-disturbing use and significance of the Egyptian coastline and its harbours across the periods. It is worth noting that this significance fluctuated between the periods as the next section discusses; however, it continued without significant interruption. It is worth noting that identifying the number of shipwrecks at each underwater site except Aboukir site was not possible based on the available date. In other words, the amphorae collections located at one particular spot and dating to a single period might belong to more than one shipwreck.

Table 8.2 The periods recorded for each underwater amphora site along the Alexandrian coastline and the North-Western Coast.

Site ID	Site	Zone	Longitude	Latitude	Pre-Hellenistic	Hellenistic	Early Roman	Mid-Roman	Late Roman (Byz.)	Islamic
2	Ras El-Hikma	North-Western Coast	27.855909	31.245209						
4	Tannum Reef	North-Western Coast	N/A	N/A						
6	Ras Hashafa	North-Western Coast	27.636945	31.195431						
8	Ras Hawala	North-Western Coast	27.556565	31.205746						
10	Marsa Oum El-Rakham	North-Western Coast	27.062845	31.405485						
12	Marsa Bagoush	North-Western Coast	27.671674	31.179722						
14	Aboukir	Alexandrian Coast	30.13333333	31.31666667						
16	Mammura	Alexandrian Coast	30.03361111	31.31027778						
18	Ibrahimia	Alexandrian Coast	29.915299	31.212908						
20	Shatby	Alexandrian Coast	29.906909	31.212651						
22	Eastern Harbour	Alexandrian Coast	29.88888889	31.21111111						
24	Qaitbay/Pharos	Alexandrian Coast	29.88388889	31.24805556						
26	Western Harbour	Alexandrian Coast	29.871569	31.192156						

8.1.5 Alexandria Across the Periods in the Light of Amphorae Evidence: Combined Binary Data and Pearson Correlation Coefficients

On one hand, the combined binary network analysis results revealed that the commercial role of Alexandria started as early as the pre-Hellenistic period. It is worth stressing that this is based on the amphorae evidence. Alexandria's commercial role dates back to earlier times than the pre-Hellenistic period based on the other ceramic materials like cups, plates, cooking and fine wares located at Aboukir, which date to Pharaonic and Persian periods.

According to the centrality degree analysis, Alexandria's most active period was during the early Roman period and this is confirmed by the study conducted by Wilson (2011:33–59) (See Chapter 4). While fluctuation is the main highlight of this network analysis, there is modest activity recorded during the late Roman period, which also agrees with Wilson's study. Further, these analyses revealed that the mid-Roman period was the same as the Early Roman period in terms of the production regions, but this is not relevant.

On the other hand, Pearson correlation coefficients calculations revealed three different results based on amphorae types, transported products and production regions as the three aspects this project examines. According to the amphorae types' aspect, no similarity exists between the time periods. Also, this agrees with the results of the combined binary data and Wilson's study.

In contrast, high similarity patterns can be observed between almost all the periods based on the amphorae contents' aspect. At the same time, low similarity along with dissimilarity patterns are the main highlights of Alexandria across the periods based on the production regions. Hence, the results of this aspect matched with the combined binary data and Wilson's study, excluding the similarity observed between the early Roman and Islamic period.

What supports these results is the Romans' success in spreading peace across the Mediterranean and clearing it from piracy by the beginning of the Roman period. This led to an increase in commercial activities, especially long-distance trade during the first and second centuries AD (see Chapter 2). Further, the decline recorded in the mid-Roman period coincided with the natural disasters that hit Alexandria by the third and fourth centuries AD (EL-Sayed, Korrat and Hussein 2004:1003–1019; Pararas-Carayannis 2011:274–275).

Moreover, during the late Roman period, trade activities continued but in a modest scale due to the religious conflict that exploded in Alexandria by that time as highlighted at Chapter 2. Similarly, trade during the Islamic period continued but on a smaller scale due to the decision taken by the Arabs regrading decreasing trading activities with foreign countries.

8.2 Summary

Based on the comparative analysis, correlated patterns are noticeable between the network analysis results and the written resources and previous studies. This chapter investigated the production regions, amphorae types and amphorae products in the light of the inscriptions and written resources and previous studies. The chapter shed light on the fluctuations that occurred across the periods regarding the use of the amphorae types, production centres and the transported products, and revealed a new and different perspective of the maritime trade network model in the Mediterranean Sea.

Based on the amphorae collections, most of the shipwreck/amphorae sites revealed evidence dating to more than one period. For example, Marsa Oum El-Rakham, Marsa Bagoush, Mammura, Ibrahimia, Shatby and Qaitbay/Pharos are witnesses of uninterrupted commercial activity since the pre-Hellenistic period until the Islamic period. Moreover, the network analysis revealed that the early Roman period was the most prosperous period for Alexandria. It is surprising that this result agrees with the study conducted by Wilson (2011) that shows that the highest number of wrecked vessels date to the early Roman period, in contrast with the study provided by Parker (1992a), which states that the Hellenistic period was a witness of the highest number of wrecked vessels.

CHAPTER 9. CONCLUSION

This chapter summarises the key findings regarding connectivity patterns between Alexandria and the rest of the Mediterranean Sea and the fluctuations in the prevalence of amphorae types, the demand for transported products and the notable Mediterranean production regions. It sheds light on local consumption, production and distribution patterns. Finally, it reiterates the limitations of this study and presents recommendations for future areas of research.

9.1 Thesis's Idea and Resources

This thesis builds on and mainly contributes to the study of amphorae and furthers the field of maritime archaeology. It set out to investigate amphorae remains located along the Alexandrian coastline and its extension to the North-Western Coast using a network analysis approach to investigate temporally the region's changing commercial ties and trade networks. This thesis is the first of its kind to investigate amphorae collections from local shipwreck sites, while all earlier amphorae studies were limited to single sites or areas. Further, conducting detailed investigations of the combined amphorae collections provided a meaningful conclusion regarding the trade network and connectivity in the ancient Mediterranean Sea.

The date range for examining the commercial ties of Alexandria started from the Hellenistic period, when Alexander founded the city, to the late Roman period, when the city enjoyed great prosperity and was an important node in an extensive maritime trade network. This thesis highlighted the pre-Hellenistic period and the Islamic period to shed light on trade patterns before the establishment of Alexandria and how these patterns fluctuated across the time periods until the decline of the city during the Islamic period.

In addition, local and imported amphorae collections from the terrestrial sites show the diversity of the amphorae types transported across the time periods. Previous studies that examined the amphorae from terrestrial sites were used in this work as comparative datasets to identify the correlated patterns with the hypotheses generated from the network analysis data. This thesis also used published materials, preliminary reports and grey literature resources to investigate, support and assess the results and conclusions from the network analyses. This research basically provided an example of a non-intrusive archaeological study and what could be learned and accomplished from the published data and grey literature to draw a historical conclusion through additional analyses, such as applying network approach and theory.

9.2 Network Analysis Approach

The thesis applied a network analyses approach on amphorae finds in order to evaluate their contribution to the broader economic history of Alexandria. This approach lends itself well to the amphorae finds recovered from the underwater and land sites as this material group provides a broad range of geographical and chronological data that is well suited to network analysis and the examination of temporal changes.

Applying network analyses provided a new perspective and culminated in mathematical hypotheses related to the published and unpublished amphorae collections. It provided dynamic networks for each period and served as a tool to visualise the fluctuations in the usage of the amphorae types, the demand for the transported products and the prominent production regions across the periods. It is worth noting that interpreting the results within a comparative archaeological and historical framework revealed the prominent amphorae types, transported products and production regions across the periods.

Furthermore, network analysis aided the tracking of changes in maritime trade networks in the Mediterranean Sea from the pre-Hellenistic period until the Islamic period. This has led to new insights to the Mediterranean maritime trade networks along with providing the field of amphorae studies with a better understanding of the trade patterns and maritime connectivity in the Mediterranean Sea.

9.3 Key Findings: Maritime Trade Networks and Connectivity

Network analysis was the main method used in this thesis to answer the following research question:
What do transport amphorae recovered from underwater and related terrestrial sites along the Alexandrian coast tell us about trade networks, connectivity and the economic history of the region from Alexandria's foundation in the fourth century BC to the fifth century AD?

The network analysis provided some key findings regarding maritime trade networks and connectivity between Alexandria and the rest of the Mediterranean Sea. The key findings are based on the following aspects: production regions, transported products and amphorae types.

9.3.1 The Production Regions

- The Aegean region was the most notable production centre during the pre-Hellenistic and Hellenistic period
- Local production flourished and was prominent by the early Roman period

- The mid-Roman period was witness to an increasing scale of import from the Central Mediterranean
- By the late Roman period, the main imported production region to Egypt changed to the Eastern Mediterranean
- The Islamic period was witness to self-sufficiency of local production due to the huge decline in the scale of imports and trading activities.

9.3.2 The Amphorae Types

- Klozomenai, Thasos and Chain amphorae were the most prominent during the pre-Hellenistic period
- Despite the prominence of the Rhodian and Lamboglia II amphorae during the Hellenistic period, Koan and Greco-Italic/Will form I were in demand as well
- By the early Roman period, the local amphorae AE3 came to prominence; however, Dressel 6A was in use on a considerable scale by that period
- Africana I amphorae and Kapitain II amphorae were the most used amphorae types during the mid-Roman period; however, African I was the most prominent type
- Late Roman 4 amphorae (LR4) were imported extensively to Alexandria during the Late Roman period alongside Late Roman 1 amphorae (LR1), but on a modest scale. Moreover, the Late Roman period was witness to increasing local production, like Amphorae Égyptienne 3 late (AE3) late/AE3T-2, variant B, AE5 and AE7
- By the Islamic period, the local amphorae AE3 Late/AE 3T-3.2, variant B was the most used amphorae in Alexandria.

9.3.2 The Transported Products

Wine was the most prominent transported product across most of the periods except during the mid-Roman period due to the prominence of olive oil.

9.4 Reflections

According to the results generated using the combined valued data through the social network analysis software, the maritime trade network between Alexandria and the rest of the Mediterranean Sea fluctuated across the time periods between dense and sparse networks as the follows:

- Based on the amphorae types aspect, the early Roman period network was the densest with 30 nodes and 29 ties. In contrast, the pre-Hellenistic period was a witness of the sparsest network with 11 nodes and nine ties (see Figures from 7.12 to 7.17 in chapter 7)

- According to the transported products aspect, the networks of early and late Roman periods were the densest with six nodes and five ties each. The Islamic period was sparse with four nodes and three ties (see Figure 7.18 in Chapter 7).
- Based on the production regions aspect, the early Roman network was extensive with seven nodes and six ties. In contrast, the pre-Hellenistic and Islamic periods networks were sparse with five nodes and four ties each (see Figure 7.19 in Chapter 7).

While it is important to consider the three previous aspects to estimate the density of the maritime trade networks of Alexandria, the production regions aspect is the most significant for estimating maritime connectivity. This is because the production region aspect is spatial. Consequently, the maritime trade network between Alexandria and the rest of the Mediterranean Sea was dense and extensive during the early Roman period (see also Section 8.1.5 in Chapter 8). Further, the trade networks declined to their lowest scales during the pre-Hellenistic and Islamic periods. It is striking to note that the early Roman period was witness to extensive local production. Further, Egypt was the most notable production region by that period, as mentioned earlier.

9.4.1 Ancient Alexandria economic history

As highlighted in Chapter 2, the political situation, natural disasters and populations' needs in Alexandria and the Mediterranean Sea were the main reasons behind the fluctuations of trade volume. In other words, the trade and exchange volume was high during the Hellenistic period due to increasing immigration rate from all around the Mediterranean to Egypt, which led in turn to increasing imports to cover the populations' needs. Especially Egypt in general, and Alexandria in particular, was distinguished by its diversity as up to eight different nationalities occupied Alexandria during the Hellenistic period, including Greeks, Jews and Levantines, along with people from Libya, Carthage, Italy, Marseille and India (Cankardeş-Şenol 2013:387).

As mentioned in Chapter 1, during the reign of Ptolemy II (285–246 BC.) merchants from all around the Mediterranean came to Alexandria to acquire or trade products. It is worth noting that the Alexandrian lighthouse was built during the Hellenistic period (El-Abbadi 2000:17–18; Blackman 1982:186; Casson 1989:13; El-Zouka 1979:75; Said 2002). Nevertheless, the maritime trade activities started earlier, especially with the Aegean region as mentioned in Chapter 2 and confirmed by the pre-Hellenistic amphorae evidence located at Aboukir Bay and Marsa Oum El-Rakham.

By the early Roman period, maritime trade extensively expanded and flourished due to Roman success in abolishing piracy in the Mediterranean Sea (Souza 1992:211–213). Despite this success

in the trade activities, the mid-Roman period was witness to a decline in the trade volume of Alexandria because of the damage affecting Alexandria's buildings during the destructive earthquake and Tsunami that hit the city in AD 365 (EL-Sayed, Korrat and Hussein 2004:1003–1019; Pararas-Carayannis 2011:274–275). Further, the division of the Roman Empire during the mid-Roman period affected the trade patterns between Alexandria and the rest of the Mediterranean. The main impact was the expansion of trade activities with the Eastern Mediterranean instead of the Western Mediterranean after Constantinople became the new capital of the Empire (Keay 1984b:414–428; Peacock and Williams 1986:57; Reynolds 1995:109).

By the late Roman period, religious conflicts started to explode and were widespread in Alexandria, which caused another decline in trading activities (Kaplow 2005:2–4; Kristensen 2010:158–175; North 2017:1–32). After that, maritime trade was ruined in the city during the Islamic period due to the decision by Ahmed Ibn Touloum, who ruled Egypt by AD 868, to suspend foreign trade (Conermann 2004:115–139).

9.4.2 Production

The Mediterranean regions discussed in this thesis were dynamic and productive across all periods. It is worth noting that the fluctuations measured in this thesis regarding the prominent production regions give no indication about the end of production of the other regions. As mentioned in Chapter 8, every production region prospered during a specific period due to the political situation in that region alongside change in the populations' needs.

As for the local production, no production was observed during the pre-Hellenistic period while the Hellenistic period was witness to production on a massive scale. This scale declined across the Roman periods to reach its lowest during the Islamic period. It is worth stressing again that the stable political situation played a critical rule in the constancy of the local production.

As mentioned before, all the production and agricultural activities were conducted in the Mareotic region (Alexandria's hinterland), which was used mainly for covering the local needs in the first place and for commercial purposes as well, as discussed in Chapter 8. Alexandria covers the needs of the wealthier inhabitants by importing products from the surrounding Mediterranean neighbours, as well as from India and Arabia.

9.4.3 Distribution

While local production was consumed mainly locally, it was exported to some countries around the Mediterranean and beyond, although tracking the Egyptian amphorae distribution is out of the scope of this thesis. Hence, further and detailed study needs to be undertaken to examine the distribution

patterns of the local amphorae, which might reveal new global connections and relationships between Egypt and the rest of the world.

9.4.4 Consumption

The amphorae evidence combined with the written sources and previous studies proved that Alexandria was a significant consumer city rather than a productive one, as all the production activities were in the Mareotic region as mentioned earlier. Alexandria was a crossroads and transhipping point for transferring products as far as India, Rome and beyond (Rickman 1980:231–235). In all, Alexandria had a continuous commercial role as a trading point and crossroads. It created large and strong maritime networks connecting more than 50% of the ancient world together.

9.5 Limitations

It is worth noting that the results of this thesis were based on the amphorae collections located along the Alexandrian coastline and its extension to the North-Western Coast. One of the limitations of this thesis is using the previous publications and preliminary reports as a secondary resource because no direct access was granted to some of the amphorae collections. The network analysis models so generated were dependent upon the quality of the input data. Therefore, the comparative amphorae data were limited to the type and quality of that available from relevant studies. Nevertheless, as mentioned in the introduction, the network analysis model remains valid for future applications and can be improved as new or better data becomes available, as locating more amphorae evidence and more types would give another perspective to the network analysis models of this thesis.

The survival of considerable amounts of specific types of amphorae rather than other types could be due to the surrounding environmental conditions which provided appropriate protection and preservation to these amphorae types. There is no doubt that the maritime environment plays a critical role in protecting and preserving the archaeological evidence along the centuries. Nevertheless, the location of archaeological sites close to the shore, exposing the sites to environmental processes and to fishing activities, or being accessible to recreational divers, is a direct threat to the survival of the archaeological evidence.

Considering these threats while investigating the archaeological evidence is significant, especially with regard to quantities and mathematical studies. In other words, the enormous amounts of particular amphorae types could be because they were protected against the surrounding threats or were recovered immediately after the site was found. If this is the case, the results generated from

the recovered amphorae collections regarding identification of the prominent amphorae types may be uncertain; however, this is not the case due to the correlations revealed between the network analysis results and the historical records and written sources.

9.6 Recommendations and Future Research

As mentioned in Chapter 4, the update undertaken by Wilson (2011) for Parker's (1992a) Mediterranean shipwrecks' database is a crucial step regarding having an up-to-date shipwreck record. Providing this record with detailed data regarding the wrecks' cargoes (types, amounts, conditions) along with making it an open access digital source would benefit future scholars and researchers. Conducting further investigations and examinations of these shipwreck databases and cargo materials would provide a global view of maritime trade. Further, applying the network analysis approach to track the fluctuations in trade of other ceramics types (cups, vases, oil lamps, cooking and table wares) located among the shipwrecks' cargoes would provide another perspective to the trade patterns and connectivity in ancient times.

By the same token, investigating the other cargo types like metals (ingots, jewellery, coins, tools, utensils), glass (bottles, vases) and organic materials would present a comprehensive image of the maritime trade networks in the Mediterranean and beyond. It is worth stressing that considering this type of data analysis would protect the archaeological sites from destructive excavations and preserve the archaeological evidence from intrusive analyses. Especially meaningful conclusions could be drawn through a detailed investigation of the unstudied archaeological records, databases, preliminary reports, grey literature and written resources. Moreover, using these databases will be beneficial in tracking the distribution and the movement of the Egyptian amphorae, or any other amphora type. Further, investigating in depth the trade patterns during the Pre-Hellenistic period (Pharaonic, Persian) using material culture would provide a view of the very early trade patterns and relationships that shaped the community by that time.

Nevertheless, conducting intrusive analysis like thin section petrography, chemical analysis or DNA will provide answers to unsolved issues regarding the uncertainty of the transported products in some amphorae types, like Spatheia, Basket-handle amphora Type 3 and AE 8-1, variant B. Further, it would confirm many hypotheses related to the contents and the production source. For example, conducting DNA analysis to identify the contents of the amphorae evidence would give new insights and evidence for the reuse of amphorae. Similarly, undertaking petrographic and chemical analysis on specific amphorae collections/types would confirm their production sources. Despite the benefits that could be gained from conducting intrusive analysis, protecting the material culture for

future generations has the priority based on the 2001 UNESCO *Convention on the Protection of the Underwater Cultural Heritage*, as mentioned in the introduction.

Finally, it is worth stressing that this thesis notes the connections between people through objects, which are in this case, amphorae. It proved that using the available date like archaeological records, preliminary reports, previous studies associated with the epigraphical and textual records, along with non-intrusive archaeological study has great potential to provide new and original contributions to knowledge. Also, finding parallel patterns and correlations between the different hypotheses generated from the network analyses alongside the previous studies, historical records and written resources proved the validity of the data used in this thesis.

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11.1. APPENDIX 1 AMPHORAE COLLECTIONS INFORMATION SHEETS

11.1.1 The Egyptian North-Western Coast

11.1.1.1 Ras El-Hekma

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Nearly complete amphora with everted rim and curved handles. The neck is cylindrical with round shoulder and narrow body. As for the base, it is missing.</td><td rowspan="10"> 
Photograph from INA-Egypt/CMAUCH Archive 1996.
Reproduced by the author. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 72 cm</td></tr>
<tr><td>Width: 15 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 10 cm</td></tr>
<tr><td>Internal diameter: 4 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 19 cm</td><td rowspan="11">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 10 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Spatheion 1/ Keay XXV</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Tunisia</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fourth century AD to fifth century AD</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Uncertain, suggestion of olives (Santamaria 1995).</td></tr>
<tr><td><u>Site/GPS coordinates</u></td><td colspan="2">Ras El-Hekma
31 13.965 N 027 52.035 E</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with wide triangular rim, curved two handles attached to the rim. The neck is broad and attached to a peer shaped body. The base is hollow and long.</td><td rowspan="13"> 
Photograph from INA-Egypt 1996 /CMAUCH Archive
Reproduced by the author. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Remains of concretions cover parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 32 cm</td></tr>
<tr><td>Width bottom: 21 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 10 cm</td></tr>
<tr><td>Internal diameter: 6 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 11 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length:12 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>7 cm</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Beltrán 72</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">South Spain</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western Mediterranean and North Africa</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Mid. third century AD to fifth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Fish sauce</td></tr>
<tr><td><u>Site/GPS coordinates</u></td><td colspan="2">Ras El-Hekma
31 13.965 N 027 52.035 E</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with wide flaring rim and slightly curved short handles. The neck is cylindrical, and the body is peer shaped with short base (part of the base is missing).</td><td rowspan="10"> 
Photograph from INA-Egypt 1996/CMAUCH Archive. Reproduced by the author. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 90 cm</td></tr>
<tr><td>Width: 38 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 20 cm</td></tr>
<tr><td>Internal diameter: 13 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 17 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 16 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 9</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">South Spain</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Fish sauce</td></tr>
<tr><td><u>Site/GPS coordinates</u></td><td colspan="2">Ras El-Hekma
31 13.965 N 027 52.035 E</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">A broken amphora with short neck; carinated shoulder and carrot shaped body. Some grooves cover the whole body.</td><td rowspan="5"> 
Photograph from INA-Egypt 1996/CMAUCH Archive. Reproduced by the author. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Concretions cover parts of the piece</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 44 cm</td></tr>
<tr><td>Width: 17 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 8 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">LR7</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Mareot)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Late fourth century AD to seventh century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
<tr><td><u>Site/GPS coordinates</u></td><td colspan="2">Ras El-Hekma
31 13.965 N 027 52.035 E</td></tr>
</table>

11.1.1.2 Ras Hashafa

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Broken amphora with triangular rim. The handles are short and bowed handles attached to tall and cylinder neck. The body is tapered and ends with pointed base which is broken but not missing.</td><td rowspan="11"> 
Photograph from INA-Egypt 1996/CMAUCH Archive. Reproduced by the author. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 70 cm</td></tr>
<tr><td>Width: 30 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 13 cm</td></tr>
<tr><td>Internal diameter: 10 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 24 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 18 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE2-3 (The transition type between AE2 and AE3) (Dixneuf 2011:93).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td>Distribution areas</td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td>Clay visual characteristics</td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">The last quarter of the first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
<tr><td><u>Site/GPS coordinates</u></td><td colspan="2">Ras Abou Hashafa
GPS (Unknown)</td></tr>
</table>

11.1.1.3 Ras Hawala

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with round and broken rim. The handles are long and attached to cylindrical neck. The body is tapered and ends with ton-toe.</td><td rowspan="11"> 
Photograph from INA-Egypt 1996/CMAUCH Archive. Reproduced by the author. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Concretions cover parts of the piece</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Koan</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Kos</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fourth century BC to third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
<tr><td><u>Site/GPS coordinates</u></td><td colspan="2">Ras Hawala
31 12.366 N 027 33.374 E</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with round rim and two long handles. The neck is cylindrical, and the body is tapered and ends with ton-toe.</td><td rowspan="2"> 
Photograph from INA-Egypt 1996/CMAUCH Archive. Reproduced by the author. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Concretions cover parts of the piece</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td><td rowspan="12">N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Koan</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Kos</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Aegean and eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fourth century BC to third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
<tr><td><u>Site/GPS coordinates</u></td><td colspan="2">Ras Hawala
31 12.366 N 027 33.374 E</td></tr>
</table>

11.1.1.4 Marsa Bagoush

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains tall cylinder neck with two intact, long and straight double handles attached below the round lip rim and the shoulder. Part of the shoulder is presented.</td><td rowspan="15"> 

Photographs by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Heavy concretion and seashells on the piece’s surface.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Reddish Brown</td></tr>
<tr><td>Slip</td><td>Yellowish Brown (10YR 6/6)</td></tr>
<tr><td rowspan="13"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 28 cm</td></tr>
<tr><td>Max. width: 26 cm</td></tr>
<tr><td>Thickness: 1.4</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter:13.5 cm</td></tr>
<tr><td>Internal diameter: 9.5 cm</td></tr>
<tr><td>Width: 2 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height:19 cm</td><td rowspan="12"></td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 18 cm</td></tr>
<tr><td>Width 1: 2.3 cm
Width 2: 1.6 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 2-4 Pompeiian shape</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Pompeii (Italy)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Yellowish brown clay and sandy texture, with weight and grey inclusion.</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">End of the first century BC to the mid. second century AD.</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with long cylinder neck and two intact round short handles. The handles attached to the neck just below the broken rim. Part of the shoulder is presented, and part of the rim is broken and missing.</td><td rowspan="9"> 
 
Photographs by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Heavy concretion inside the piece, and some on the surface of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>Brown (7.5YR ¾)</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 30 cm</td></tr>
<tr><td>Max. width: 21.4 cm</td></tr>
<tr><td>Thickness: 1.4 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 12 cm</td></tr>
<tr><td>Internal diameter: 9 cm</td></tr>
<tr><td>Width: 2 cm</td></tr>
<tr><td>Thickness: 1.4 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 24 cm</td><td rowspan="10"></td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 13 cm</td></tr>
<tr><td>Width: 2 cm</td></tr>
<tr><td>Thickness: 2.7 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3/ AE 3-1.5 variante B (Dixneuf 2011:110)</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Brown clay and soft texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century AD – third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Long oval handle pointed on top.</td><td rowspan="3"> 
Photographs by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. The handle contains some cracks and light concretion.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Brown</td></tr>
<tr><td>Slip</td><td>Brown (7.5YR ¾)</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td>Rim</td><td>N/A</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>N/A</td><td rowspan="11"></td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 19 cm</td></tr>
<tr><td>Width: 2 cm</td></tr>
<tr><td>Thickness: 2.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Knidian middle</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Knidos</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Brown soft texture clay.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora; the neck is tall and cylindrical with two intact double fake and straight handles. It contains broken round rim and part of the shoulder is presented.</td><td rowspan="8"> 
Photographs by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Heavy concretion inside the amphora, on the surface combined with some seashells. The lower parts of the handles covered with solid coral. The handles are not similar; their dimensions are different from each other as shown below).</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Brown</td></tr>
<tr><td>Slip</td><td>Yellowish brown (10YR 6/6)</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 30 cm</td></tr>
<tr><td>Max. width: 26 cm</td></tr>
<tr><td>Thickness: 1.6 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 14 cm</td></tr>
<tr><td>Internal diameter: 10 cm</td></tr>
<tr><td>Width: 2 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 19 cm</td><td rowspan="11"></td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 20 cm</td></tr>
<tr><td>Width (Left one): 2.3 cm / 2.1 cm
Width (Right one): 2.8 cm / 1.6 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 2-4 Pompeiian shape</td></tr>
<tr><td><u>Production area/origin</u></td><td colspan="2">Uncertain (suggestion Mareot)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Yellowish brown clay and the texture is sandy.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">End of the first century BC to the mid. second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Nearly complete amphora with round rim and cylinder neck. The handles are slightly higher at the edges and continue straight to the shoulder. The body is oval, and the base is broken and missing.</td><td rowspan="6"> 
Photograph from INA-Egypt 1996/CMAUCH Archive. Reproduced by the author. Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">A layer of shiny black resin visible in the interior walls of the piece (Haldane 1996).</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 90 cm</td></tr>
<tr><td>Width: 30 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 13 cm</td></tr>
<tr><td>Internal diameter: 11 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 25 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 20 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Knidian late</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Knidos</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete intact amphora, the rim is round, and the handles are short, and round attached to the cylindrical neck just below the rim. The neck contains grooves. The body is tapered (wide top and narrower down) with pointed base.</td><td rowspan="11"> 
Photograph from INA-Egypt 1996/CMAUCH Archive. Reproduced by the author. Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3/AE 3-1.5 variante B (Dixneuf 2011:110)</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt Marotic/ Nile Delta</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century AD to third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 004</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with triangular rim. The neck is tall and cylindrical, and the handles are short and bowed. Part of the shoulder is presented.</td><td rowspan="3"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">The concretions cover parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>Yellowish brown</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 34.5 cm</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: 19.5 cm</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 25.5 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 18 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE2-3 (The transition type between AE2 and AE3) (Dixneuf 2011:93).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Sandy and coarse texture with white and black inclusions.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">The last quarter of the first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 005</td><td><u>Photograph</u></td></tr>
</table>

<table>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains two intact round and bowed handles attached to the cylindrical neck.</td><td rowspan="2"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td><td></td></tr>
<tr><td>Slip</td><td>N/A</td><td></td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 33 cm</td><td rowspan="2"></td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.5 cm</td><td></td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td><td rowspan="3"></td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td><td></td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 23 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 15 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3/AE 3-1.5 variante B (Dixneuf 2011:110)</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD – fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 015</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains long cylinder neck and one intact long handle. The second handle is broken and missing. Part of the neck and rim is broken and missing.</td><td rowspan="6"> 
Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Concretion cover parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 29.5 cm</td></tr>
<tr><td>Width: 12 cm</td></tr>
<tr><td>Thickness: 0.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 27 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 20 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 3 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE2-3 (The transition type between AE2 and AE3) (Dixneuf 2011:93).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">The last quarter of the first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 016</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains long cylinder neck with one intact short and bowed handle.</td><td rowspan="5"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Concretion cover parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 29 cm</td></tr>
<tr><td>Width: 13.5 cm</td></tr>
<tr><td>Thickness: 0.6 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 15 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3/AE 3-2, variante A (Dixneuf 2011:112–113).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">first century AD to second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 017</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains long cylinder neck with one intact short and bowed handle. The second handle is missing, and part of the shoulder is presented.</td><td rowspan="2"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Concretion cover parts of the piece</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dark brown</td><td rowspan="12"><u>Drawing</u>
N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 38.5 cm</td></tr>
<tr><td>Width: 25.5 cm</td></tr>
<tr><td>Thickness: 0.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 27 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 18 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE2-3 (The transition type between AE2 and AE3) (Dixneuf 2011:93).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Sandy texture with white inclusions.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">The last quarter of the firstcentury B.C</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 019</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains long cylinder neck with two intact, short and bowed handles. The rim is triangular, and part of the shoulder is presented.</td><td rowspan="10"> 
Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 35 cm</td></tr>
<tr><td>Width: 11.5 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 16.2 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 13 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE2-3 (The transition type between AE2 and AE3) (Dixneuf 2011:93).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Similar located at south Egypt)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">The last quarter of the first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains long cylinder neck with two intact short and bowed handles.</td><td rowspan="6"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3/type AE 3-2, variant A (Dixneuf 2011:112–113)</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD – third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 012</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains long cylinder neck with two intact, short and bowed handles attached to the rim.</td><td rowspan="8"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Light concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dark brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 24 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 21.5 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 7.5 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3 Late/AE 3T-3.2, variante B (Dixneuf 2011:141).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Alexandria, Carthage, Benghazi and Ostia.</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">seventh century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z1 001</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with long cylinder neck and two intact short and bowed handles attached to the round rim. Grooves covers the neck.</td><td rowspan="5"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 41 cm</td></tr>
<tr><td>Width: 23 cm</td></tr>
<tr><td>Thickness: 1.4 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 31 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 15 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3/ AE3-I.4 (Dixneuf 2011:108)</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Alexandria-Mareotic Region)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 015</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with long cylinder neck and one intact short and bowed handle attached to the round rim. Grooves covers the neck.</td><td rowspan="2"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td><td rowspan="11"><u>Drawing</u>

N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 26 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.3 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 21 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 10 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3 Late/ AE 3T-2, variant B (Dixneuf 2011:139–140)</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fourth century AD to fifth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 007</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Part of amphora’s neck with intact round rim and two short and bowed handles attached to the round rim.</td><td rowspan="5"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 16 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 10.2 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 3 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3 Late/ AE 3T-3.2, variante B (Dixneuf 2011:141).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Alexandria, Carthage, Benghazi and Ostia.</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">seventh century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z1 019</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Part of the upper part of amphora. The neck is short and narrow, and the rim is collar. The handles are wide bowed and parts of it are broken and missing.</td><td rowspan="6"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 10.5 cm</td></tr>
<tr><td>Width: 7 cm</td></tr>
<tr><td>Thickness: 0.7 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 9 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 6 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.2 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Agora G 197/Crétoise 1</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Crete</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">first century AD to mid. fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains tall cylinder neck with two intact, long and double handles. Part of the shoulder is presented.</td><td rowspan="6"> 
Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 2-4 Pompeiian Shape</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Pompeii (Italy)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">End of first century BC to the mid-second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains broken round lip rim, the neck is hourglass shape attached with the carinated shoulder. The double pointed handles attached below the rim.</td><td rowspan="6"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish dark brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 2-4 (Italian Campanian shape)</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Uncertain</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 008</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with round wide everted rim and no neck. Only one short and round handle is still presented. Lots of grooves presented.</td><td rowspan="6"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion and seashells cover parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Late Roman 4</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Palestine (Gaza)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century to fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with round simple rim, long cylinder neck and two long and slightly curvy handles.</td><td rowspan="3"> 
Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="11">N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE2-3 (The transition type between AE2 and AE3) (Dixneuf 2011:93).</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Similar located at south Egypt)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">The last quarter of the first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 019</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with collar round rim, short neck and one short and curvy handle.</td><td rowspan="5"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: 22 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 17 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 12 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 3 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Brindisi</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Italy</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century BC to first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 011</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with triangular rim (mushroom shape) with long cylinder neck. One of the handles is broken and missing, the other one is long and straight.</td><td rowspan="2"> 


Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">This piece is distinguished with a stamp on the existed handle; the stamp is not clear.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dark brown</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="12"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="12">N/A</td></tr>
<tr><td>Width: 14.5 cm</td></tr>
<tr><td>Thickness: 3 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 22 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 18.5 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 4 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Greco-Italic /Will form A2</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Sicily – Italy</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Mid. fourth century BC to third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 006</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with triangular rim (mushroom shape) and long cylinder neck. The handles are long and straight.</td><td rowspan="2"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="12"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 24.5 cm</td><td rowspan="12">N/A</td></tr>
<tr><td>Width: 17.5 cm</td></tr>
<tr><td>Thickness: 4.3 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 21.2 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Greco-Italic/Will form A2</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Sicily – Italy</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Mid. fourth century BC to third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 003</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with triangular rim (mushroom shape) with short neck and one slightly round short handle. Part of the shoulder is presented.</td><td rowspan="5"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 27 cm</td></tr>
<tr><td>Width: 15 cm</td></tr>
<tr><td>Thickness: 3 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 12 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 12.5 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 4 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Greco-Italic/Will form A1</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Sicily – Italy</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Mid fourth century BC to third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z1 021</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with tall cylinder neck and one long and double handle. The rim is round, the other handle is broken and missing. Part of the shoulder is presented.</td><td rowspan="9"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dull brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 2-4 Pompeiian shape</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Pompeii (Italy)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">End of the first century BC to the mid. second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z1 022</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains long cylinder neck with intact round rim. The handles raise as higher as the rim and parts of it broken and missing.</td><td rowspan="2"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="12"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="12">N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian middle</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century BC until the second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 018</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains round rim and short cylindrical neck. The handles are curvy attached to the neck just below the rim.</td><td rowspan="5"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 13 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 8.4 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 11 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Subgroup late Roman 13, close to Peacock and Williams Class 54</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Cyprus</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Sixth century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unknown</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 012</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains concave rim and very short neck. The handles are short, and round attached to the rim. Part of the shoulder is presented and contains grooves.</td><td rowspan="8"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 9.3 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 0.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 2.5 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 7 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Byzantine (Suggestion)</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unidentified</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 002</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains a wide triangular rim, short neck and two round short handles.</td><td rowspan="3"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellow</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 16.5 cm</td><td><u>Drawing</u></td></tr>
<tr><td>Width: 23.5 cm</td><td rowspan="10">N/A</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 2.5 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 11 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Byzantine (Suggestion)</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unidentified</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 018</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains round rim and two round handles starting with short neck.</td><td rowspan="5"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 16 cm</td></tr>
<tr><td>Width: 23 cm</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 7.8 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 7 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 3.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE8-2/ imitations for LR7</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Seventh century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 007</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains round rim and two short curvy handles. The neck is short and covered with some grooves.</td><td rowspan="2"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish Brown</td><td rowspan="11"><u>Drawing</u>

N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 21.5 cm</td></tr>
<tr><td>Width: 10.5 cm</td></tr>
<tr><td>Thickness: 1.2 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 10.5 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 11.5 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 3.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Byzantine (suggestion)</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unidentified</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 013</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with wide round rim. The neck is upside down in a triangular shape. The handles rise to the edge but not as the same level as the rim.</td><td rowspan="6"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 17.8 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 10.4 cm</td><td rowspan="8">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 12 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Günsenin 2</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Unknown</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Aegean, Black Sea</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Mid. 11th century AD to early 12th century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">N/A</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z1 002</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with broken round lip rim, pyramid shape neck and two curvy bowed short handles.</td><td rowspan="4"> 

Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Orange brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Width: N/A</td><td rowspan="10">N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Globular</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Aegean, Cyprus, or Italy</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Seventh century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with round lip rim, pyramid shape neck and two curvy bowed handles.</td><td rowspan="6"> 
Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Orange brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Globular</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Aegean, Cyprus, or Italy</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Seventh century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z2 014</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with wide triangular shape rim and short neck. One of the handles is broken and missing, the other one is round and short. This handle is thick and wide with a concave groove in the middle.</td><td rowspan="11"> 


Photographs by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion and seashells cover parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 12.3 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 6.5 cm</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 9.5 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Bailey O 17</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Ninth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">N/A</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with collar rim and cylindrical neck. The handles are thick and curvy.</td><td rowspan="2"> 
Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretions cover parts of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Brown</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="11">N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Bailey V 17-18</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Hermopolis)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Sixth century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">Z3 001</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains flared mouth with short neck and two thick and wide handles. Some grooves appear below the neck. Part of the body is presented.</td><td rowspan="6"> 
Photograph by E. Khalil 2017. © Copyright 2020, with permission from E. Khalil.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dark brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 34 cm</td></tr>
<tr><td>Width: 50 cm</td></tr>
<tr><td>Thickness: 2.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 8 cm</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 18 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Bailey W26-8</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Egypt (Hermopolis)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Ninth century AD to tenth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Water, dried food</td></tr>
</table>

11.1.2 The Alexandrian Coastline

11.1.2.1 Aboukir Bay

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">HXX 4268 - SCA 357</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with intact rim, two long curvy handles and short cylindrical neck. The shoulder is edgy, and the body is oval which ends with short base.</td><td rowspan="3">Removed due to copyright restriction
Photograph by Christoph Gerigk 2006 from Goddio and Fabre 2006:216).</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Concretion all around the surface of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 7.5YR 6.6</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 65 cm</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: 40 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Mendean</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Macedonia</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Greece and Aegean Sea</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Sixth century BC to fourth century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">H4 3650 - SCA 548</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Broken amphora with wide round rim and one round short handle. The body is wider at the top with sharp and pointed base at the bottom.</td><td rowspan="3">Removed due to copyright restriction
Photograph by Christoph Gerigk 2006 from Goddio and Fabre 2006:215).</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion and seashells present around the lower part of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellow 7.5YR 8.4</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 56 cm</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 30 cm</td><td rowspan="9">N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Persian Torpedo</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Phoenician coast</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Uncertain</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century BC until first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Cereal and fish</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">E8 5971 - SCA 846</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora, with round rim and two vertical handles. The neck is short, and the body is puffed below the handles, then narrower down and sharper towards the base.</td><td rowspan="3">Removed due to copyright restriction
Photograph by Christoph Gerigk 2006 from Goddio and Fabre 2006: 215, fig 364).</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Two wide brown color lines around the shoulder.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 6/4</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 42.5 cm</td><td><u>Drawing</u></td></tr>
<tr><td>Width: N/A</td><td rowspan="10">N/A</td></tr>
<tr><td>Thickness: 1.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 10.5 cm</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Klozomenai</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">North Ionian Asia Minor.</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Unknown</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Sixth century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unknown</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">HXX 2723 - SCA 609</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with long cylindrical neck and complete intact concave rim. The handle contains stamp like what was found in Rhodes and Knidos. The stamp is a motif of two letters maybe indicates to the potter.</td><td rowspan="5">Removed due to copyright restriction

Photograph by Christoph Gerigk 2006 from Goddio and Fabre 2006:230). The stamp’s photograph by Christoph Gerigk 2006 from Goddio and Clauss 2006:340).</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 8/4</td></tr>
<tr><td>Slip</td><td>Red</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 22 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 0.6 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 17 cm</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Greco-Italic/ Will form A2</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Sicily and Calabria (South Italy)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second half of fourth century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">HXX 6729 - SCA 865</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with thin round rim and two short semicircular handles. The body is oval with no prominent base.</td><td rowspan="4">Removed due to copyright restriction
Photograph by Christoph Gerigk 2006 from Goddio and Fabre 2006:234).</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Six lines around the shoulder covers the upper part of the body.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish dark brown 5YR 4/4</td></tr>
<tr><td>Slip</td><td>Red</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 46.5 cm</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: 1.7 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 9.5</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">LR4 / Almagro 54</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Palestine/Syria</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean and Black Sea</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A/</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century AD until fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine/ Olive oil/ Sesame oil</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphorae with simple round rim, short round handles and short neck. The body is oval body and ends with flat base.</td><td rowspan="11">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Unclear decoration appears around the body.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction

Drawing from Grataloup 2010:152, fig 12.3</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Klozomenai</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">North Ionian Asia Minor.</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Unknown</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">sixth century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unknown</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper half of amphora with intact two loop handles which raise higher than the rim level.</td><td rowspan="9">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness:</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction

Drawing from Grataloup 2010:153, fig 12.4.1</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Basket-handle amphora (Type 3)</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Cyprus</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Sixth century BC to fourth century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil (uncertain)</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Stamp contains a monogram/letters' signs indicate to a person's name.</td><td rowspan="8">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness:</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter:</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction

Drawing from Grataloup 2010:155, fig 12.7.1</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Knidian early</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Knidos</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century BC to second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Rhodian stamps contain names of persons. The left one is (ETTI Xpvo looTpaT ‘ou’) and the right one is (llAHMON) (Grataloup 2010:155).</td><td rowspan="9">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction

Drawing from Grataloup 2010:155, fig 12.7.2</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian mid</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Rhodian stamp contains the name of (Hippokrates). According to Grataloup (2010:156), it indicates to a producer.</td><td rowspan="9">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction

Photograph from Grataloup 2010:157, fig 12.10.1</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian mid</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Rhodian stamp contains the name of (Timourrodos) (Grataloup 2010:156).</td><td rowspan="10">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">Removed due to copyright restriction
Photograph from Grataloup 2010:157, fig 12.10.2</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian mid</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
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<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Rhodian stamp contains the name of (Mentor). According to Grataloup (2010:156), it indicates to a producer.</td><td rowspan="10">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height:</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
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Photograph from Grataloup 2010:157, fig 12.10.3</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian mid</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second half of the second century BC.</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
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<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Rhodian stamp contains the name of Nikasagoras (Grataloup 2010:156).</td><td rowspan="11">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="10">Removed due to copyright restriction
Photograph from Grataloup 2010:157, fig 12.10.4</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian mid</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Rhodian stamp contains the name of (Timaratos). According to Grataloup (2010:156), it indicates to a producer.</td><td rowspan="10">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="10">Removed due to copyright restriction
Photograph from Grataloup 2010:157, fig 12.10.5</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian mid</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

11.1.2.2 Mammura

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete intact amphora with narrow round rim, long conical neck and two long arched handles higher than the rim. The body is tapered and wider from above, while the base is hollow and long.</td><td rowspan="10">Removed due to copyright restriction
Photograph from Elsayed 2012. Reproduced by the author.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is existed.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 6/4</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Kapitän II</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Aegean/Asia Minor</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean, Black Sea, Ostia, Iraq, Britain, Greece, Germany.</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century AD until fourth century AD</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Wine (Uncertain)</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Nearly complete amphora; only the rim and one handle are broken and missing. The neck is long with one long arched handle higher than the rim. The body is tapered and wider from above, while the base is hollow and long.</td><td rowspan="11">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Three grooves around the neck and no stamp is presented.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">Removed due to copyright restriction
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Kapitän II</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Aegean/Asia Minor</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean, Black Sea, Ostia, Iraq, Britain, Greece, Germany.</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century AD until fourth century AD</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Wine (Uncertain)</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with narrow round rim and long conical neck. Two handles are long and arched and higher than the rim. Part of the shoulder is presented.</td><td rowspan="10">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Three grooves around the neck and no stamp is presented.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Kapitän II</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Aegean/Asia Minor</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean, Black Sea, Ostia, Iraq, Britain, Greece, Germany.</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century AD until fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine (Uncertain)</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora contains round and long cylinder neck with two round short small handles starting from the rim.</td><td rowspan="10">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Twelve grooves around the neck, two of them are between the handles.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3 Late/AE 3T-2, variant B (Dixneuf 2011:139–140)</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Egypt</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fourth century AD to fifth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Amphora’s neck with nearly intact thick curvy rim, two rounds curvy handles (human ear shape); part of one of them is broken and missing. Part of the shoulder is presented.</td><td rowspan="9">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Africana 2B Grande</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Tunisia</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Ostia, southern France and Lusitania</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century AD.</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil and fish products (Panella 1973).</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with thick collar round rim and two small curvy handles (human shape ear) and short neck.</td><td rowspan="10">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Africana 2D Grande</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Tunisia</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">End of third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Fish sauce or wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with long cylinder neck and round rim. The handles are long, and the body is oval with slightly pointed base.</td><td rowspan="8">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="6">Removed due to copyright restriction
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Cyrenaican I</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Cyrenaica</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Unknown</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fifth century BC to third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with round rim and two small vertical handles. Part of the shoulder is presented.</td><td rowspan="11">N/A</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">Removed due to copyright restriction

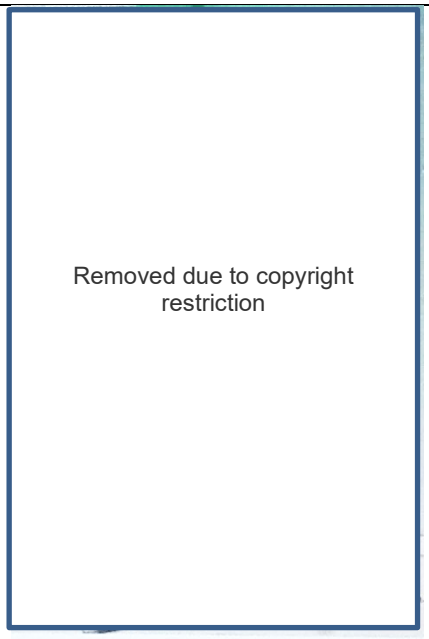
Drawing by M. Ghazala 1999 (from Elsayed 2012).</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Agora G 199</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Cilicia</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine and olive oil</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with cylindrical neck and triangular rim shape and one long handle.</td><td rowspan="4">Removed due to copyright restriction
Photograph from Ragheb 2011</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 2.5 YR6/4</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian early</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with short neck. The handles are short and vertical. Part of the shoulder is presented.</td><td rowspan="5">Removed due to copyright restriction
Photograph from Ragheb 2011</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Three lines/grooves cover the shoulder.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dark brown 5YR 4/4</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Günsenin 1</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Marmara Sea (Turkey)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean, Aegean and Black Sea</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Tenth century AD to 11th century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unknown</td></tr>
</table>

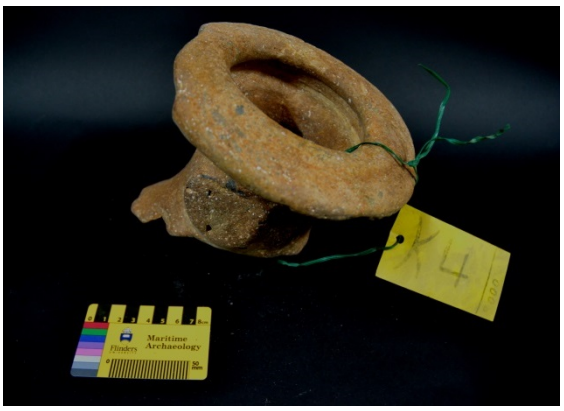
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with long cylindrical neck with intact round rim. The handles are long raise as higher as the rim.</td><td rowspan="5"> 

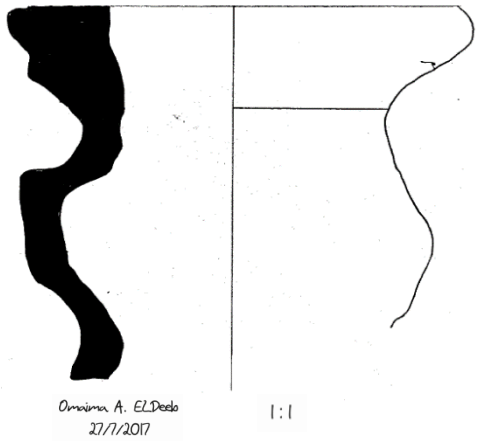
Photograph from Ragheb 2011</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dark brown
5YR 4/4</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="3">Rim</td><td>External diameter:
N/A</td></tr>
<tr><td>Internal diameter:
N/A</td></tr>
<tr><td>Width:
N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian Middle</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Late second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete cylindrical amphora with wide round rim and round base with no neck. The handles are short and round. Numbers of lines/grooves cover the upper part.</td><td rowspan="10"> 

Photograph from Ragheb 2011</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Dull brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Late Roman 4</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Gaza</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Sandy and smooth texture</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fourth century AD to sixth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine, olive oil and sesame oil.</td></tr>
</table>

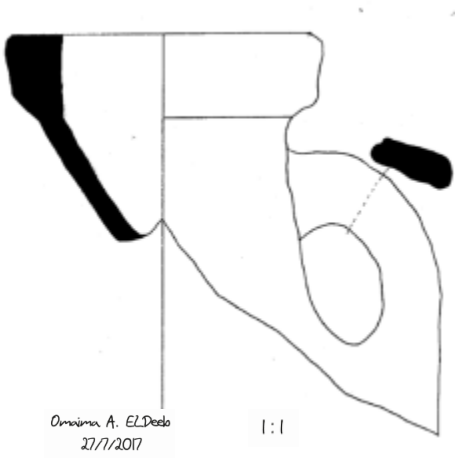
11.1.2.3 Ibrahimia

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">K 4</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Amphora’s neck with nearly complete concave thick rim, except some broken and missing pieces of its edges. The handles are broken and missing.</td><td rowspan="2"> 

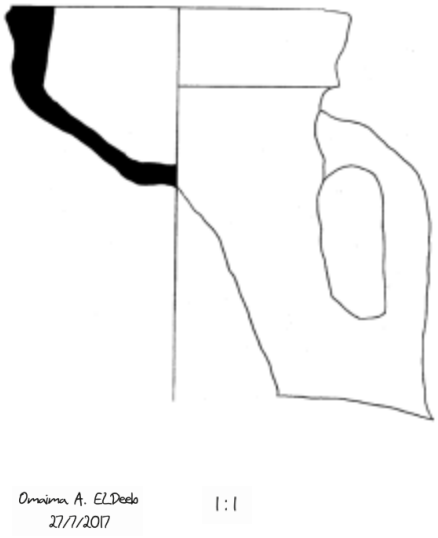
Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Two prominent parts indicate to the handles’ place. In addition to some light concretion around the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>Black</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 13.5 cm</td></tr>
<tr><td>Max. width: 16.9 cm</td></tr>
<tr><td>Thickness: 1.5 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 17.5 cm</td></tr>
<tr><td>Internal diameter: 9.5 cm</td></tr>
<tr><td>Width: 3.7 cm</td></tr>
<tr><td>Thickness: 3.7 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 9.8 cm</td><td rowspan="8"> 

Drawing by the author. © Copyright 2020</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 20</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Southern Spain</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">Grey clay with black spots/parts inclusions, sandy texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

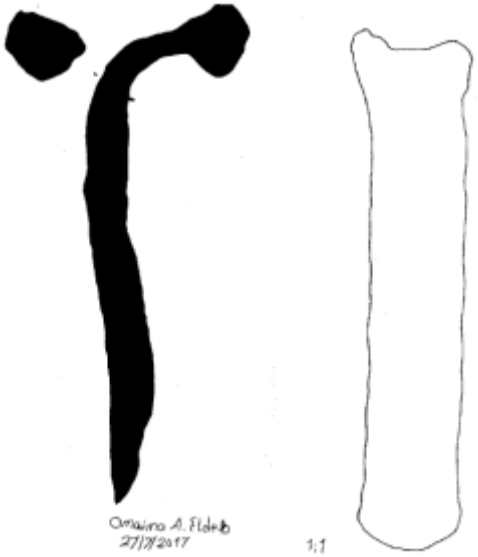
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">K 6</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Broken amphora’s neck with complete intact rim. The rim is wider from above. The round curvy handle contains prominent line in the middle.</td><td rowspan="8"> 

Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Heavy concretion inside the piece and crack appears in the rim.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>Yellow sandy</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 15 cm</td></tr>
<tr><td>Max. width: 18.9 cm</td></tr>
<tr><td>Thickness: 1. cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 13.7 cm</td></tr>
<tr><td>Internal diameter: 10.1 cm</td></tr>
<tr><td>Width: 3.6 cm</td></tr>
<tr><td>Thickness: 2.3 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 10.5 cm</td><td rowspan="5"> 

Drawing by the author. © Copyright 2020</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 12 cm</td></tr>
<tr><td>Width: 3.5 cm</td></tr>
<tr><td>Thickness: 2.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Tripolitanian III
Lepcis Magna (Libya)</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Libya</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">White inclusions and tough texture</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century BC to fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

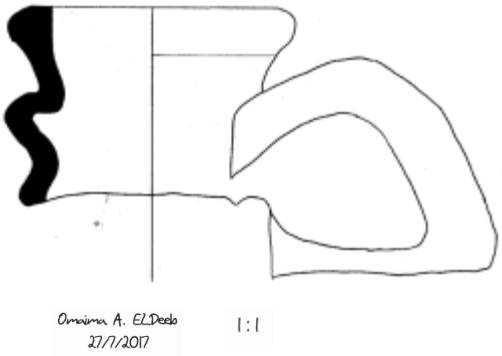
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">K 8</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Part of amphora’s neck with persevered one oval handle and complete intact rim. Part of the neck is broken and missing.</td><td rowspan="6"> 
Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some remains of concretion around the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>Reddish brown</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 19 cm</td></tr>
<tr><td>Max. width: 19.1 cm</td></tr>
<tr><td>Thickness: 1.2 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 15 cm</td></tr>
<tr><td>Internal diameter: 11.4 cm</td></tr>
<tr><td>Width: 3.5 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 10.5 cm</td><td rowspan="6"> 
Omaima A. ELDesb
27/7/2017
1:1
Drawing by the author. © Copyright 2020</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 14 cm</td></tr>
<tr><td>Width: 4.7 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Tripolitanian I
Pompeii</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Pompeii</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">White inclusions and tough texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century BC to first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">K 9</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Long and flat amphora’s handle.</td><td rowspan="3"> 

Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some remains of concretion around the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>Yellow</td></tr>
<tr><td rowspan="6"><u>Dimensions</u></td><td>Rim</td><td>N/A</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>N/A</td><td rowspan="5"> 

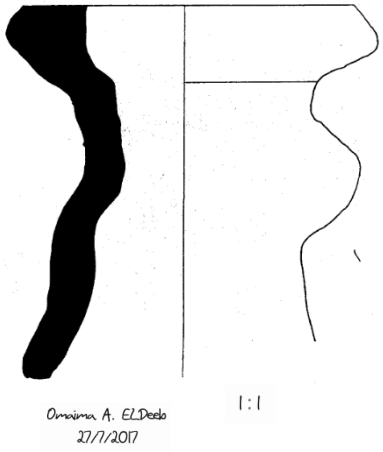
Drawing by the author. © Copyright 2020</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 16 cm</td></tr>
<tr><td>Width: 3 cm</td></tr>
<tr><td>Thickness: 1.6 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Greco-Italic Will form A2</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Sicily and Calabria (South Italy)</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean and North Africa</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">Light white inclusions and soft texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Fourth century BC to second century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">K 15</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with short neck and semicircular wide handle and complete intact round rim.</td><td rowspan="2"> 

Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td><td rowspan="11"></td></tr>
<tr><td>Slip</td><td>Gray</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 13 cm</td></tr>
<tr><td>Max. width: 20.8 cm</td></tr>
<tr><td>Thickness: 1.1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 12 c</td></tr>
<tr><td>Internal diameter: 9.8 cm</td></tr>
<tr><td>Width: 2 cm</td></tr>
<tr><td>Thickness: 1.3 cm</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 6 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 9 cm</td></tr>
<tr><td>Width: 3 cm</td></tr>
<tr><td>Thickness: 1.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 23</td><td rowspan="6"><u>Drawing</u>
 

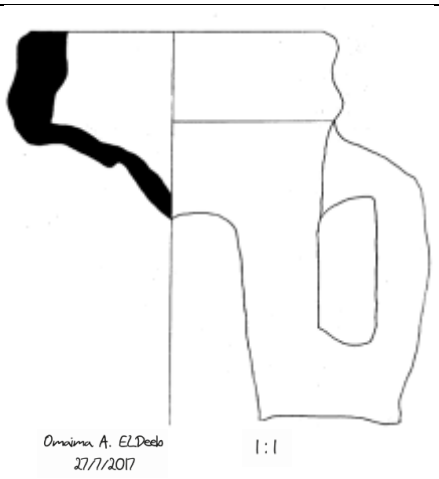
Drawing by the author. © Copyright 2020</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Spain – Western Mediterranean</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western Mediterranean, Black Sea and North Africa</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">White and black/gray inclusions with rough texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century AD to fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive products</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">K 20</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Amphora’s neck with completed concave intact rim. The handles are broken and missing; only small part of one handle is presented.</td><td rowspan="4"> 

Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">A cavernous sign at one side indicates to broken and missing handle, and a prominent small piece at the other side indicates to the place of the other handle.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>Dark brown</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 16.4 cm</td></tr>
<tr><td>Max. width: 15.8 cm</td></tr>
<tr><td>Thickness: 1.7 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter:15 cm</td></tr>
<tr><td>Internal diameter: 9 cm</td></tr>
<tr><td>Width: 3.4 cm</td></tr>
<tr><td>Thickness: 3.2 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 9.5 cm</td><td rowspan="5"> 

Drawing by the author. © Copyright 2020</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 20</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Southern Spain</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">Gray clay with black spots/parts inclusions, sandy texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">K 28</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Broken amphora’s neck with complete intact rim and one handle.</td><td rowspan="6"> 

Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some remains of concretion around the piece, in addition to obvious crack in the rim and transversal lines inside the pieces.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>Gray/Black</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: 20 cm</td></tr>
<tr><td>Max. width: 20.3 cm</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 16.2 cm</td></tr>
<tr><td>Internal diameter: 12.5 cm</td></tr>
<tr><td>Width: 4.3 cm</td></tr>
<tr><td>Thickness: 2.3 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 15.7 cm</td><td rowspan="5"> 

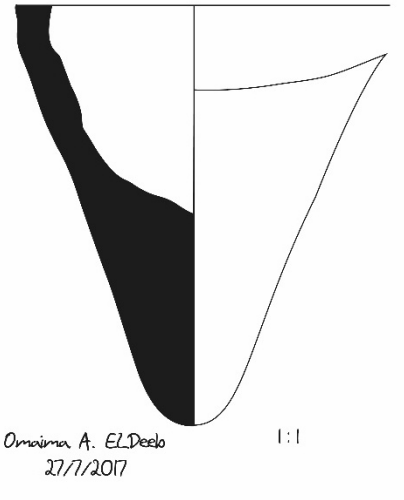
Drawing by the author. © Copyright 2020</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 12.7 cm</td></tr>
<tr><td>Width: 3.3 cm</td></tr>
<tr><td>Thickness: 2.6 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Tripolitanian I
Lepcis Magna (Libya)</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Libya</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">White inclusions and tough texture</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century BC to first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

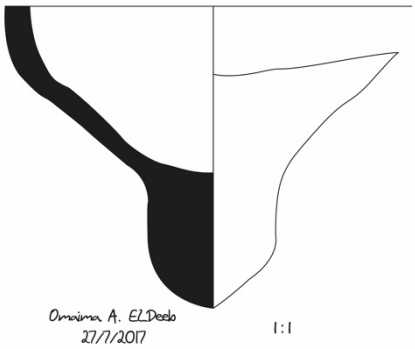
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with intact two wide and short handles and intact round rim. The neck is short and has seven round grooves.</td><td rowspan="6"> 

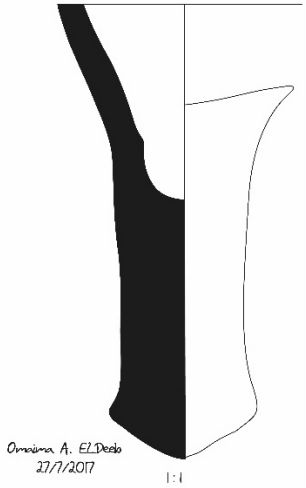
Photograph by © H. Tzalas 2016. © Copyright 2020, with permission from H. Tzalas.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>Reddish brown</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: N/A</td></tr>
<tr><td>Max. width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="8">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE 8-1, variant B – Eglaff 766-767</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Egypt</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Mid. seventh century AD to mid. eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Uncertain</td></tr>
</table>

11.1.2.4 Shatby

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td rowspan="2"><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with long cylinder neck and two long and double handles. The rim is round but part of it is broken.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Light remains of some concretion on the piece’s surface.</td><td rowspan="10"> 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish/reddish brown 5YR 6/4</td></tr>
<tr><td>Slip</td><td>Yellow (10YR 9/1)</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 26 cm</td></tr>
<tr><td>Width: 29 cm</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 14 cm</td></tr>
<tr><td>Internal diameter: 11.3 cm</td></tr>
<tr><td>Width: 2.8 cm</td></tr>
<tr><td>Thickness: 2.2 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 20.4 cm</td><td rowspan="11"></td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 21.7 cm</td></tr>
<tr><td>Width 1: 3 cm
Width 2: 2.4 cm</td></tr>
<tr><td>Thickness: 2.8 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 2-4 Pompeiian shape</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Pompeii</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Sandy texture/fabric with white and gray inclusions.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">End of first century BC to the mid. second century AD</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Wine</td></tr>
</table>

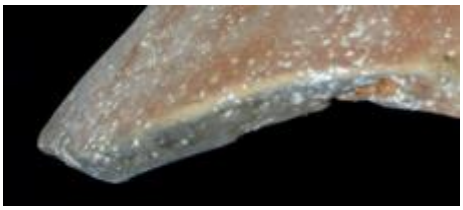
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td rowspan="2"><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Small pointed base.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td><td rowspan="2"> 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 6/4</td></tr>
<tr><td>Slip</td><td>Yellow (10YR 7/2)</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 7.7 cm</td></tr>
<tr><td>Width: 12 cm</td></tr>
<tr><td>Thickness: 1.5 cm</td><td rowspan="2"> 
Drawing by the author. © Copyright 2020</td></tr>
<tr><td>Rim</td><td>N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="2">Base</td><td>Height: 4.3 cm</td></tr>
<tr><td>Max. width: 11.6 cm
Min. width: 4.7 cm</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Agora M 54</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Turkey and Cyprus</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Stony solid fabric/texture with white and black inclusions</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">The second half of first century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine - Fruit</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Short base, and part of the body is presented.</td><td rowspan="3"> 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 6/4</td></tr>
<tr><td>Slip</td><td>Yellow (10YR 9/1)</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 11 cm</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: 16.6 cm</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td>Rim</td><td>N/A</td><td rowspan="10"> 
Drawing by the author. © Copyright 2020</td></tr>
<tr><td rowspan="3">Body</td><td>Height: 7 cm</td></tr>
<tr><td>Width: 16.6 cm</td></tr>
<tr><td>Thickness: 1 cm</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="2">Base</td><td>Max. height: 4 cm
Min. height: 2 cm</td></tr>
<tr><td>Width: 4.5 cm</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Africana I</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Tunisia</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and Western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Sandy yellow fabric with white and brown elements</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Second century AD to fourth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

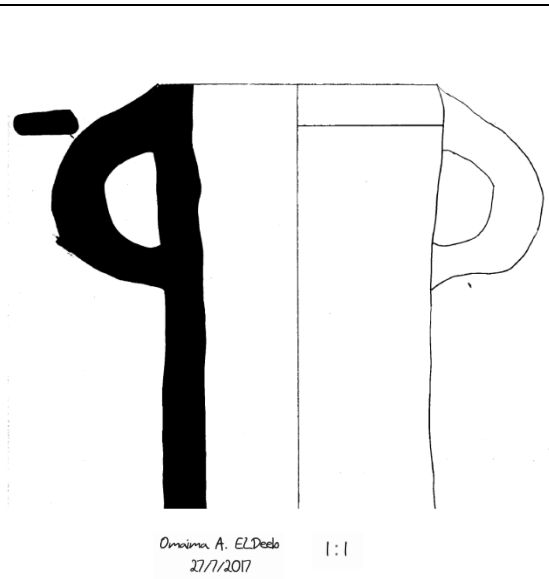
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td rowspan="2"><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Tall amphora’s base; wider from above and narrower down in the middle, then wider in the end. Small part of the body is presented.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers the piece.</td><td rowspan="3"> 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 6/4</td></tr>
<tr><td>Slip</td><td>Dull brown (7.5YR ¾)</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 19 cm</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: 10.6 cm</td></tr>
<tr><td>Thickness: 1.4 cm</td><td rowspan="10"> 
Drawing by the author. © Copyright 2020</td></tr>
<tr><td>Rim</td><td>N/A</td></tr>
<tr><td rowspan="3">Body</td><td>Height: 4 cm</td></tr>
<tr><td>Width: 10.6 cm</td></tr>
<tr><td>Thickness: 1.4 cm</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="2">Base</td><td>Height: 15 cm</td></tr>
<tr><td>Max. width: 6.4 cm
Min. width: 5 cm</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 2-4 Pompeiian shape</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Pompeii</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Sandy texture/fabric with white and gray inclusions.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">End of the first century BC to the mid. second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">ΑΛΚ 2
S.C.A 769</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with cylindrical neck and complete concave and thick rim. Two curvy thick handles and part of the shoulder are presented.</td><td rowspan="10"> 
 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Some holes and cracks cover the surface of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 8/4</td></tr>
<tr><td>Slip</td><td>Gary 7.5YR 6/1</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 29.5 cm</td></tr>
<tr><td>Width: 34.5 cm</td></tr>
<tr><td>Thickness: 1.7 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 17 cm</td></tr>
<tr><td>Internal diameter: 9.7 cm</td></tr>
<tr><td>Width: 3.5 cm</td></tr>
<tr><td>Thickness: 4 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 14.5 cm</td><td rowspan="8"></td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 17 cm</td></tr>
<tr><td>Width: 4.7 cm</td></tr>
<tr><td>Thickness: 4 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 20</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Southern Spain[17]</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean[18]</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Gray clay with black spots and stony texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to third century AD[19]</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

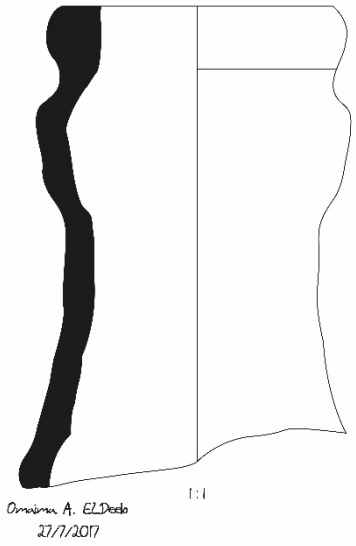
[17] Peacock, D. and D. Williams 1986:136.
[18] Peacock, D. and D. Williams 1986:136.
[19] Peacock, D. and D. Williams 1986:136

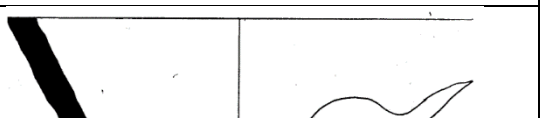
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with nearly complete concave and thick rim. The neck is short, and the handles are curvy and thick. Part of the shoulder is presented.</td><td rowspan="11"> 
 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some black spots and remains of concretion cover the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 8/4</td></tr>
<tr><td>Slip</td><td>Dark gray 5YR 5/1</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 28.5 cm</td></tr>
<tr><td>Width: 39.5 cm</td></tr>
<tr><td>Thickness: 1.7 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 18.5 cm</td></tr>
<tr><td>Internal diameter: 10.6 cm</td></tr>
<tr><td>Width: 3.8 cm</td></tr>
<tr><td>Thickness: 4.3 cm</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: 11.4 cm</td><td rowspan="10"></td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 17 cm</td></tr>
<tr><td>Width: 5 cm</td></tr>
<tr><td>Thickness: 4.7 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Dressel 20</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Southern Spain</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Western and Eastern Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Gray clay with black spots inclusions, sandy texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Olive oil</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">ΑΛΚ 1
S.C.A 768</td><td rowspan="2"><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora. The rim is round and intact. The neck is short, and the handles are double and short. Five grooves cover the neck.</td><td rowspan="3">   
Photographs by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Prominent round groove around the body below the handles.</td></tr>
<tr><td rowspan="15"><u>Dimensions</u></td><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 8/4</td></tr>
<tr><td>Slip</td><td>Dark Brown (5YR 7/4-8/6)</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 14 cm</td></tr>
<tr><td>Internal diameter: 10cm</td></tr>
<tr><td>Width: 3 cm</td><td rowspan="13"></td></tr>
<tr><td>Thickness: 2.8 cm</td></tr>
<tr><td rowspan="3">Body</td><td>Height: 30 cm</td></tr>
<tr><td>Width: 50.5 cm</td></tr>
<tr><td>Thickness: 1.9 cm</td></tr>
<tr><td>Neck</td><td>Height: 8.5 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 16.5 cm</td></tr>
<tr><td>Width 1: 2.8 cm
Width 2: 2.2 cm</td></tr>
<tr><td>Thickness: 3.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Unidentified</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Reddish yellow clay with soft texture and white, red and gray inclusions</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Unidentified/ maybe late Roman – Byzantine</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Unidentified</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with long cylindrical neck and nearly intact round rim and two round short handles.</td><td rowspan="3"> 
Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Prominent round line appears in the middle of each handle. Remains of prominent lines around the neck.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown 5YR 5/3</td></tr>
<tr><td>Slip</td><td>Yellowish brown (10YR 6/6)</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 30 cm</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: 23.6 cm</td></tr>
<tr><td>Thickness: 1.9 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 13.7 cm</td><td rowspan="7"> 
Drawing by the author. © Copyright 2020</td></tr>
<tr><td>Internal diameter: 10.5 cm</td></tr>
<tr><td>Width: 2 cm</td></tr>
<tr><td>Thickness: 1.7 cm</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 24 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: 10.1 cm</td></tr>
<tr><td>Width: 2.8 cm</td></tr>
<tr><td>Thickness: 2.5 cm</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">AE3 Late/AE 3T-3.2, variante B (Dixneuf 2011:141).</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Egypt</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Alexandria, Carthage, Benghazi and Ostia.</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Yellowish brown clay with some white inclusions and the texture is soft.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">seventh century AD to eighth century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Long cylindrical neck with intact rim. The handles are broken and missing.</td><td rowspan="3"> 

Photograph by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented. Prominent pieces on each site indicate the place of the missing handles.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 7/3</td></tr>
<tr><td>Slip</td><td>Yellowish brown (10YR 6/6)</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 19.5 cm</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: 13.5 cm</td></tr>
<tr><td>Thickness: 1.3 cm</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 12.5 cm</td><td rowspan="9"> 
Drawing by the author. © Copyright 2020</td></tr>
<tr><td>Internal diameter: 9.9 cm</td></tr>
<tr><td>Width: 2.5 cm</td></tr>
<tr><td>Thickness: 2 cm</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: 17.5 cm</td></tr>
<tr><td rowspan="3">Handles</td><td>Length (prominent piece): 5.5 cm</td></tr>
<tr><td>Width (prominent piece): 6.3 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian late</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Rhodes, the Aegean and Asia Minor</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Yellowish brown clay and soft texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Late first century AD to second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Short base wider from above then narrower towards the end. The base is flat, and part of the body is presented.</td><td rowspan="2"> 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Surface Clay</td><td>Yellowish brown 5YR 8/4</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Slip</td><td>Yellowish brown (10YR 6/6)</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 16.5 cm</td><td rowspan="11"> 
Drawing by the author. © Copyright 2020</td></tr>
<tr><td>Width: 20 cm</td></tr>
<tr><td>Thickness: 1.3 cm</td></tr>
<tr><td>Rim</td><td>N/A</td></tr>
<tr><td rowspan="3">Body</td><td>Height: 12.5 cm</td></tr>
<tr><td>Width: 20 cm</td></tr>
<tr><td>Thickness: 1.3 cm</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="3">Base</td><td>Height: 5.5 cm</td></tr>
<tr><td>Max. width: 6 cm
Min. width: 4.4 cm</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Lamboglia II</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Adriatic cost</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Yellowish brown clay with some white and gray inclusions and the texture is soft.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">From the second to the last third of the first century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine – Olive oil</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td rowspan="3"><u>Photograph</u>
 

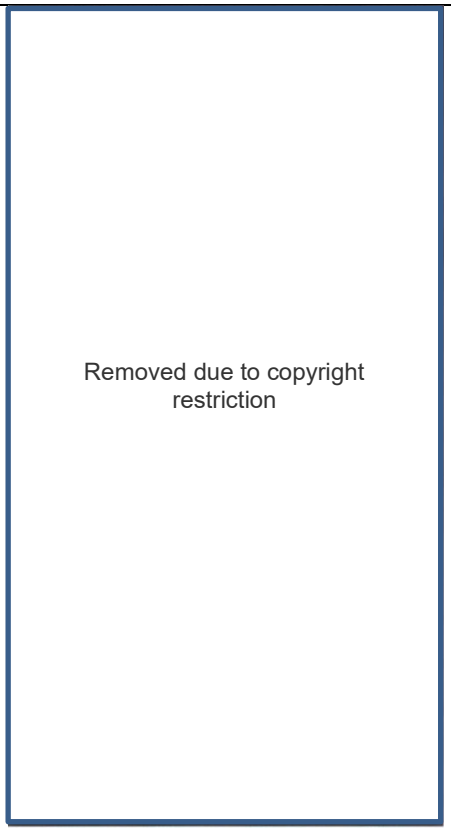
 
Photographs by the author. © Copyright 2020</td></tr>
<tr><td><u>Description</u></td><td colspan="2">Long base (triangle shape) wider from above then narrower down to a pointed base. Part of the body is presented.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 8/4</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Slip</td><td>Dark brown (7.5YR ¾)</td></tr>
<tr><td rowspan="13"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 31 cm</td><td rowspan="13"></td></tr>
<tr><td>Width: 22 cm</td></tr>
<tr><td>Thickness: 1.6 cm</td></tr>
<tr><td>Rim</td><td>N/A</td></tr>
<tr><td rowspan="3">Body</td><td>Height: 21 cm</td></tr>
<tr><td>Width: 22 cm</td></tr>
<tr><td>Thickness: 1.6 cm</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="2">Base</td><td>Height: 10 cm</td></tr>
<tr><td>Max. width: 7.7 cm
Min. width: 3.3 cm</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Beltrán 2A</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Spain</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">Dark brown clay with gray and white inclusions and stony texture.</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century BC to second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Fish products</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Long and cylindrical amphora’s neck with thick lip rim. Part of one of the handles is presented.</td><td rowspan="3">  
Photographs from H. Tzalas 2014. © Copyright 2020, with permission from H. Tzalas.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">N/A</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="10"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Rim</td><td>N/A</td><td rowspan="9">N/A</td></tr>
<tr><td rowspan="3">Body</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="2">Base</td><td>Height: N/A</td></tr>
<tr><td>Max. width: N/A
Min. width: N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian early</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century BC</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora with wide mushroom shape rim and one short handle. The neck is long, and part of the body is presented.</td><td rowspan="4"> 


Photographs from H. Tzalas 2014. © Copyright 2020, with permission from H. Tzalas.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Rim</td><td>N/A</td><td rowspan="10">N/A</td></tr>
<tr><td rowspan="3">Body</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="2">Base</td><td>Height: N/A</td></tr>
<tr><td>Max. width: N/A
Min. width: N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Cilicia V?</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">N/A</td></tr>
</table>

11.1.2.5 Eastern Harbour

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">13 143 - SCA 32</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with round rim, two long pointed handles and long cylindrical neck. The body is oval and ends with pointed sharp base.</td><td rowspan="2"> 

Photograph by Christoph Gerigk 2006 from Goddio and Fabre 2006:268).</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some black spots around the surface of the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 7/6</td><td rowspan="12"><u>Drawing</u>

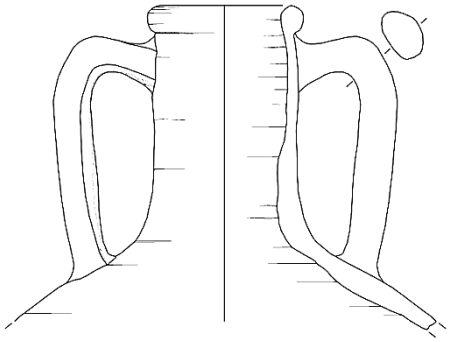
N/A</td></tr>
<tr><td>Slip</td><td>N/A</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 98.5 cm</td></tr>
<tr><td>Width: 29 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 12 cm</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian late</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes, the Aegean and Asia Minor</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD until second century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

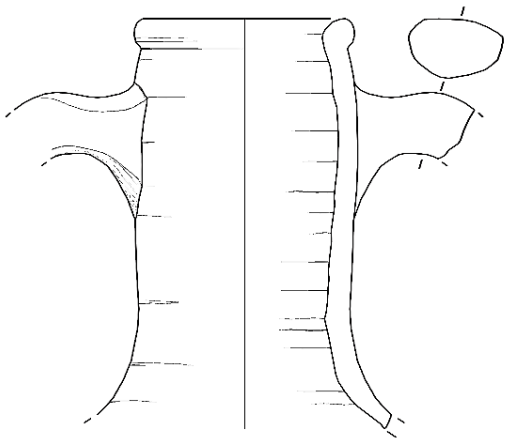
<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">11 0133 - SCA 81</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Complete amphora with round rim, two long pinched and curvy handles. The neck is cylindrical, and the body is oval which ends with flat base.</td><td rowspan="3">Removed due to copyright restriction

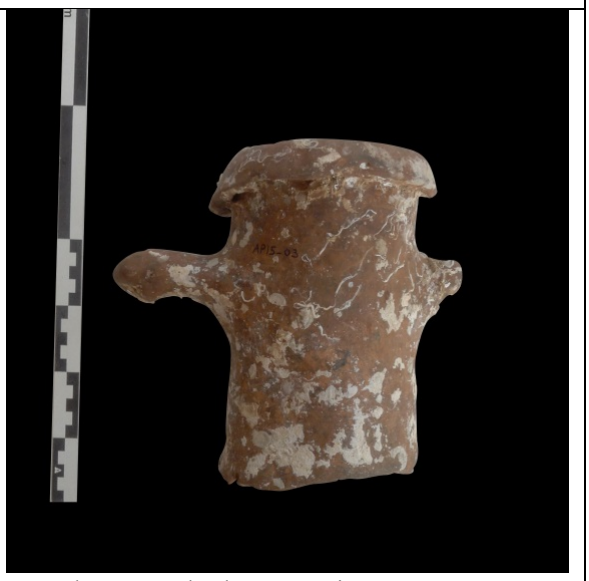
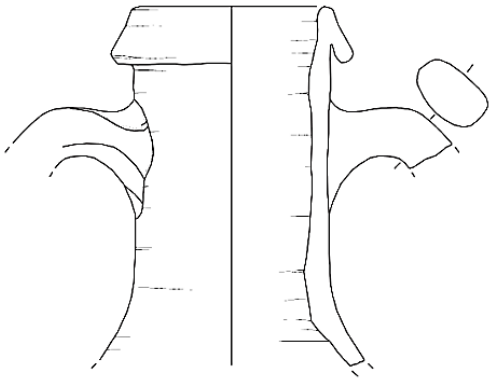
Photograph by Christoph Gerigk 2006 from Goddio and Fabre 2006:268).</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No significant features.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 7/6</td></tr>
<tr><td>Slip</td><td>Red</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: 46 cm</td><td rowspan="10"><u>Drawing</u>

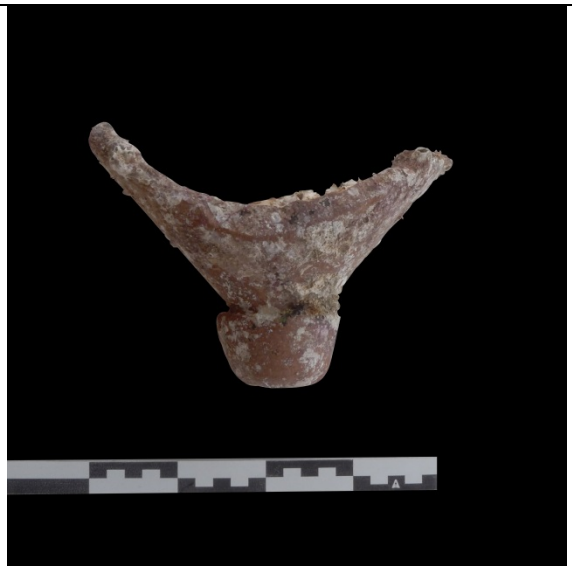
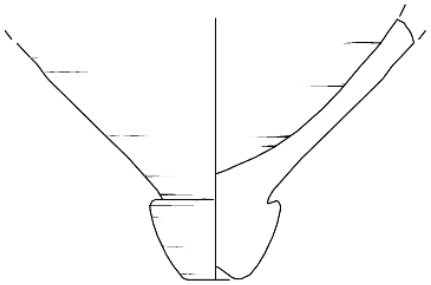
N/A</td></tr>
<tr><td>Width: 12.8 cm</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 6 cm</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Cretan</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Crete</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern and western Mediterranean</td></tr>
<tr><td><u>Clay visual characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">First century AD to third century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine</td></tr>
</table>

11.1.2.6 Western Harbour

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">AP15-01</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Upper part of amphora consists of two broken pieces. The image to the right shows a broken rim, long cylinder neck and one handle. Part of the shoulder is presented. The image to the left shows the other handle and the rest parts of the rim and the neck.</td><td rowspan="10"> 
Photographs by Sergei Ivanov 2015. Reproduced by the author 2017. © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">No stamp is presented.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Buff Brown
2.5 YR6/3</td></tr>
<tr><td>Slip</td><td>Beige-red</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter:
10.6 cm</td></tr>
<tr><td>Internal diameter:
N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>N/A</td><td rowspan="7"> 
Drawing by S.Laemmel 2015. (From Belova et.al 2015: 8, fig.3). © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Lesbian</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Lesbos</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">Tough sandy texture and contains limestones</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">fourth century BC</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">AP15-02</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Amphora’s neck with complete rim. The handles are broken and missing.</td><td rowspan="2"> 
Photographs by Sergei Ivanov 2015. Reproduced by the author 2017. © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>brown beige
2.5 YR6/4</td><td rowspan="11"></td></tr>
<tr><td>Slip</td><td>Brown</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 10.0 cm</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>N/A</td><td rowspan="6"><u>Drawing</u>
 
Drawing by S.Laemmel 2015. (From Belova et.al 2015: 8, fig.4). © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Knidian early</td></tr>
<tr><td><u>Production area/Origin</u></td><td colspan="2">Knidos</td><td rowspan="5"></td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">Tough sandy texture</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century BC to second century BC</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">AP15-03</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Broken neck with complete thick triangular rim. The handles are broken and missing.</td><td rowspan="2"> 
Photographs by Sergei Ivanov 2015. Reproduced by the author 2017. © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some concretion covers the piece.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Beige-buff
2.5 YR6/4</td><td rowspan="2"></td></tr>
<tr><td>Slip</td><td>Red Brown</td></tr>
<tr><td rowspan="11"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="2"></td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td><td rowspan="2"></td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: 10.3 cm.</td></tr>
<tr><td>Internal diameter: N/A</td><td rowspan="2"></td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td><td rowspan="2"></td></tr>
<tr><td>Body</td><td>N/A</td><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>N/A</td><td rowspan="8"> 
Drawing by S.Laemmel 2015. (From Belova et.al 2015: 9, fig.5). © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian early</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">Tough sandy texture</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century BC</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Wine</td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">AP15-04</td><td rowspan="2"><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Base and part of the body is presented.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some remains of concretion all around the piece’s surface.</td><td rowspan="3"> 
Photographs by Sergei Ivanov 2015. Reproduced by the author 2017. © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Reddish brown 2.5 YR5/2</td></tr>
<tr><td>Slip</td><td>Reddish brown 2.5 YR5/2</td></tr>
<tr><td rowspan="8"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Height: N/A</td><td rowspan="2"><u>Drawing</u></td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Rim</td><td>N/A</td><td rowspan="7"> 
Drawing by S.Laemmel 2015. (From Belova et.al 2015: 9, fig.6). © Copyright 2020, with permission from A. Belov.</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>N/A</td></tr>
<tr><td>Handles</td><td>N/A</td></tr>
<tr><td rowspan="2">Base</td><td>Height: N/A</td></tr>
<tr><td>Max. width: 5.5 cm
Min. width: N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Rhodian early</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Rhodes</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">The Aegean and western Mediterranean</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">Black and white inclusions</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Third century BC</td></tr>
<tr><td><u>Content</u></td><td colspan="2">Wine</td></tr>
</table>

11.1.3 The Terrestrial sites

11.1.3.2 Kour Island

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Broken upper part of amphora consists of two pieces. The first one presents short neck, round rim, one curvy handle, and part of the shoulder. The second one presents the second handle.</td><td rowspan="11"> 
Photograph from Ragheb 2010:416. © Copyright 2020, with permission from John Wiley and Sons.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some grooves presented in the neck and the shoulder. In addition to unknown red marks appear below the neck.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 6/4</td></tr>
<tr><td>Slip</td><td>Dull Yellow 5YR 8/3</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: N/A</td></tr>
<tr><td>Max. width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td>Neck</td><td>Height: N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Late Roman Amphora 1</td><td rowspan="7">N/A</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Cilicia, Cyprus, Rhodes, Caria and Chios</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean, South France, North Africa, Britain, Black Sea, Italy and Iberia.</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Early fifth century AD to late seventh century AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine and olive oil</td></tr>
<tr><td colspan="3"><u>Drawing</u></td></tr>
</table>

<table>
<tr><td><u>Inventory no.</u></td><td colspan="2">N/A</td><td><u>Photograph</u></td></tr>
<tr><td><u>Description</u></td><td colspan="2">Broken upper part of amphora consists of two pieces. The first one presents a short neck, round rim, one curvy handle, and part of the shoulder. The second one presents the second handle.</td><td rowspan="10"> 
Photograph from Ragheb 2010: 416. © Copyright 2020, with permission from John Wiley and Sons.</td></tr>
<tr><td><u>Features</u></td><td colspan="2">Some grooves around the neck.</td></tr>
<tr><td rowspan="2"><u>Color</u></td><td>Clay</td><td>Yellowish brown 5YR 8/4</td></tr>
<tr><td>Slip</td><td>Reddish brown 7.5YR 4.6</td></tr>
<tr><td rowspan="9"><u>Dimensions</u></td><td rowspan="3">Piece</td><td>Max. height: N/A</td></tr>
<tr><td>Max. width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td rowspan="4">Rim</td><td>External diameter: N/A</td></tr>
<tr><td>Internal diameter: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Body</td><td>N/A</td></tr>
<tr><td><u>Drawing</u></td></tr>
<tr><td>Neck</td><td>Height: N/A</td><td rowspan="11">N/A</td></tr>
<tr><td rowspan="3">Handles</td><td>Length: N/A</td></tr>
<tr><td>Width: N/A</td></tr>
<tr><td>Thickness: N/A</td></tr>
<tr><td>Base</td><td>N/A</td></tr>
<tr><td><u>Type</u></td><td colspan="2">Late Roman Amphora 1</td></tr>
<tr><td><u>Production Area/Origin</u></td><td colspan="2">Cilicia, Cyprus, Rhodes, Caria and Chios</td></tr>
<tr><td><u>Distribution areas</u></td><td colspan="2">Eastern Mediterranean, South France, North Africa, Britain, Black Sea, Italy and Iberia.</td></tr>
<tr><td><u>Visual clay characteristics</u></td><td colspan="2">N/A</td></tr>
<tr><td><u>Dating</u></td><td colspan="2">Early fifth century AD to late seventh AD</td></tr>
<tr><td><u>Contents</u></td><td colspan="2">Wine and olive oil</td></tr>
</table>

11.2 APPENDIX 2 NETWORK ANALYSIS DATASET

11.2.1 Underwater Sites

11.2.1.1 Phase One - Binary Data

11.2.1.1.1 Amphorae types

	Spatheia	Beltrán 72	Dr 9	LR7/ AE7	Rhodian early	Rhodian Middle	Rhodian late
Ras El-Hikma	1	1	1	1	0	0	0
Tannum Reef	0	0	0	0	0	1	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	0	0	0	0	0	0	0
Marsa Bagoush	0	0	0	0	1	0	0
Aboukir	0	0	0	0	0	0	0
Mammura	0	0	0	0	1	1	0
Ibrahimia	0	0	0	0	0	0	0
Shatby	0	0	0	0	1	0	1
Eastern Harbour	0	0	0	0	0	0	1
Qaitbay/Pharos	0	0	0	0	0	1	0
Western Harbour	0	0	0	0	1	0	0

	Knidian early	Knidian middle	Knidian late	Koan	AE2-3	AE3 Late/ AE3T-2, variant B	LR 4
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	1	0	1	0	0	0
Ras Hashafa	0	0	0	1	1	0	0
Ras Hawala	0	0	0	1	0	0	0
Marsa Oum El-Rakham	0	0	0	0	0	1	1
Marsa Bagoush	0	1	1	0	1	1	1
Aboukir	1	0	0	1	0	0	1
Mammura	1	0	0	0	0	1	1
Ibrahimia	0	0	0	0	0	0	0
Shatby	0	0	0	0	0	1	0
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	0	0	1	0	0
Western Harbour	1	0	0	0	0	0	0

	Greco-Italic / Will form A1	LR 2	LR 1	LR3	Agora K 114	Agora G 199	Chios
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	0	1	1	0	1	1	1
Marsa Bagoush	1	0	0	0	0	0	0
Aboukir	0	0	0	0	0	0	1
Mammura	0	0	1	0	0	1	0
Ibrahimia	0	0	0	0	0	0	0
Shatby	0	0	0	0	0	0	0
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	1	1	0	0	0
Western Harbour	0	0	0	0	0	0	0

	Chain	Dr 5	AE2	AE 3-1.5 variant B	AE 3-2, variant A	AE3-I.4	AE3 Late/ AE 3T-3.2, variant B
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	1	1	0	0	0	0	0
Marsa Bagoush	0	0	1	1	1	1	1
Aboukir	0	0	0	0	0	0	0
Mammura	0	0	0	0	0	0	0
Ibrahimia	0	0	0	0	0	0	0
Shatby	0	0	0	0	0	0	0
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	0	0	0	0	0
Western Harbour	0	0	0	0	0	0	0

	AE 5/6	AE8-2	Bailey O 17	Bailey V 17-18	Bailey W26-8	Dr 2-4 Pompeii	Dr 2-4 Imitated Pompeiian
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	0	0	0	0	0	0	0
Marsa Bagoush	1	1	1	1	1	1	1
Aboukir	0	0	0	0	0	0	0
Mammura	0	0	0	0	0	0	0
Ibrahimia	0	0	0	0	0	0	0
Shatby	0	0	0	0	0	1	0
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	0	0	0	1	0
Western Harbour	0	0	0	0	0	0	0

	Agora G 197	Dr 2-4 Imitated Campanian	Brindisi	Greco-Italic Will Form A2	Subgroup LR 13	Günsenin 2	Globular
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	0	0	0	1	0	0	0
Marsa Bagoush	1	1	1	1	1	1	1
Aboukir	0	0	0	1	0	0	0
Mammura	0	0	0	0	0	0	0
Ibrahimia	0	0	0	1	0	0	0
Shatby	0	0	0	0	0	0	0
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	0	1	0	0	0
Western Harbour	0	0	0	0	0	0	0

	Samian	Lesbian	Klozomenai	Miletus	Chiote	Basket-handle amphora Type 3	Thasos
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	0	0	0	0	0	0	0
Marsa Bagoush	0	0	0	0	0	0	0
Aboukir	1	1	1	1	1	1	1
Mammura	0	0	0	0	0	0	0
Ibrahimia	0	0	0	0	0	0	0
Shatby	0	0	0	0	0	0	0
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	0	0	0	0	0
Western Harbour	0	1	0	0	0	0	0

	Mendean	Persian Torpedo	AE2	Kapitän II	Africana 2B Grande	Africana 2D Grande	Cyrenaican
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	0	0	0	0	0	0	0
Marsa Bagoush	0	0	0	0	0	0	0
Aboukir	1	1	1	0	0	0	0
Mammura	0	0	0	1	1	1	1
Ibrahimia	0	0	0	0	0	0	0
Shatby	0	0	0	0	0	0	0
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	0	0	0	0	0
Western Harbour	0	0	0	0	0	0	0

	Günsenin 1	Dr 20	Tripolitanian I	Tripolitanian III	Dr 23	AE 8-1, variant B	Agora M 54
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	0
Ras Hawala	0	0	0	0	0	0	0
Marsa Oum El-Rakham	0	0	0	0	0	0	0
Marsa Bagoush	0	0	0	0	0	0	0
Aboukir	0	0	0	0	0	0	0
Mammura	1	0	0	0	0	0	0
Ibrahimia	0	1	1	1	1	1	0
Shatby	0	1	0	0	0	0	1
Eastern Harbour	0	0	0	0	0	0	0
Qaitbay/Pharos	0	0	0	0	0	0	0
Western Harbour	0	0	0	0	0	0	0

	Africana I	Lamboglia II	Beltrán 2A	Cretan	Dr 6A	Sinope	Unidentified
Ras El-Hikma	0	0	0	0	0	0	0
Tannum Reef	0	0	0	0	0	0	0
Ras Hashafa	0	0	0	0	0	0	1
Ras Hawala	0	0	0	0	0	0	1
Marsa Oum El-Rakham	0	0	0	0	0	0	1
Marsa Bagoush	0	0	0	0	0	0	1
Aboukir	0	0	0	0	0	0	0
Mammura	0	0	0	0	0	0	0
Ibrahimia	0	0	0	0	0	0	1
Shatby	1	1	1	0	0	0	1
Eastern Harbour	0	0	0	1	0	0	0
Qaitbay/Pharos	0	1	0	0	1	1	1
Western Harbour	0	0	0	0	0	0	0

11.2.1.1.2 Amphorae contents

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Ras El-Hikma	1	0	1	1	0	0	0	0	0
Tannum Reef	1	0	0	0	0	0	0	0	0
Ras Hashafa	1	0	0	0	0	0	0	0	1
Ras Hawala	1	0	0	0	0	0	0	0	1
Marsa Oum El-Rakham	1	1	0	0	0	0	1	0	1
Marsa Bagoush	1	1	0	0	0	1	0	0	1
Aboukir	1	1	0	0	1	0	1	1	0
Mammura	1	1	0	1	1	0	1	0	0
Ibrahimia	1	1	1	0	0	0	0	0	1
Shatby	1	1	0	0	1	0	0	0	1
Eastern Harbour	1	0	0	0	0	0	0	0	0
Qaitbay/Pharos	1	1	0	0	0	0	0	0	1
Western Harbour	1	0	0	0	0	0	0	0	0

11.2.1.1.3 Amphorae production regions

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
Ras El-Hikma	1	0	1	1	0	0	0
Tannum Reef	0	0	0	0	1	0	0
Ras Hashafa	1	0	1	0	1	0	1
Ras Hawala	0	0	1	0	1	0	1
Marsa Oum El-Rakham	1	1	0	1	1	0	1
Marsa Bagoush	1	1	0	1	1	0	1
Aboukir	1	1	1	1	1	0	0
Mammura	1	1	0	1	1	0	0
Ibrahimia	1	0	1	1	0	0	1
Shatby	1	1	1	1	1	0	1
Eastern Harbour	0	0	0	0	1	0	0
Qaitbay/Pharos	1	1	0	1	1	0	1
Western Harbour	0	0	0	0	1	0	0

11.2.1.2 Phase Two

11.2.1.2.1 Step A. Sites attributes

11.2.1.2.1.1 Amphorae types

11.2.1.2.1.1.1 Pre-Hellenistic period

Site ID	Site	Zone	Longitude	Latitude	Pre Hellenistic (n)	Mendean	Klozomenai	Basket-handle (type 3)	Chain	Persian Torpedo	Thasos	Samian	Chiote	Milesian	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			1	0	0	0	1	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			0	0	0	0	0	0	0	0	0	0	0
14	Aboukir	Alexandrian Coastline			9	1	2	1	0	1	1	1	1	1	0
16	Mammura	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
				Total	10	1	2	1	1	1	1	1	1	1	0

11.2.1.2.1.1.2 Hellenistic period

Site ID	Site	Zone	Hellenistic	Cyrenaican I	Rhodian early	Rhodian Middle	Knidian early	Knidian middle	Lesbian	Greco-Italic/ Will type A1	Greco-Italic/ Will type A2	Koan	Chios	Brindisi	Lamboglia II	AE2	Unidentified	AE2-3
2	Ras El-Hikma	North-Western coast	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast	3	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast	4	0	0	0	0	0	0	0	0	1	0	0	0	0	2	1
8	Ras Hawala	North-Western coast	3	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0
10	Marsa Oum El-Rakham	North-Western coast	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
12	Marsa Bagoush	North-Western coast	11	0	1	0	0	1	0	1	2	0	0	1	0	1	0	5
14	Aboukir	Alexandrian Coastline	11	0	0	5	1	0	1	0	1	1	1	0	0	1	0	0
16	Mammura	Alexandrian Coastline	7	1	3	1	2	0	0	0	0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline	2	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
22	Eastern Harbour	Alexandrian Coastline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline	622	0	100	17	0	0	0	0	5	0	0	0	495	0	0	5
26	Western Harbour	Alexandrian Coastline	4	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0
			669	1	107	24	4	2	2	1	10	4	2	1	496	2	2	11

11.2.1.2.1.1.3 Early Roman period

Site ID	Site	Zone	Early Roman	Agora G 199	Agora M 54	Agora K 114	Agora G 197	Dr 2-4 Imitated Pompeii	Dr 2-4 Pompeii	Dr 2-4 Imitated Campanian	Dr 5	Dr 6A	Dr 9	Dr 20	Cretan	Beltrán 2A	AE3/ AE 3-2, variant A	AE3/ AE3-I.4	Rhodian late	Knidian late	Tripolitanian I
2	Ras El-Hikma	North-Western coast	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast	3	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast	10	0	0	0	1	1	3	1	0	0	0	0	0	0	2	1	0	1	0
14	Aboukir	Alexandrian Coastline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline	4	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
20	Shatby	Alexandrian Coastline	7	0	1	0	0	0	2	0	0	0	0	2	0	1	0	0	1	0	0
22	Eastern Harbour	Alexandrian Coastline	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
24	Qaitbay/Pharos	Alexandrian Coastline	15	0	0	0	0	0	5	0	0	10	0	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			43	2	1	1	1	1	10	1	1	10	1	4	1	1	2	1	2	1	2

11.2.1.2.1.1.4 Mid. Roman period

Site ID	Site	Zone	Longitude	Latitude	Mid Roman	Kapitän II	Africana 2D Grande	Africana 2B Grande	Africana I	Tripolitanian III	Dressel 23	AE3/ AE 3-1.5 variant B	Sinope	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			0	0	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			3	0	0	0	0	0	0	3	0	0
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			39	37	1	1	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			2	0	0	0	0	1	1	0	0	0
20	Shatby	Alexandrian Coastline			1	0	0	0	1	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			5	0	0	0	0	0	0	0	5	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
				Total	50	37	1	1	1	1	1	3	5	0

11.2.1.2.1.1.5 Late Roman period

Site ID	Site	Zone	Longitude	Latitude	Late Roman	LR 1	LR 2	LR3	LR4	LR 5/6	LR7	AE3 Late/ AE 3T-2, variant B	Spatheia	Beltrán 72	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		3	0	0	0	0	0	1	0	1	1	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			4	1	1	0	1	0	0	1	0	0	0
12	Marsa Bagoush	North-Western coast			3	0	0	0	1	1	0	1	0	0	0
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			4	2	0	0	1	0	0	1	0	0	0
18	Ibrahimia	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			52	50	0	2	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0
				Total	66	53	1	2	3	1	1	3	1	1	0

11.2.1.2.1.1.6 Islamic period

Site ID	Site	Zone	Longitude	Latitude	Islamic	Günsenin 1	Günsenin 2	AE3 Late/ AE 3T-3.2, variant B	AE 8-1, variant B – Eglaff 766-767	Subgroup late Roman 13	AE8-2	Globular	Bailey O 17	Bailey V 17-18	Bailey W26-8	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			0	0	0	0	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			10	0	1	2	0	1	1	2	1	1	1	0
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			1	1	0	0	0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			1	0	0	0	1	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			1	0	0	1	0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0	0	0
				Total	13	1	1	3	1	1	1	2	1	1	1	0

11.2.1.2.1.2 Amphorae Contents

11.2.1.2.1.2.1 Pre-Hellenistic period

Site ID	Site	Zone	Longitude	Latitude	Pre-Hellenistic	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			1	1	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			0	0	0	0	0	0	0	0	0	0
14	Aboukir	Alexandrian Coastline			9	4	1	0	0	1	0	0	0	3
16	Mammura	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
				Total	10	5	1	0	0	1	0	0	0	3

11.2.1.2.1.2.2 Hellenistic period

Site	Zone	Longitude	Latitude	Hellenistic	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0	0	0
Tannum Reef	North-Western coast			3	3	0	0	0	0	0	0	0	0
Ras Hashafa	North-Western coast			3	1	0	0	0	0	0	0	0	2
Ras Hawala	North-Western coast			3	2	0	0	0	0	0	0	0	2
Marsa Oum El-Rakham	North-Western coast			2	2	0	0	0	0	0	0	0	0
Marsa Bagoush	North-Western coast			12	11	1	0	0	0	0	0	0	0
Aboukir	Alexandrian Coastline			11	11	0	0	0	0	0	0	0	0
Mammura	Alexandrian Coastline			7	6	0	0	0	0	0	0	0	1
Ibrahimia	Alexandrian Coastline			1	1	0	0	0	0	0	0	0	0
Shatby	Alexandrian Coastline			2	1	1	0	0	0	0	0	0	0
Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
Qaitbay/Pharos	Alexandrian Coastline			622	127	495	0	0	0	0	0	0	0
Western Harbour	Alexandrian Coastline			4	4	0	0	0	0	0	0	0	0
			Total	660	168	497	0	0	0	0	0	0	5

11.2.1.2.1.2.3 Early Roman period

Site ID	Site	Zone	Longitude	Latitude	Early Roman	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		1	0	0	0	1	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			3	3	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			10	8	0	0	0	0	0	0	0	2
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			1	1	0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			4	0	4	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			7	4	2	0	0	1	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			2	2	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			15	15	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
				Total	43	33	6	0	1	1	0	0	0	2

11.2.1.2.1.2.4 Mid. Roman period

Site ID	Site	Zone	Longitude	Latitude	Mid Roman	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			0	0	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			3	3	0	0	0	0	0	0	0	0
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			39	37	1	0	1	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			2	0	1	1	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			1	0	1	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			5	5	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
				Total	50	45	3	1	1	0	0	0	0	0

11.2.1.2.1.2.5 Late Roman period

Site ID	Site	Zone	Longitude	Latitude	Late Roman	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		3	1	0	0	2	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			4	4	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			3	3	0	0	0	0	0	0	0	0
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			4	4	0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			52	52	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
				Total	66	64	0	0	2	0	0	0	0	0

11.2.1.2.1.2.6 Islamic period

Site ID	Site	Zone	Longitude	Latitude	Islamic	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			0	0	0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			10	6	0	0	0	0	1	0	0	3
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			1	0	0	0	0	0	0	0	0	1
18	Ibrahimia	Alexandrian Coastline			1	1	0	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			1	1	0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0	0	0
				Total	13	8	0	0	0	0	1	0	0	4

11.2.1.2.1.3 Production regions

11.2.1.2.1.3.1 Pre-Hellenistic period

Site ID	Site	Zone	Longitude	Latitude	Pre Hellenistic (n)	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			1	0	0	0	0	1	0	0
12	Marsa Bagoush	North-Western coast			0	0	0	0	0	0	0	0
14	Aboukir	Alexandrian Coastline			9	0	2	1	1	5	0	0
16	Mammura	Alexandrian Coastline			0	0	0	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			0	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
				Total	10	0	2	1	1	6	0	0

11.2.1.2.1.3.2. Hellenistic period

Site ID	Site	Zone	Longitude	Latitude	Hellenistic (n)	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			3	0	0	0	0	3	0	0
6	Ras Hashafa	North-Western coast			4	1	0	1	0	2	0	0
8	Ras Hawala	North-Western coast			3	0	0	1	0	2	0	0
10	Marsa Oum El-Rakham	North-Western coast			2	0	0	0	1	1	0	0
12	Marsa Bagoush	North-Western coast			12	6	0	0	4	2	0	0
14	Aboukir	Alexandrian Coastline			11	1	0	0	1	9	0	0
16	Mammura	Alexandrian Coastline			7	0	0	0	1	6	0	0
18	Ibrahimia	Alexandrian Coastline			1	0	0	0	1	0	0	0
20	Shatby	Alexandrian Coastline			2	0	0	0	1	1	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			622	5	0	0	500	117	0	0
26	Western Harbour	Alexandrian Coastline			4	0	0	0	0	4	0	0
				Total	671	13	0	2	509	147	0	0

11.2.1.2.1.3.3 Early Roman period

Site ID	Site	Zone	Longitude	Latitude	Early Roman (n)	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		1	0	0	1	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			3	0	1	0	1	1	0	0
12	Marsa Bagoush	North-Western coast			6	3	0	0	3	2	0	2
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			1	0	1	0	0	0	0	0
18	Ibrahimia	Alexandrian Coastline			4	0	0	2	2	0	0	0
20	Shatby	Alexandrian Coastline			7	0	1	3	2	1	0	0
22	Eastern Harbour	Alexandrian Coastline			2	0	0	0	0	2	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			15	0	0	0	15	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
				Total	43	3	3	6	22	6	0	2

11.2.1.2.1.3.4 Mid. Roman period

Site ID	Site	Zone	Longitude	Latitude	Mid. Roman (n)	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			3	3	0	0	0	0	0	0
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			39	0	37	0	2	0	0	0
18	Ibrahimia	Alexandrian Coastline			2	0	0	1	1	0	0	0
20	Shatby	Alexandrian Coastline			1	0	0	0	1	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			5	0	0	0	0	5	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
				Total	50	3	37	1	4	5	0	0

11.2.1.2.1.3.5 Late Roman period

Site ID	Site	Zone	Longitude	Latitude	Late Roman (n)	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		3	1	0	1	1	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			4	1	2	0	0	1	0	0
12	Marsa Bagoush	North-Western coast			3	2	1	0	0	0	0	0
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			4	1	1	0	0	2	0	0
18	Ibrahimia	Alexandrian Coastline			0	0	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			0	0	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			52	0	50	0	0	2	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
				Total	66	5	54	1	1	5	0	0

11.2.1.2.1.3.6 Islamic period

Site ID	Site	Zone	Longitude	Latitude	Islamic (n)	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	unknown
2	Ras El-Hikma	North-Western coast	Content removed for privacy reasons		0	0	0	0	0	0	0	0
4	Tannum Reef	North-Western coast			0	0	0	0	0	0	0	0
6	Ras Hashafa	North-Western coast			0	0	0	0	0	0	0	0
8	Ras Hawala	North-Western coast			0	0	0	0	0	0	0	0
10	Marsa Oum El-Rakham	North-Western coast			0	0	0	0	0	0	0	0
12	Marsa Bagoush	North-Western coast			10	6	1	0	0	1	0	2
14	Aboukir	Alexandrian Coastline			0	0	0	0	0	0	0	0
16	Mammura	Alexandrian Coastline			1	0	0	0	0	1	0	0
18	Ibrahimia	Alexandrian Coastline			1	1	0	0	0	0	0	0
20	Shatby	Alexandrian Coastline			1	1	0	0	0	0	0	0
22	Eastern Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
24	Qaitbay/Pharos	Alexandrian Coastline			0	0	0	0	0	0	0	0
26	Western Harbour	Alexandrian Coastline			0	0	0	0	0	0	0	0
				Total	13	8	1	0	0	2	0	2

11.2.1.2.2 Step B. Valued Data

11.2.1.2.2.1 Amphorae types

11.2.1.2.2.1.1 Pre-Hellenistic period

	Mendean	Klozomenai	Basket-handle (type 3)	Chain	Persian Torpedo	Thasos	Samian	Chiote	Milesian	Unidentified
Alexandria Pre-H	1	2	1	1	1	1	1	1	1	0

11.2.1.2.2.1.2 Hellenistic period

	Cyrenaican I	Rhodian early	Rhodian Middle	Knidian early	Knidian middle	Lesbian	Greco-Italic/ Will type A1	Greco-Italic/ Will type A2	Tripolitanian I	Koan	Chios	Brindisi	Lamboglia II	AE2	Unidentified	AE2 -3
Alexandria H.	1	107	24	4	2	2	1	10	2	4	2	1	496	2	2	11

11.2.1.2.2.1.3 Early Roman period

	Agora G 199	Agora M 54	Agora K 114	Agora G 197	Dr 2-4 Pompeii	Dressel 2-4	Dr 2-4 Imitated Campanian	Dr 5	Dr 6A	Dr 9	Dr 20	Cretan	Beltrán 2A	AE3/ AE 3-2, variant A	AE3/ AE3-I.4	Rhodian late	Knidian late	Tripolitanian I
Alexandria ER	2	1	1	1	10	1	1	1	10	1	4	1	1	2	1	2	1	2

11.2.1.2.2.1.4 Mid. Roman period

	Kapitän II	Africana 2D Grande	Africana 2B Grande	Africana I	Tripolitanian III	Dressel 23	AE3/ AE 3-1.5 variant B	Sinope	Unidentified
Alexandria MR	37	1	1	1	1	1	3	5	0

11.2.1.2.2.1.5 Late Roman period

	LR 1	LR 2	LR3	LR4	LR 5/6	LR7	AE3 Late/ AE 3T-2, variant B	Spatheia	Beltrán 72	Unidentified
Alexandria LR	53	1	2	3	1	1	3	1	1	0

11.2.1.2.2.1.6 Islamic period

	Günsenin 1	Günsenin 2	AE3 Late/ AE 3T-3.2, variant B	AE 8-1, variant B – Eglaff 766-767	Subgroup late Roman 13	AE8-2	Globular	Bailey O 17	Bailey V 17-18	Bailey W26-8	Unidentified
Alexandria Islamic	1	1	3	1	1	1	2	1	1	1	0

11.2.1.2.2.2 Amphorae Contents

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Alexandria Pre-H	5	1	0	0	1	0	0	0	3
Alexandria H	168	497	0	0	0	0	0	0	5
Alexandria ER	33	6	0	1	1	0	0	0	2
Alexandria MR	45	3	1	1	0	0	0	0	0
Alexandria LR	64	0	0	2	0	0	0	0	0
Alexandria Islamic	8	0	0	0	0	1	0	0	4

11.2.1.2.2.3 Production Regions

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
Alexandria Pre-H	0	2	1	1	6	0	0
Alexandria H	13	0	2	509	147	0	0
Alexandria ER	3	3	6	23	6	0	2
Alexandria MR	3	37	1	4	5	0	0
Alexandria LR	5	54	1	1	5	0	0
Alexandria Islamic	8	1	0	0	2	0	2

11.2.2 Terrestrial Sites

11.2.2.1 Amphorae Types

11.2.2.1.1 Pre-Hellenistic period

	Thasos	Chain
Serapium	0	0
Gabbari Necropolis	0	0
Mareotic Region	2	2
Total	2	2

11.2.2.1.2 Hellenistic period

	Knidian early	Koan	AE1	Dr 1	Rhodian early	Dr 1A Campania	Greco-Italic	Lamboglia II
Serapium	0	0	0	0	0	0	0	0
Gabbari Necropolis	124	157	0	38	2026	0	0	30
Mareotic Region	345	571	1843	0	373	7	19	0
Total	469	728	1843	38	2399	7	19	30

11.2.2.1.3 Early Roman period

	Agora M 54	Agora G119	AE4	Pompeii V	Dressel 2-4 Cilicia	Dressel 2-4 Campania	Cretan	AE3	MC 2/12	MC 22/3
Serapium	0	0	0	0	0	0	0	5	0	0
Gabbari Necropolis	9	11	33	0	0	0	32	2589	0	0
Mareotic Region	2	0	667	5	1	4	0	6	1	229
Total	11	11	700	5	1	4	32	2600	1	229

11.2.2.1.4 Mid. Roman period

	Dr 30	Africana I	Africana II	Africana 2D Grande	Africana III	Kapitän II	Tripolitanian II
Serapium	0	1	3	0	0	0	0
Gabbari Necropolis	0	349	0	0	0	0	0
Mareotic Region	13	0	0	8	11	7	11
Total	13	345	3	8	11	7	11

11.2.2.1.5 Late Roman period

	LR1	LR2	LR3	LR4	LR5/6	AE3 late	AE7	Spatheia	Keay 8B	Keay 25	Keay 35	Keay 36	Keay 45	Egloff 169
Serapium	6	0	5	6	0	5	6	0	6	16	1	1	1	0
Gabbari Necropolis	916	4	36	2063	464	0	83	1	0	0	0	0	0	0
Mareotic Region	1105	24	8	221	44	0	48	0	0	0	0	0	0	28
Total	2027	28	49	2290	508	5	137	1	6	16	1	1	1	28

11.2.2.2 Amphorae Contents

11.2.2.2.1 Pre-Hellenistic period

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Serapium	0	0	0	0	0	0	0	0	0
Gabbari Necropolis	0	0	0	0	0	0	0	0	0
Mareotic Region	4	0	0	0	0	0	0	0	0
Total	4	0	0	0	0	0	0	0	0

11.2.2.2.2 Hellenistic period

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Serapium	0	0	0	0	0	0	0	0	0
Gabbari Necropolis	3096	30	0	0	0	0	0	0	0
Mareotic Region	3158	0	0	0	0	0	0	0	0
Total	6254	30	0	0	0	0	0	0	0

11.2.2.2.3 Early Roman period

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Serapium	5	0	0	0	0	0	0	0	0
Gabbari Necropolis	85	0	0	0	0	0	0	0	0
Mareotic Region	686	0	0	0	0	0	0	0	230
Total	776	0	0	0	0	0	0	0	230

11.2.2.2.4 Mid. Roman period

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Serapium	3	1	0	0	0	0	0	0	0
Gabbari Necropolis	0	349	0	0	0	0	0	0	0
Mareotic Region	31	11	0	8	0	0	0	0	0
Total	34	361	0	8	0	0	0	0	0

11.2.2.2.5 Late Roman period

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Serapium	17	25	6	0	0	0	0	0	5
Gabbari Necropolis	2614	916	1	0	0	0	0	0	36
Mareotic Region	337	1133	0	0	0	0	0	0	8
Total	2968	2074	7	0	0	0	0	0	49

11.2.2.3 Production Regions

11.2.2.3.1 Pre-Hellenistic period

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unknown
Serapium	0	0	0	0	0	0	0
Gabbari Necropolis	0	0	0	0	0	0	0
Mareotic Region	0	0	0	0	4	0	0
Total	0	0	0	0	4	0	0

11.2.2.3.2 Hellenistic period

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	unknown
Serapium	0	0	0	0	0	0	0
Gabbari Necropolis	751	0	0	68	2307	0	0
Mareotic Region	1843	0	0	26	1289	0	0
Total	2594	0	0	94	3596	0	0

11.2.2.3.3 Early Roman period

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unknown
Serapium	5	0	0	0	0	0	0
Gabbari Necropolis	33	20	0	0	32	0	0
Mareotic Region	897	8	0	4	0	0	0
Total	935	28	0	4	32	0	0

11.2.2.3.4 Mid. Roman period

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unknown
Serapium	0	0	0	4	0	0	0
Gabbari Necropolis	0	0	0	349	0	0	0
Mareotic Region	0	0	0	43	0	0	0
Total	0	0	0	396	0	0	0

11.2.2.3.5 Late Roman period

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unknown
Serapium	11	17	0	25	0	0	0
Gabbari Necropolis	547	2979	0	1	40	0	0
Mareotic Region	92	1354	0	0	32	0	0
Total	650	4350	0	26	72	0	0

11.2.3 Amphorae collection at the Greco-Roman Museum in Alexandria

11.2.3.1 Amphorae Types

11.2.3.1.1 Hellenistic period

	Brindisi	Mana	Rhodian early	Koan	Chios	Lesbos	Greco-Italic	Dressel 1A	Lamboglia II	AE1	AE2	Tripolitania
Alexandria H	1	1	14	2	3	7	4	1	11	4	7	5

11.2.3.1.2 Early Roman period

	Pompeiv	Pseudo-cos	Dressel 2-4 Campania	AE3	AE4	Dressel 7/11	Cretan	Dr IB	Dr 1C	Dr 6A	Knidian
Alexandria ER	5	2	3	95	4	3	2	1	1	16	3

11.2.3.1.3 Mid. Roman period

	Dressel 36	Dressel 43	Kapitän II	Africana Grande
Alexandria MR	1	1	2	10

11.2.3.1.4 Late Roman period

	LR1	LR2	LR4	Spatheia	AE5/6	LR7
Alexandria LR	1	2	7	9	18	5

11.2.3.2 Amphorae Contents

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Alexandria H	23	17	0	1	0	0	0	0	0
Alexandria ER	133	0	0	3	0	0	0	0	0
Alexandria MR	2	0	0	10	0	0	0	0	0
Alexandria LR	32	1	9	0	0	0	0	0	0

11.2.3.3 Production Regions

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unknown
Alexandria H	6	1	0	22	12	0	0
Alexandria ER	99	5	3	22	6	0	2
Alexandria MR	0	2	0	10	0	0	0
Alexandria LR	23	8	0	9	2	0	0

11.2.4 Alexandria as One Large Site Across the Time Periods

11.2.4.1 Combined Binary Data

11.2.4.1.1 Amphorae types

	Mendean	Klozomenai	Basket-handle (type 3)	Chain	Chiote	Samian	Milesian	Thasos	Persian Torpedo	Cyrenaican I
Alexandria Pre-H	1	1	1	1	1	1	1	1	1	0
Alexandria H	0	0	0	0	0	0	0	0	0	1
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	Rhodian H.	Knidian H.	Greco-Italic	Tripolitania	Koan	Brindisi	Lamboglia II	AE2	Lesbian	Chios
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	1	1	1	1	1	1	1	1	1	1
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	AE1	DR 1A	Mana	Agora G 199	Rhodian M.	Knidian M.	Agora M 54	Agora K 114	Dr 2-4 Pompeii	Agora G 197

Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	1	1	1	0	0	0	0	0	0	0
Alexandria ER	0	0	0	1	1	1	1	1	1	1
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	Dr 2-4 Imitated Pompeiian	Dr 2-4 Imitated Campanian	Dr 5	Dr 6A	Dr 9	Dr 20	Cretan	Beltran 2A	AE3	AE2-3
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	1
Alexandria ER	1	1	1	1	1	1	1	1	1	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	AE4	Pompeii V	Dr 2-4 Cilicia	Dr 2-4 Campania	MC 2/12	MC 22/3	Pseudo-Cos	Dr 1B	DR 1C	Dr 6A
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	1	1	1	1	1	1	1	1	1	1
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0

	Dr 7/11	Tripolitania n I	Kapitän II	Africana Grande	African a I	African a III	Tripolitania n II	Tripolitania n III	Dr 23	Sinope
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	1	1	0	0	0	0	0	0	0	0
Alexandria MR	0	0	1	1	1	1	1	1	1	1
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	Dr 30	AE3	Dr 36	Dr 43	LR 1	LR2	LR3	LR4	LR5/6-AE5/6	LR7 - AE7
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	1	1	1	1	0	0	0	0	0	0
Alexandria LR	0	0	0	0	1	1	1	1	1	1
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	AE3 Late	Spatheia	Beltran 72	Keay 8B	Keay 25	Keay 35	Keay 36	Keay 45	Egloff 169	Gunsenin 1
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	8	1	1	1	1	1	1	1	1	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	1

	Gunsenin 2	AE3 Late	AE 8-1 Variant B	LR 13	AE 8-2	Globular	Bailey O 17	Bailey V 17-18	Bailey W 26-8	
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	
Alexandria H	0	0	0	0	0	0	0	0	0	
Alexandria ER	0	0	0	0	0	0	0	0	0	
Alexandria MR	0	0	0	0	0	0	0	0	0	
Alexandria LR	0	0	0	0	0	0	0	0	0	
Alexandria Islamic	1	1	1	1	1	1	1	1	1	

11.2.4.1.2 Amphorae contents

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Alexandria Pre-H	1	1	0	0	1	0	0	0	1
Alexandria H	1	1	0	1	0	0	0	0	1
Alexandria ER	1	1	0	1	1	0	0	0	1
Alexandria MR	1	1	1	1	0	0	0	0	0
Alexandria LR	1	1	1	1	0	0	0	0	1
Alexandria Islamic	1	0	0	0	0	1	0	0	1

11.2.4.1.3 Production Regions

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
Alexandria Pre-H	0	1	1	1	1	0	0
Alexandria H	1	1	1	1	1	0	0
Alexandria ER	1	1	1	1	1	0	1
Alexandria MR	1	1	1	1	1	0	0
Alexandria LR	1	1	1	1	1	0	0
Alexandria Islamic	1	1	0	0	1	0	1

11.2.4.2 Combined Valued Data

11.2.4.2.1 Amphorae types

	Mendean	Klozomenai	Basket-handle (type 3)	Chain	Chiote	Samian	Milesian	Thasos	Persian Torpedo	Cyrenaican I
Alexandria Pre-H	1	2	1	3	1	1	1	3	1	0
Alexandria H	0	0	0	0	0	0	0	0	0	1
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	Rhodian H.	Knidian H.	Greco-Italic	Tripolitania	Koan	Brindisi	Lamboglia II	AE2	Lesbian	Chios
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	2544	475	34	6	734	2	537	9	9	5
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	AE1	DR 1A	Mana	Agora G 199	Rhodian M.	Knidian M.	Agora M 54	Agora K 114	Dr 2-4 Pompeii	Agora G 197

Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	1847	46	1	0	0	0	0	0	0	0
Alexandria ER	0	0	0	13	2	4	12	1	8	1
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	Dr 2-4 Imitated Pompeiian	Dr 2-4 Imitated Campanian	Dr 5	Dr 6A	Dr 9	Dr 20	Cretan	Beltran 2A	AE3	AE2-3
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	11
Alexandria ER	3	1	1	10	1	4	35	1	2698	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	AE4	Pompeii V	Dr 2-4 Cilicia	Dr 2-4 Campania	MC 2/12	MC 22/3	Pseudo-Cos	Dr 1B	DR 1C	Dr 6A
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	704	10	1	7	1	229	2	1	1	16
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0

	Dr 7/11	Tripolitania n I	Kapitän II	Africana Grande	African a I	African a III	Tripolitania n II	Tripolitania n III	Dr 23	Sinope
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	3	2	0	0	0	0	0	0	0	0
Alexandria MR	0	0	46	23	346	11	11	1	1	5
Alexandria LR	0	0	0	0	0	0	0	0	0	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	Dr 30	AE3	Dr 36	Dr 43	LR 1	LR2	LR3	LR4	LR5/6-AE5/6	LR7 - AE7
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	13	3	1	1	0	0	0	0	0	0
Alexandria LR	0	0	0	0	2080	31	51	2300	527	143
Alexandria Islamic	0	0	0	0	0	0	0	0	0	0
	AE3 Late	Spatheia	Beltran 72	Keay 8B	Keay 25	Keay 35	Keay 36	Keay 45	Egloff 169	Gunsenin 1
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	0
Alexandria H	0	0	0	0	0	0	0	0	0	0
Alexandria ER	0	0	0	0	0	0	0	0	0	0
Alexandria MR	0	0	0	0	0	0	0	0	0	0
Alexandria LR	8	11	1	6	16	1	1	1	28	0
Alexandria Islamic	0	0	0	0	0	0	0	0	0	1

	Gunsenin 2	AE3 Late	AE 8-1 Variant B	LR 13	AE 8-2	Globular	Bailey O 17	Bailey V 17-18	Bailey W 26-8	
Alexandria Pre-H	0	0	0	0	0	0	0	0	0	
Alexandria H	0	0	0	0	0	0	0	0	0	
Alexandria ER	0	0	0	0	0	0	0	0	0	
Alexandria MR	0	0	0	0	0	0	0	0	0	
Alexandria LR	0	0	0	0	0	0	0	0	0	
Alexandria Islamic	1	3	1	1	1	2	1	1	1	

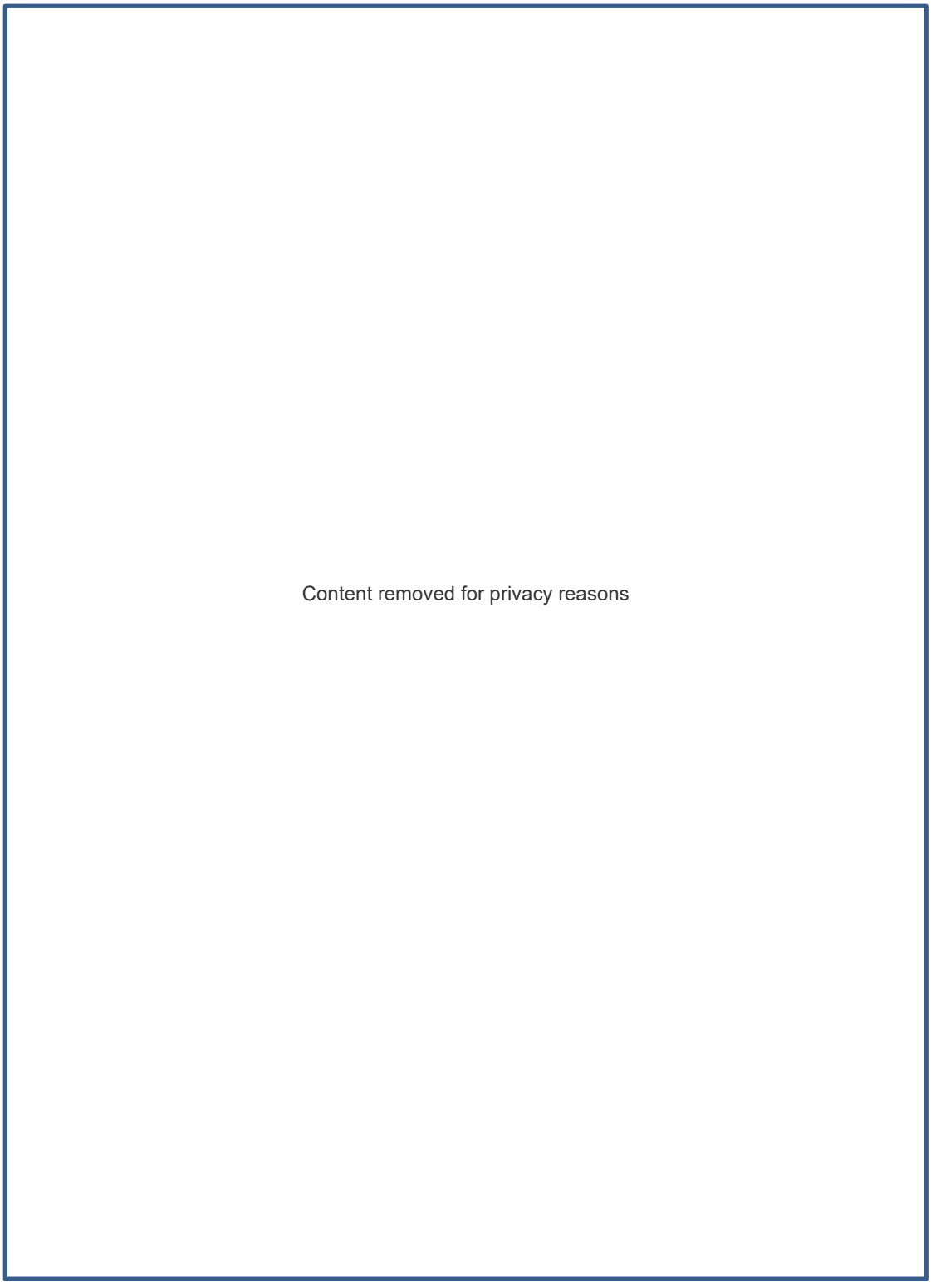
11.2.4.2.2 Amphorae Contents

	Wine	Olive oil	Olive	Fish sauce	Fish products	Dried food/Fruit	Sesame Oil	Cereal	Unknown
Alexandria Pre-H	9	1	0	0	1	0	0	0	3
Alexandria H	6445	544	0	1	0	0	0	0	5
Alexandria ER	942	6	0	4	1	0	0	0	232
Alexandria MR	81	364	1	18	0	0	0	0	0
Alexandria LR	3064	2075	16	2	0	0	0	0	49
Alexandria Islamic	8	0	0	0	0	1	0	0	4

11.2.4.2.3 Production Regions

	Egypt	Eastern Med.	Western Med.	Central Med.	Aegean	North Africa	Unidentified
Alexandria Pre-H	0	2	1	1	10	0	0
Alexandria H	2613	1	2	625	3755	0	0
Alexandria ER	1037	36	9	49	44	0	4
Alexandria MR	3	39	1	410	5	0	0
Alexandria LR	678	4412	1	36	79	0	0
Alexandria Islamic	8	1	0	0	2	0	2

11.3 APPENDIX 3 PERMISSIONS



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11.3 APPENDIX 4 THE AMPHORAE TYPES LOCATED AT THE UNDERWATER SITES RECORD

Periods	Amphorae Types	Underwater Sites												
		North-Western Coast						Alexandrian Coastline						
		Ras El-Hikma	Tannum Reef	Ras Hashafa	Ras Hawala	Marsa Oum El-Rakham	Marsa Bagoush	Aboukir	Mammura	Ibrahimia	Shatby	Eastern Harbour	Qaitbay/Pharos	Western Harbour
Pre-Hellenistic	Chain					1								
	Samian							1						
	Klazomenai							2						
	Milesian							1						
	Chiote							1						
	Basket-handle Type 3							1						
	Thasos							1						
	Mendean							1						
	Persian Torpedo							1						
Hellenistic	Rhodian early						1	5	3		1		100	2
	Rhodian Middle		1						1				17	
	Knidian Early							1	2					1
	Knidian Middle		1				1							
	Koan		1	1	1			1						
	Greco-Italic / Will form A1						1							
	Greco-Italic/ Will form A2					1	2	1		1			5	
	Cyrenaican I								1					

Periods	Amphorae Types	Underwater Sites												
		North-Western Coast						Alexandrian Coastline						
		Ras El-Hikma	Tannum Reef	Ras Hashafa	Ras Hawala	Marsa Oum El-Rakham	Marsa Bagoush	Aboukir	Mammura	Ibrahimia	Shatby	Eastern Harbour	Qaitbay/Pharos	Western Harbour
	AE2						1	1						
	AE2-3			1									5	
	Brindisi						1							
	Lesbian							1						1
	Lamboglia II										1		495	
	Chios					1		1						
Early Roman	Agora G 199					1			1					
	Agora M 54										1			
	Agora K 114					1								
	Agora G 197						1							
	Dr 2-4 Pompeii						3				2		5	
	Dr 2-4 Imitated Pompeiian						1							
	Dr 2-4 Imitated Campanian						1							
	Dr 5					1								
	Dr 6A												10	
	Dr 9	1												
	Dr 20									2	2			
	Cretan											1		
	Beltrán 2A										1			
	AE3/ AE 3-2, variant A						2							
	AE3/ AE3-I.4						1							

Periods	Amphorae Types	Underwater Sites												
		North-Western Coast						Alexandrian Coastline						
		Ras El-Hikma	Tannum Reef	Ras Hashafa	Ras Hawala	Marsa Oum El-Rakham	Marsa Bagoush	Aboukir	Mammura	Ibrahimia	Shatby	Eastern Harbour	Qaitbay/Pharos	Western Harbour
	Rhodian late										1	1		
	Knidian late						1							
	Tripolitanian I									2				
Mid. Roman	Kapitän II								37					
	Africana 2D Grande								1					
	Africana 2B Grande								1					
	Africana I										1			
	Tripolitanian III									1				
	Dressel 23									1				
	AE3/ AE 3-1.5 variant B						3							
	Sinope												5	
Late Roman	LR 1					1			2				50	
	LR 2					1								
	LR3												2	
	LR4					1	1		1					
	LR 5/6						1							
	LR7	1												
	AE3 Late/ AE 3T-2, variant B					1	1		1					
	Spatheia	1												
	Beltrán 72	1												

Periods	Amphorae Types	Underwater Sites												
		North-Western Coast						Alexandrian Coastline						
		Ras El-Hikma	Tannum Reef	Ras Hashafa	Ras Hawala	Marsa Oum El-Rakham	Marsa Bagoush	Aboukir	Mammura	Ibrahimia	Shatby	Eastern Harbour	Qaitbay/Pharos	Western Harbour
Islamic	Günsenin 1								1					
	Günsenin 2						1							
	AE3 Late/ AE 3T-3.2, variant B						2				1			
	AE 8-1, variant B – Eglaff 766-767									1				
	Subgroup late Roman 13						1							
	AE8-2						1							
	Globular						2							
	Bailey O 17						1							
	Bailey V 17-18						1							
	Bailey W26-8						1							