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## **A physicochemical study of Medieval and Post-Medieval ceramics from the Aegean**

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## CHAPTER 13 CONCLUSION

### 13.1 CONCLUSION

The 11th century marked the return of relative peace and safety in the eastern Mediterranean. The expulsion of the Saracens from the Aegean and the end of the Cretan Emirate through the reconquest by Nicephorus Phocas in 961 established Byzantine sovereignty which enabled navigation and sea trade to flourish again. The three regions under study became important commercial hubs, connected to the major maritime trade routes across the Mediterranean. However, Byzantium was already waning and the Crusades, launched in 1095, brought the Western feudal states to its threshold. The conquest of Constantinople (Istanbul) by the Crusaders in 1204 ended up in the establishment of Frankish hegemonies in Greece and the Aegean and in the predominant role of Genoese and Venetians in the Bosphorus, commanding the Eastern trade even after the recuperation of the Byzantine capital by the Palaeologian dynasty in 1261. The privileges offered by the Byzantines to the great Italian seafarers and their native cities led to the establishment of trade posts in important ports of the Aegean, such as Chalcis/Negroponte, Euboea, and Almyros, in the Gulf of Pagasae (Laiou and Morisson 2007). Such ports controlled the maritime communication between North and South, between Byzantine strongholds such as Constantinople (Istanbul) and Thessaloniki with the Levant and North Africa, Egypt in particular. Rhodes, Lesvos and Naxos are among the stations and the outposts of the fleets and merchants of the Latins: the Order of Saint John that occupied the Dodecanese, the Genoese Company (Maona) that governed Chios and the Divine Duchy of the Archipelago and the Divine Duchy of the Archipelago that governed Cyclades (except Mykonos and Tinos). The 13th century marked a decisive turn in the maritime trade and communication between East and West over the Mediterranean Sea (François 1997a; Belavilas 2010).

The establishment of Turkish sultanates in Asia Minor on the one hand and the presence of the mercenary army of the Catalan company in Greece, on the other, along with the increasing political and economic influence of the Genoese and Venetians marked the transitional 14th century. It is in this period that Mytilene was given as dowry to the Gattilusi family, that the Duchy of Athens and Neopatria came under the Catalans after the Battle of Halmyros and that Chalcis along with large part of Negroponte were ruled by the Venetian Doge and his *bailo*. By the late 14th century, Venice was expanding and investigating potential markets and sources of primary materials: let's not forget that Marco Polo reached China through the Silk Road exactly at this period. This gradually led to the development of a high-quality material culture, influenced by west and east alike, which is reflected in the ceramics, weapons, wall paintings, Gothic and Late Byzantine sculpture, as well as in all other forms of artistic and artisanal production. Especially in the 14th and 15th centuries, the cities under study progressively evolved into the primary transit hub in the western Aegean, with commodities arriving from diverse locations in order to be further transported to nearby or distant destinations. The 15th century changes the character of the Aegean. It is the century of the rapid expansion of Ottoman rule, which will be completed in the middle of the next century, turning the islands into a part of the Ottoman Empire and the Aegean into an

Ottoman Sea. People living on the islands of the Aegean and in some seaside cities of mainland Greece had been formerly influenced by the western culture and tended to adopt western institutions and traditions, due to the aforementioned predominant presence of Franks, Venetians and Genoese. After the Ottoman conquest, this world adapted partly to the new conditions and succumbed to Ottoman influence, without losing, however, completely its Latin veneer (Belavilas 2010). The areas that constitute the focus of this study underwent phases of occupation (and subsequent influence) by Franks, Italians (Genoese, Venetian, Florentine), Catalans and Ottomans. These rulers left their traces on the culture of each area, both in terms of “high” artistic endeavours and in terms of arts and crafts.

The richness and the variety of pottery that has come to light during this study reflects the economic prosperity of **Chalcis** and its contacts with major centers of the Byzantine Empire as well as with the East and the West. During the **Middle Byzantine period (10th-12th century)**, the city served as the station for the flotilla of the Theme of Hellas, which was one of the main military/administrative divisions of the middle Byzantine Empire. Also, it served as the physical port of call in the Aegean for nearby Thebes, a significant city and bishopric in that period (Koder et al. 1976, p. 156; Triantafyllopoulos 1990, p. 170; Georgopoulou 2001, p. 73). As a result, Byzantine art had a significant influence on the island, which was evident in the pottery, architecture, and fine arts of Euboea. In the Late Byzantine/Frankish period (1204-1470), Chalcis was dominated by the Latins. Imported pottery (Glazed White Ware II, Zeuxippus Ware, Didymoteicho Ware, Glazed Frit Ware and Maiolica) during the Frankish period is a testimony for the important position that Chalcis held in the commercial network of the Mediterranean, as one of the largest Venetian transit ports, confirming the city's contacts with major commercial centers at that time: Northern Greece, Islamic East, Spain and Italy. After 1204, despite the significant changes in the political, economic and social conditions due to the Latin conquest, a continuity in the production and the use of the same pottery types of the Middle Byzantine period is noticed into the 13th century (such as Incised Sgraffito Ware, Painted Fine Sgraffito Ware, Brown Painted Ware, Splashed Ware, Champlevé Ware, Green and Brown Painted Ware, Slip-Painted Ware, Painted Ware, A8A Amphora, Günsenin 2 Amphora and Günsenin 3 Amphora). From the second half of the 13th c. onwards, the imported pottery from Italy related to the gradual predominance of the Venetians in Euboea and the integration of the port of Chalcis into the Venetian commercial network. After the Ottoman conquest of 1470, the city of Chalcis in Euboea served as one of the administrative and economic centres of the southern Balkans and the Aegean region until the Greek War of Independence in 1821 (Triantafyllopoulos 1990; Papadia-Lala 2006; Kontogiannis 2012a). The violent conquest and expulsion of the Venetians by the Ottomans undoubtedly caused a breach in the commercial networks which had an effect on the prosperity of the city and its surroundings.

**Athens** dominates the region of Attica, as it is the capital and the largest city of modern Greece, as well as one of the world's oldest settlements, with the earliest human presence around the 11th–7th millennium BC. Athens is not often mentioned in texts of the dark ages (7th-9th centuries), because the empire suffered mainly from frequent attacks by enemies from land and sea. Furthermore, in the middle of the 10th century Arabs settled in Athens (Kontogeorgopoulou 2016). In the Middle Byzantine period (10th–12th centuries), Athens grew under the influence of the Byzantine Empire and can truly be said to have flourished, despite the Arab danger which was imminent (Setton 1975a,b). The road networks of Byzantine Athens did not deviate much from

the ancient road networks. The Athenian Agora apparently formed part of this road and trade network, spreading from the Levant to the coast of Western Turkey, over the Aegean and as far west as Southern Italy, based at least on the pottery sherds' finds. In the Early to Middle Byzantine period pottery finds become sparser and more limited in geographical range, originating mainly from the Aegean. In the Middle Byzantine period, it seems that the local production becomes predominant whereas imports from the Aegean islands and Constantinople (Istanbul) are few (Vroom 2015). In the **Late Byzantine/Frankish period (13th–15th centuries)**, Athens found itself under the rule, successively, by the French dukes de la Roche and de Brienne (1204–1311), the Catalans (1311–87), and the Acciajuoli family of Florence (1387– 1456) (Setton 1975a,b; Skoumpourdi 2004, p. 45). In the Late Byzantine/Frankish period, the ceramic production seems to be reduced and some local ceramics under study were found keeping the same technology production of the previous years such as Monochrome Glazed Ware, Polychrome Sgraffito Ware, Zeuxippus Ware subtype, Slip-Painted Ware, Painted Ware, Late Sgraffito Ware. A new era in the long history of the city began in 1456 when the last Florentine duke surrendered Athens to the conquering Ottomans (Setton 1975a). A variety of new ceramic products first appeared in Athens towards the end of the 15th century and throughout the 16th; the most prominent of these pottery types were the Kütahya and Iznik ceramics from modern-day Turkey and the tin-glazed Maiolica from Italy. Furthermore, a big variety of pottery made with local raw materials and two different types of clay were observed such as Polychrome Sgraffito Ware and Polychrome Painted Ware/Maiolica that were made with a pinkish clay and Incised Sgraffito Ware, Green and Brown Painted Ware, Fine Sgraffito Ware that were made with a red clay. Finally, during the Ottoman period, the Athenian Agora formed part of a road and trade network, spreading from the Levant to the coast of Western Turkey, over the Aegean, and as far west as Southern Italy, based at least on the pottery sherds' finds.

**Mytilene** was a prosperous seaport, connecting East and West. During the Hellenistic, Roman and Medieval periods, as well as in the early modern and modern periods until 1922 the communication between Lesvos and the shores of Western Turkey was frequent. The history of the island is unclear for the troubled years of the late 7th and 8th centuries. Arabs raided Lesvos only in the 9th century. Lesvos appears to have been a naval base of great significance since it was used in 821 by Thomas the Slav in his assault on the Byzantine capital as well as by many Byzantine admirals of the 10th century, especially in their attacks against the Arabs of Crete (Lock 1980; Kaldellis et al. 2010). As the Komnenos dynasty lasted for less than a century before being overtaken by the disturbances at the end of the 12th century and, ultimately, the Fourth Crusade. During the Fourth Crusade (1204), Lesvos suffered from raids by Italian fleets and in 1355 came under the domination of the Genovese family of the Gattilusi. During the Medieval period, the island retained its commercial links with Egypt and the Near East dating back to ancient times. The history of Lesvos is completely interwoven with that of the Aegean Sea, and the eastern Mediterranean in general (Kaldellis 2002). Finally, in 1462 Lesvos was conquered by the Turks. There is some evidence of pottery activity in Early and Middle Byzantine times in Lesvos, and indeed in its capital Mytilene. Until today, there are no evident eastern imports during the Medieval period (Williams 2009). The four hundred and fifty years (1462-1912) of Ottoman rule left numerous traces in the castle and town of Mytilene. The Ottoman period yielded a rich collection of different imported wares, such as Polychrome Marbled Ware, Iznik Ware, Kütahya Ware, Glazed White Ware, Miletus Ware, Painted Ware, Polychrome Sgraffito Ware, Elaborate Incised Ware, Zeuxippus Ware,

Monochrome and one-colour Ware, Roulette/Veneto Ware but also local ceramic wares which attest to Byzantine influences such as Monochrome Painted Ware and Polychrome Sgraffito Ware from the 16th to the 19th century. Construction practices from Western Turkey have spread into Lesbos as glazing and decorative themes.

In Chalcis and also in Athens, **the imported pottery under study** corresponded to small proportional quantities in relation to the local Byzantine pottery, whereas high percentages of imported pottery were found in the Castle of Mytilene. According to the examined samples, in Chalcis there are almost equal imports from the Islamic East and from the Italian peninsula and some ceramics of Northern Greece, while in Athens there are imports from the Italian and Iberian Peninsula. Finally in Mytilene most samples are from the Islamic East and China, less samples from the Italian Peninsula and some samples from Northern Greece. At the end of the 13th century, the samples from Chalcis show imports from the Islamic East and from the Italian peninsula, in contrast to the pottery of other Latin-occupied areas of Greece, among which areas that belonged to the Principality of Achaia (Corinth, Isthmia, Chlemoutsi, Clarenza, etc.) where Italian pottery predominated (Francois 1997a, pp. 396-397; Skartzis 2012, pp. 90-91). This may be reflected to some extent to different political, economic and social conditions that were formed in each of the regions of Greece after the Fourth Crusade. The presence and the spread of Spanish pottery in Athens has been linked to the activity of Spanish merchants but mainly to the Catalan invasions and the occupation of the Duchy of Athens in 1311 (Francois 1997a, p. 401). Finally, in Mytilene imports were mainly from the Ottoman East and it is natural due to the proximity of the areas to the constant commuting of their inhabitants, to the Western Turkey refugees' establishment on the island, but also from the Turkish occupation of Lesbos until 1912.

Furthermore, **imitations** of characteristic pottery types of other regions in Greece or of other countries were produced in Chalcis, such as Roulette/Veneto Ware, originating from Northeast Italy; Didymoteicho Ware, originating from the Dardanelles or Northern Greece; and Zeuxippus Ware, originating from Western Turkey. It was clear that imitations of Spanish Luster Ware were also made in the Athenian Agora, although it was a characteristic pottery made in Spain. But the potters of the Ancient Agora mainly imitated the Maiolica of Italy, creating a unique style, the 'Polychrome Painted Ware/Maiolica' with a pinkish clay. Attempts were being made to imitate original Zeuxippus Ware and Kütahya Ware in Mytilene. It was clear that Kütahya Ware (MYT218) constructed in Mytilene has a red body fabric as opposed to the original Kütahya Ware with a white body fabric from Western Turkey.

The physicochemical analyses of fabrics from **Chalcis** proved that **local production** used as primary material clay from the Lelantine plain, which is located in the southeastern part of Chalcis. This attests to continuity since antiquity, verified both by written and material evidence which shows the importance of the Lelantine plain for the provision of raw materials (Waksman and Wartburg 2006; Waksman et al. 2014; 2018; Skartzis and Vaxevanis 2017). Finally, Matson in his article, in 1973, described all the locations of the raw materials for pottery that have been used from ancient times to 20th century (see ethnographical research at chapter 4). Regarding the **Athenian Agora** finds, it was proven that two different sources of raw materials were used for the locally made pottery. The first one was the typical red fine clay of Attic ceramics that had been

used for many centuries and was mainly found on Mt. Pentelikon and Mt. Parnitha. It is clear that the raw materials from Mt. Pentelikon were used since the ancient period. This type of clay is attested also at the northwest part of Hymettus Mountain. The second group consisted of a pinkish clay and the potential provenance of this clay is the Municipality of Vari-Voula-Vouliagmeni at the Saronic Gulf in Attica, at a distance of about 15 klms from the Athenian Agora. As for **Mytilene**, the raw materials seem to have come from an area near the castle as the south east coastal area and specifically from Mytilene to the airport or from another area 'Moria'. In conclusion, the origin of raw materials is a study that depends on many variables such as the geological characteristics of each area as well as the way the raw material was treated, sieving, washing, mixing with local and imported clays. For instance, Lesbos was characterized by complex geological features and trace elements due to volcanic deposits. Moreover, even if the clay paste used at a particular production site was always based on the same raw materials collected from specific sources, variation was introduced by the clay paste recipes used in terms of varying amounts of components that were removed or added. Potters have to achieve a clay paste suitable for moulding and firing ceramic products that have to fulfil different functions. Therefore, different clay pastes were used for the manufacture of different vessels, and the clay paste could be modified over time in order to improve the production process or the material properties. It is noteworthy, that the studied ceramics were excellent fine wares.

Many achievements in the **production technology** were noticeable in these areas. The studied pottery samples in **Chalcis** were dated from Early Byzantine to Early Modern times. From the Early Byzantine period and beyond, a high know-how of firing ceramics was achieved at temperatures T 850-1050 °C. The great interest of the potters is focused on specific types of pottery which used a strict protocol of raw materials, firing temperature and kiln conditions such as Champlévé and Incised Sgraffito Ware. Of secondary importance were some simple ceramics such as Plain Ware, Splashed Ware and Slip-Painted Ware which were characterized by a meticulously designed decoration and shape but the firing temperature varied (Panagopoulou et al. 2021b,c; 2022). Also, technological differences regarding the firing temperature were observed in the amphorae depending on the typology. Specifically, for the A8A Amphora, potters used a lower temperature T 800-900 °C than the Günsenin 2 and at the Günsenin 3 Amphorae with T 850-1050 °C (Panagopoulou et al. 2019a; 2022). Finally, a technological leap from the Middle Byzantine to the Late Byzantine/Frankish period was noticed. Potters fired at even higher temperatures around 100-150 °C more than the ones reached previously. In this collection, the imported ceramics of Polychrome White Ware and Glazed White Ware II from Constantinople (Istanbul) were fired at T 800-850 °C, Roulette/Veneto Ware from Italy at T 850-950 °C, the Maiolica from Italy and the Lustre Ware from Egypt at T 950-1050 °C, the Zeuxippus Ware from Western Turkey and the Polychrome Marbled Ware from Italy were fired at T 1050-1150 °C, the Glazed Frit Ware and Frit Ware from Egypt or Syria as well as the Didymoteicho Ware from Northern Greece at T >1050 °C. Also, different technology constructions were observed at the imported pottery that came from different regions.

The studied pottery dated from Middle Byzantine to Turkish/Venetian times in the **Athenian Agora**. Almost the same firing temperature of T 850-1050 °C was observed in all the ceramic collections and in all periods (Panagopoulou et al. 2019b). Only some Green and Brown Painted

Ware and Monochrome Glazed Ware were fired at a degree higher by about 100 °C. This may be due to the higher temperature the kilns reached sometimes or to the fact that the firing lasted longer and thus a different stage of vitrification was achieved. In terms of the imported ceramics, Spanish Luster Ware from Spain and Maiolica from Italy have almost the same firing temperature T 850-1050 °C.

It seems that in the field of pottery there were interactions between Chalcis and Athens as both were famous pottery production centres during Medieval to Post-Medieval periods, lying in close distance to each other. It is no coincidence that ceramics were excavated in the Athenian Agora which had been made in Chalcis among which Incised Sgraffito Ware, Painted Ware and Zeuxippus Ware Subtype. As a result, they made some common pottery typologies that were constructed in both cities as Slip-Painted Ware with the same firing temperature T 850-1050 °C. Furthermore, Monochrome Glazed Ware in Chalcis had a slightly lower firing temperature T 850-1150 °C than Athens with T 1000-1150 °C. The ceramics of Incised Sgraffito Ware were fired at T 850-950 °C during the Middle Byzantine period and at higher T about 950->1150 °C during the Late Byzantine/Frankish period in contrast to Athens where the potters kept the same T 850-1050 °C. Some differences were also observed in the imported ceramics of Zeuxippus Ware from Western Turkey that were fired at a high temperature, namely T 1050-1150 °C, in contrast to the Zeuxippus Ware Subtype from Athens fired at a low temperature T 800-950 °C.

The studied pottery samples in **Mytilene** can be dated between the Late Byzantine/Frankish and the Early Modern periods. In the Late Byzantine/Frankish period, only imported ceramics were found including Roulette/Veneto from Italy with T 850-950 °C and Glazed White Ware IV from present-day Turkey with a lower temperature T 800-850 °C. During the Turkish/Venetian period, local and imported pottery appeared. The influences mainly from the neighboring pottery workshops in present-day Turkey seem to be very strong. The ceramics of Polychrome Sgraffito Ware, Monochrome Glazed Ware, Polychrome Painted Ware with T>1000 °C and Unglazed Painted Ware with T 800-850 °C can be either local or imported. It seemed that the unglazed ceramics were of little value to the potters either because they were intended for simple use or for the not so well-off customers. Furthermore, the imported pottery of Iznik and Kütahya Ware from present-day Turkey was fired at a high T>1000 °C while the imported pottery of Miletus Ware was fired at a slightly lower temperature of T 800-950 °C. The pieces of Glazed Frit Ware from Syria or Egypt were fired at a temperature of T>950 °C as well as Porcelain and the Overfired Stoneware at T>1100 °C. Finally, the pieces of Polychrome Marbled Ware from Italy were fired mainly at T 950-1050 °C and the local or imported pieces of Painted Ware at T>1100 °C. The higher the temperatures, the more resistant the pottery would be.

Although Mytilene had many influences from neighboring workshops in present-day Turkey, the comparison of the technology construction of the common pottery types with that of other cities was considered useful. As a result, the ceramics of Monochrome Glazed Ware from Mytilene have similar temperature firing as those from Athens. The ceramics of Roulette/Veneto Ware from Mytilene and those from Chalcis have the same temperature firing T 850-950 °C. The ceramics of Polychrome Marbled Ware from Chalcis have higher temperature T 1050-1150 °C than those from Mytilene T 950-1050 °C; similarly, the ceramics of Glazed Frit Ware, Frit Ware from Chalcis with

T>1050 °C were fired at a higher temperature than those from Mytilene with T>950 °C. Finally, the ceramics of Polychrome Sgraffito Ware from Mytilene and from Athens were fired at the same T 850-1050 °C. Higher temperatures achieved in advanced pottery kilns can be considered as a technological advance because the ceramic body reached a higher degree of vitrification and density resulting in higher mechanical strength.

Apart from sophisticated fabrics, the **pottery decoration** of the studied samples is admirable. In fact, decoration with geometric designs or free style lines, plants or vegetal motifs, animals and inscriptions or monograms was very important. For instance, rabbits or hares were noticed in the samples. Specifically, the decorative motifs in the Chalcis samples were: geometric designs or free style lines 57.3%, plants or vegetal motifs (4.9%), animals (3,7%) and inscriptions or monograms (2,4%). On the other hand, the decorative motifs in the Athenian samples were geometric designs or free style lines (71.3%) and plants or vegetal motifs (5%). Finally, the decorative motifs in the Mytilene samples were: geometric designs or free style lines (68.7%), plants or vegetal motifs (19.3%) and inscriptions or monograms (2,4%). The rest of the studied ceramics in each area were unglazed or they have just a colourless glaze on the clay body.

The pottery from Chalcis presents a slightly higher/larger variety of motifs (geometric designs or free style lines, plants or vegetal motifs, animals and inscriptions or monograms) compared to Mytilene and Athens. The decorative designs on the vessels from Athens were more simplified than those of Chalcis and Mytilene. They are usually geometric designs or free style lines and plants or vegetal motifs. On the other hand, Mytilene has a rather high variety of colours compared to Athens and Chalcis. Furthermore, the decoration and the iconographical aspects of these artifacts (single-coloured, bi-coloured and tri-coloured) are very interesting. I noticed that in Chalcis single-coloured pottery predominates; to a lesser extent, bi-coloured wares bearing a decoration marked by intense green hue or olive and light ochre hue are extant. Yellow is the most common pigment followed by green, brown and blue. In contrast to all the above, the Athenian potters used rather the bi-coloured decoration with light ochre, green or blue hues. Brown is the most common pigment followed by green, yellow, blue, dark pigment, red and turquoise. Finally, Lesvian potters used ochre, green, brown, yellow, blue, red, turquoise, dark pigment and purple colour coming in many tones. All the potters who fabricated the pottery studied for the purpose of this research were experienced in opacity, whiteness, glossy or matte glazes and for the achievement of the desired result.

The potters who made the studied pottery were experienced in glossy or matte glazes and for the achievement of the desired result. For this reason, they used: Zink oxide, ZnO, for increasing the brightness (Glazed Frit Ware) and for a matte finish (some ceramics of Monochrome Glazed Ware); Tin dioxide, SnO<sub>2</sub>, for opacity (ceramics of Lustre Ware, Glazed Frit Ware, Iznik Ware and the imitated Kütahya Ware); and Titanium dioxide, TiO<sub>2</sub> for whiteness and opacity (Didymoteicho Ware, Polychrome Sgraffito Ware, the Polychrome Painted Ware/Maiolica, Green and Brown Ware, Porcelain). For the alkali glazes, about 5% of the incident light is reflected; for the high-lead glazes, the specular reflectance almost doubles and greatly increases the glaze brilliance.

Specifically, all the local pottery from **Chalcis** ‘Champlevé Ware, Incised Sgraffito Ware, Monochrome Glazed Ware, Splashed Ware, Slip-Painted Ware and Plain Glazed Ware’ were typically lead glazes with a small amount of alkalis. The same was observed at the imported glazes in Chalcis ‘Didymoteicho Ware, Zeuxippus Ware, Lustre Ware, Polychrome Marbled Ware, Roulette/Veneto Ware, Polychrome White Ware and Glazed Frit Ware’ (Panagopoulou et al. 2021b,c). Regarding local pottery from the **Athenian Agora**, Polychrome Painted Ware/Maiolica, Polychrome Sgraffito Ware, Incised Sgraffito Ware, Monochrome Glazed Ware, Green and Brown Painted Ware, Slip-Painted Ware and Zeuxippus Ware subtype’, all of them had typically lead glazes with a small amount of alkalis (Panagopoulou et al. 2019b). Imported Maiolica samples both from Chalcis and the Athenian Agora have a lead glaze with a high amount of  $K_2O$ .

The local analysed glazes from **Mytilene** were mainly lead glaze and sometimes they had a small amount of alkalis. The glazes of the Polychrome Sgraffito Ware and the Polychrome Marbled Ware are lead glazes. Whereas the Polychrome Painted Ware is a soda lead glaze. A wonderful variation was noticed in the imported glaze recipes. Specifically, the imitations of Kütahya Ware had been constructed in Mytilene. The pieces of Iznik Ware have lead alkali glaze; the pieces of Miletus Ware have soda alkali glazes; the pieces of Glazed Frit Ware has lead alkali glaze; the pieces of Maiolica has a lead alkali glaze; the pieces of Porcelain have an alkali glaze (Panagopoulou et al. 2019c; 2021a); the pieces of Overfired Stoneware has an alkali glaze which is a high calcium glaze; the two pieces of Monochrome Glazed samples (MYT200, MYT201) had also alkali glazes; and the pieces of Roulette/Veneto Ware which is a quite pure high concentration lead calcium glaze. Moreover, the percentage of lead is quite lower at the imported ceramics than the local ceramics.

At the analyzed pigments of the **Chalcis sample collection** some **recipe pigments** were noticed. The colourants of the green colour were Cu and Fe; of the yellow, brown and dark colour was Fe; of the blue colour were Fe, Co and Ni; and of the turquoise colour were Cu, Fe and Sn. Many different **recipe pigments** were found also at the **Athenian Agora sample collection**. Three different green colour recipes were extant and specifically the combination of Cu, Fe for light to dark greens; Fe, Cu, Co for bluish greens; and Fe, Cu, Mn for brownish green colours. Furthermore, three different yellow colour recipes were noticed the Fe; Fe, Cu, Mn for dark greenish yellow; and Fe, Cu for greenish yellow colours. The colourant of the orange colour was Fe. Two different brown colour recipes were noticed Fe; Fe, Cu for greenish brown colours and one recipe for brown lines with Mn, Fe. The high percentage of Fe or Mn was produced dark colours. Two different recipes for blue colour were noticed also Fe, Co; Fe, Co, Cu for greenish blue colours. In addition, the colourants of the turquoise colour were Cu and Fe. Two different recipes for dark colour were noticed Fe; and Mn, Fe.

The high diversity of **recipe pigments** in the **Mytilene sample collection** was remarkable. The potters followed the same recipe for the green colour as the main colourant was Cu and for the yellow colours was Fe. Three different recipes for red colour were noticed and specifically Fe; Fe, Mn for brownish red; and Fe, Cu, Sn for greenish red colours. Three brown colour recipes were noticed and specifically Fe; Fe, Mn for reddish brown colours; and Co, Fe, Mn for bluish dark brown colours. To continue with, four blue colour recipes were noticed and specifically Co, Fe;

Cu, Sn for a light blue to turquoise colour; Co, Cu, Fe; Co, Mn. Furthermore, three different recipes were noticed for the dark blue lines Co, Mn, Cr, Fe; Cu, Mn, Cr, Fe; Co, Cu, Fe and two recipes for turquoise colour Cu, Fe; Cu, Co, Fe. The colourants of the dark colour were Fe, Mn and Cr. Also, the dark lines came from four different recipes Fe, Mn, Cu, Cr; Fe, Cu, Cr, Co; Fe, Cr; Fe, Co, Cr, Sn. Finally, three recipes are also noticed in reference to the purple colours: Fe, Cu, Co, Zn, Ti; Fe, Mn, Co, Cr; and Fe, Mn, Co, Cu.

For the dark colours the main colourant was at higher proportion than the light colour. For bright glaze colours, the underlying fabric should be white or a slip layer need to be applied on it in order to have a good reflectivity. The layer of slip was observed in all types of pottery apart from Polychrome White Ware, Glazed White Ware II, Glazed White Ware IV, Glazed Frit Ware, Porcelain and Overfired Stoneware which do not have this layer as they have white body fabric. Finally, significant difference was observed in the slip layers of Iznik and Kütahya Ware as both of them are fine, white slip of a quartz-frit type. In conclusion, regarding the decoration, the pigment oxides were added in the glaze of Champlevé, Frit Ware, Monochrome Glazed Ware, Incised Sgraffito Ware, Roulette/Veneto Ware, Plain Ware, Frit Ware, Porcelain and the Zeuxippus Subtype. All the other pottery typologies have underglaze decoration. In some cases, a combination of underglaze decoration with a brush or similar tool on slip and also a red coloured slip at some points was observed only in sherds from Mytilene (Panagopoulou et al. 2019b,c; 2021a,b,c).

***Final Remarks***

The comparative study of the three production centres, with similarities and differences in their historical background, has yielded interesting results. A sophisticated fabric technology construction with high vitrification stages was followed by potters who manufactured these vessels in mass production in Chalcis. The potters focused on specific types of pottery which used a strict protocol of raw materials, firing temperature and kiln conditions (Panagopoulou et al. 2021). The Lelantine plain actually provided a spectacular convergence of agricultural surplus and the accessibility of good clay resources near a significant harbor (Vroom 2022, p. 461). Furthermore, they seemed to have standard recipes for each colour and they did not make experiments with new colour recipes. Mainly, the potters tried to improve and keep in high standards the fabric technology construction as well as the incised depictions on slip rather than the use of a variable colour palette. These finds are clear indications of large-scale standardised pottery production, in which the motifs on the wares were imitating luxurious metal vessels or textile designs. The increase in demand for this decorated pottery may have been influenced by interregional contacts. Surely, pottery from the Islamic world had influenced the designs and the production technology of these ceramics (Vroom 2022, pp. 474-475). The potters in Athens used very fine-grained clayey raw materials but different fabric construction technology regarding temperature and kiln conditions. Having a long pottery tradition for many centuries, they mainly followed the same know-how in firing with unstable kiln conditions sometimes, but they paid great importance to the raw materials and their processing. Concerning the colour palette, they tried to enrich it with different hues as they tried to imitate some pottery types from other regions, such as Maiolica from Italy, and create their own style in the Polychrome Painted Ware/Maiolica. A varied construction technology regarding temperature, kiln conditions, and size of inclusions was observed in Mytilene. It seems that potters have experimented several times in this production centre, in order to change or improve their production.

Chalcis and Athens were renowned centers for the manufacturing of pottery during Medieval to Post-Medieval periods and it seemed that there were interacted between them in the field of pottery. It clearly demonstrates the intense competition between Chalcis, Athens and Thebes in central Greece, followed by Corinth, Argos, and Sparta in the Peloponnese (Laiou 2012, p. 141; Vroom 2022, p. 471). Although the Chalcis workshop served as the primary production hub for its surrounding area, it had to compete with further contemporary pottery workshops in the western Aegean that created tableware resembling Byzantine glazed tableware for greater interregional distribution. The most significant of these were based in Corinth, Thessaloniki, Sparta, Larissa, and Argos (and perhaps in Heraklion on Crete) (Bakirtzis 2007; Papanikola-Bakirtzi 2012; Vroom 2022, p. 471). However latest archaeometrical studies have undoubtedly demonstrated that the Chalcis workshop was the primary and most widely dispersed provider of Middle Byzantine to Late Byzantine/Frankish ceramic wares throughout the eastern Mediterranean and beyond. This is for instance shown by the compatibility of the Chalcis chemical group with samples from nearby shipwreck cargoes and from numerous sites in the Aegean, Black Sea, and eastern Mediterranean (Waksman et al. 2014; 2018a; 2018b; Vroom 2022, p. 471). It is no coincidence that ceramics made in Chalcis were discovered at excavations in the Athenian Agora, among which Incised Sgraffito Ware, Painted Ware and Zeuxippus Ware. As a result, some common pottery typologies appear in both the locally-made ceramics in both cities, for instance Slip-Painted Ware and Monochrome Glazed Ware with the same or very similar technology construction. Although

Mytilene was influenced by neighboring workshops in present-day Turkey, the comparison of the technology construction of the common pottery types with that of other cities under study was considered useful. As a result, for instance the locally made Byzantine pottery types from Mytilene have similar or even identical technology construction with the other cities.

Finally, the samples show that Chalcis was prone to artistic influences from present-day Turkey, Italy and the East but the Athenian Agora was rather influenced by Italy and Spain, a natural constatation given the fact that Athens remained under Italian and Catalan occupation for almost a century and a half. Mytilene had high artistic influences from Western Turkey and less from Italy possibly due to its geographical location. Although Greek traditional pottery was developed many centuries ago, potters tried to create a new artistic identity in order to compete with well-established workshops in Italy, Spain, present-day Turkey Near West as well as to be integrated equally to the new trade context. Let us not forget that pottery and glassmaking was an art based on trial, error and experimentation.

We were given the opportunity to approach satisfactorily and to interpret the pottery information from Chalcis, the Ancient Agora in Athens and the Castle of Mytilene, which in combination with historical sources, testify to the flourishing of these cities in Medieval and Post-Medieval times making them very important commercial and productive centers in the Mediterranean. The history of the three regions under study is very rich and could not become the focus of the present study which has as a main objective the archaeometric analyses of the 245 samples under study. The historical context was regarded as the framework which allowed me to understand differences and similarities in ceramics. In general, many imported ceramics from various regions of the Mediterranean and the East were found, thus interpreting the commercial connection of the workshops of Chalcis, Athens and Mytilene with these regions and the importance of their ports as trading hubs of the Mediterranean throughout the Medieval and Post-Medieval times. The presence of these ceramics from Italy, Spain, China and especially from the Islamic East, is certainly not a strong indication of the existence of systematic trade with all these areas, but it reflects the importance of these ports and their participation in a wide network of commercial and cultural contacts.

The methodology was carefully selected and the finds were interpreted in a careful way. The arguments based on it are appropriate and coherent. The aim was to contribute with scientific analysis to the general picture of material culture. Hence, this thesis shows some evidence of originality and contributes to the state-of-the-art of our knowledge.

The chosen methodology was used effectively as it can be proved by the flow of the chapters. **Chapter 2** provided a historical overview of the three important locations of pottery production in detail and specifically Chalcis in Euboea, Athens in Attica and Mytilene in Lesvos from the Medieval to the Early Modern periods, and presents the physical evidence for glazed pottery manufacture during these periods. The amount and quality of material evidence show that these three centres were of a certain standing both in the pottery production and in the cultural life of Medieval Greece. **Chapter 3** relied on statistical methods in order to collect the archaeological data, take decisions based on these data and make predictions in order to employ the correct analyses and effectively present the results in the following chapters. At **Chapter 4**, ethnography allowed me to gain a deep understanding of these artifacts culture and cultural differences of the potters from the three studied areas. I compared also the ethnographic data with the archaeometric data in order to enrich my knowledge about the provenance and the technology construction of the raw materials in the three studied areas. At **Chapter 5**, I studied the typology of the ceramics deeply in order to carry out a comprehensive physicochemical study, with the intention of determining whether such production was sufficiently identified in order to be defined "local or imported production", exclusive to certain territories. At **Chapter 6**, I described the chemistry but also the chemical reaction of the glazes, the decoration techniques of pottery, firing, fluxes and clay. **Chapter 7** pXRF was very important to examine up to which extent the archaeological typology as well as fabric and glaze classification could be linked to grouping according to chemical composition. Apart from pXRF, WDXRF was used in order to investigate the provenance of the studied samples. **Chapter 8** presents an introductory overview on the prevailing geological formations that make up the three areas where the studied ceramic material comes from, namely Attica, central Euboea and eastern Lesvos. **Chapter 9** X-ray Diffraction provided qualitative analysis of the chemical compounds through the study of the ceramics crystalline structure as well as the firing temperature of the ceramic materials. At **Chapter 10**, SEM-EDS, the stratigraphic structure of the layers, the distribution of inclusions and colourants and the elemental composition of the ceramics and surface coatings of ceramics such as slip, paints and glazes and the firing conditions were investigated. Finally at **Chapter 11**, Micro-Raman spectroscopy was applied at the surface of painted ceramics in order to analyze existing pigments. The combination of all the above scientific analyses made it possible the study of provenance, establish which fabrics were produced at these regions and which were imported, and make observations concerning ceramic technological practices.

### 13.2. FUTURE RESEARCH

The results and conclusions reported in this thesis have highlighted areas that would benefit from further investigations.

Further analysis about provenance should be carried out on material. Specifically, the remaining pottery fragments of 245 samples need to be categorized as local and non-local based upon chemical and petrographic characteristics of the fabrics.

Furthermore, the investigation of the influence on local potters by the craftsmanship of other well-known workshops such as Thebes, Sifnos, Corinth in Greece or even other well-known workshops beyond the Aegean could be attested through archaemetric analyses which unfortunately has not yet been carried out.

It is crucial to examine more glazes and pigments' recipes. Specifically, the existence of particular recipes for specific pigments and unveiling practices for mixtures of pigments in order to achieve specific tones of colours have to be examined. Further analysis is needed to elucidate the sense of colour and design patterns in Chalcis, the Athenian Agora in Athens and in the Castle of Mytilene. Finally, what is the meaning of the motifs in each region.

It is essential the study of the ethnography of these local societies in order to investigate how the cultural tradition of West and East influenced them.

Last but not least, the most important aspect of any future work should be to make the glazed pottery dataset available in a format readily accessible to other researchers.