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PLASTER CHARACTERISTICS OF BYZANTINE WALL PAINTINGS IN WESTERN ANATOLIA

ZNAČILNOSTI OMETOV BIZANTINSKIH STENSKIH SLIK V ZAHODNI ANATOLIJI

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In this study, the execution technique and material characteristics of the plaster layers of Byzantine wall paintings from three archaeological sites (Anaia, Olympos and Aigai) from western Anatolia were examined for the purpose of their conservation. Throughout the study, mineralogical and chemical composition of the plaster layers were determined with a scanning electron microscope coupled with an X-ray energy dispersive system (SEM-EDS) and X-ray diffraction analyses (XRD). Reflected light microscopy (RLM) and SEM studies conducted on polished cross-sections of samples revealed the stratigraphy and microstructural properties of the plaster layers of the Anaia Church (4th–12th centuries), Başpınar Church (13th century) in Olympos and a Byzantine settling and the Chapel (13th century) in Aigai. Throughout the research, pure lime and aggregates in the plasters of Aigai, as well as magnesium-rich lime and straw in the plasters of Anaia and Başpınar were determined. The plasters from the Anaia and Başpınar Churches exhibit characteristics similar to the samples from the post-iconoclastic period due to a similar raw-material use. In the samples from Aigai, plastering techniques such as marmorino, intonachino and cocciopesto, indicating earlier periods, were observed. As a result of this study, it was concluded that the number and characteristics of the plaster layers from the paintings had been applied intentionally in accordance with the technique of the painting. Plaster characteristics of the wall paintings in western Anatolia from the Byzantine period were found to be similar to the ones in İstanbul, the Balkans, Crete and Cyprus. The results of this study will guide the conservation efforts of the wall paintings.

Keywords: wall paintings, Byzantine, lime plaster, post-iconoclastic

V tem članku avtorji predstavljajo tehnike izvedbe in materialne lastnosti plasti ometov, ki so nosilci bizantinskih stenskih slik, iz treh arheoloških najdišč v zahodni Anatoliji (Anaia, Olympos in Aigai), z namenom njihovega konserviranja. Mineraloška in kemijska sestava plasti ometov je bila določena z vrstičnim elektronskim mikroskopom sklopljenim z energijsko disperzijsko spektroskopijo (SEM-EDS) in rentgensko difrakcijo (XRD). Stratigrafske in mikrostrukturne lastnosti slojev ometa cerkve Anaia (4. do 12. stol.), cerkve Başpınar (13. stol.) v Olymposu ter bizantinske naselbine in kapelice (13. stol.) v Aigai, so bile določene z odbojno svetlobno mikroskopijo (RLM) in SEM analizo na spoliranih prečnih prerezih vzorcev. V ometih iz mesta Aigai je bila odkrita prisotnosti čistega apna in agregatov, ometi iz Anaia in Başpınar, pa so bili proizvedeni iz apna bogatega z magnezijem in slame. Ometa v cerkvah Anaia in Başpınar imata glede na uporabljene primarne materiale podobne karakteristike kot vzorci iz post-ikonoklastičnega obdobja. Pri vzorcih iz Aigai so bile uporabljene tehnike izdelave ometov, kot so marmorino, intonachino in cocciopesto, kar kaže na poznejše obdobje. Rezultati preiskave so pokazali, da je bilo število in lastnosti slojev ometa za poslikave izbrano zavedno, glede na tehniko stenske slike. Lastnosti ometov za stenske slike v zahodni Anatoliji v bizantinskem obdobju so enake s tistimi v Istanbulu, na Balkanu, Kreti in Cipru. Rezultati te študije so zato dobro vodilo pri konserviranju stenskih slik.

Ključne besede: stenske slike, Bizanc, apneni omet, post-ikonoklastičen

1 INTRODUCTION

Wall paintings applied on lime plaster were frequently used in history, going as far back as the Neolithic settlements.[1] The raw materials of these plasters and the ways they were applied differed among civilizations. Lime, which first found use in portable art works with the development of pyrotechnology,[2] became widespread over time and one of the most common binders used in plasters and mortars. Lime has been an indispensable material in the Roman architecture. Although it was a continuation of the Roman Empire, the materials used in the Byzantine architecture show regional differences. The plasters used in the Byzantine period are especially different from the ones used in the Roman period and in Western Europe. Of the early Middle Ages, it is known that a simplification of the classic Roman technique for wall-painting plasters occurred.[3,4] This simplification reduced the number of plaster layers, while the main components stayed the same. However, after Iconoclasm (8th and 9th centuries AD), straw and animal hairs started to be used as inert charges with a small quantity of sand in wall painting plasters.[4] In this period Byzantine renderings of wall paintings consisted of two layers, arriccio (the rough plaster) and intonaco (the fine plaster), which consisted of lime, straw, chopped hog bristles, and containing only a small quantity of sand. Crushed straw is a common ingredient of the plasters in the Byzantine period. Because of this material, Byzantine plasters are more related to traditional clay renderings.[4] The purpose of using straw was to reduce the shrinkage and prevent the cracking of plaster. The water-retention character of

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straw also slows down the drying of plaster, providing a longer working time, as required for the fresco technique.[5] During the Byzantine period, bricks were used in the construction of walls. Brick walls absorb moisture from the plaster. Because of this, the thickness of plasters was increased to provide the moisture needed for frescoes.[4] The thickness of the arriccio and intonaco can be 20–30 mm in total.[5]

The Craftsman's Handbook of Cennino Cennini, written in the 14th century, is a historic source that gives important information on the material use and method of painting in the Byzantine era.[6,7] Its author recommends two units of sand and one unit of lime for plaster while both ingredients must be well sifted. Before plastering, the wall has to be swept and well wetted. After that, the first layer of plaster is applied onto the wall. The first layer should be fairly rough and quite uneven to provide an appropriate surface for the adhesion of the second plaster layer. The picture is drawn on the first plaster layer when it is dry. After wetting down the first layer, a thin and quite even layer of plaster is applied over it.[7]

Dionysios of Fourna[8] provided detailed information on the painting technique of the late Byzantine period. In his Painters' Guide, he gives instructions for the technique of Manuel Panselinos. Fourna recommends slaking lime in a trough and mix the lime, straw and tow with plenty of water. Straw and tow should be clean and the mixture should be left to settle for two or three days until it becomes appropriate for plastering. Before plastering a wall, he also recommends wetting its surface well. Fourna recommends polishing the plaster after wetting it with water. Afterwards the picture composition should be drawn on the plaster with a compass and ochre brushwork. The second polishing, the application of the color black and the third polishing should be carried out.[7,8]

Beside the ancient sources, studies concerning the late Byzantine-period wall paintings support this significant change in the material use. Studies conducted on the wall paintings from the Kariye Museum (from the early 14th century) detected two plaster layers composed of lime and a large amount of coarse straw without any sand aggregate.[9] Similarly, in the Sancta Sophia Church in Trabzon, intonacoes were composed of lime, coarse straw and negligible amounts of sand.[10] Wall paintings of the Protaton Church (13th century) were executed on a fine plaster layer of pure lime (1 mm) over a plaster layer (of up to 30 mm) composed of lime, straw and small amounts of aggregate.[11] A similar implementation was

Figure 1: Studied monuments and samples collected from the archaeological sites

also found on the wall paintings of the Monastery of Žiča (13–14th centuries) in Serbia.[12] Linen fibers in St. Theodori Church (16th century) and straw in St. Trinity Church (14th century) were detected in the fine plasters of the wall paintings.[13] Hein et al. also found considerable amounts of animal and plant fibers in plaster layers of the wall paintings of the churches at the Mani Peninsula dating back to 10–15th centuries.[14] Winfield reported the use of lime plaster composed of lime, sand or lime dust in the wall paintings from the 1st to the 4th century and the use of straw in the plasters of the wall paintings of Direkli Kilise (10th century), Samanlı Kilise in Cappadocia, St Nicholas Church in Myra (12th century), Byzantine churches of Pontus from the 10th to the 15th century and the Parecclesion of the Kariye Church (14th century).[7] Beside İstanbul and Anatolia, straw was detected in the middle and later period Byzantine wall paintings from Yugoslavia, Russia, Cyprus and Italy.[7,15]

In this study, material characteristics of the plasters of wall paintings from three byzantine settlings from western Anatolia are determined. Painting samples belong to the buildings, constructed in a close time range. The studied wall paintings from Aigai (Manisa) and Başpınar – Olympos (İzmir) were dated to the 13th century and the ones from Anaia (Aydın) to the 4–12th century (**Figure 1**).

2 EXPERIMENTAL PART

Experimental studies were carried out on small fragments of the wall paintings, provided by the head of archaeological excavation teams from their archives. Beside the substructure of the Anaia Church, two further structures were widely demolished and only small fragments of wall paintings survived. During sampling, special care was taken not to damage the in-situ conserved paintings. Plaster samples collected from the soil fill and classified by the excavation team during excavations were preferred for studying. During the sampling, visual similarities between the samples from the western fortification wall of Aigai (2nd century) and samples from the byzantine settlement (13th century) were observed. Therefore, a sample from the fortification wall was included into the study for comparison.

The samples were labelled with letters or abbreviations showing the archaeological site that they were collected from (Aigai: Aig, Olympos: O, Anaia; An). The samples that had more than one layer, had the same basic sample number, but with different decimal numbers (**Table 1**).

The chemical and microstructural properties of the plaster layers were determined with a scanning electron microscope (SEM) coupled with an X-ray energy dispersive system (EDS) and a polarized light microscope (PLM). SEM-EDS analyses were performed on polished sections of the samples using Philips XL 30S-FEG. The elemental mapping acquired with the SEM was used for distinguishing plaster layers with aggregates of different origins. PLM analyses were carried out with a Nikon Eclipse E400 polarized light microscope.

The mineralogical compositions of fine plaster layers were determined with X-ray diffraction analyses (XRD) performed on fine-powdered plaster samples with grain sizes of less than 53 μm, with a Philips X-Pert Pro X-ray diffractometer. The instrument operated with a CuK_{α} radiation and a Ni filter adjusted to 40 kV and 40 mA in a range of 5–60°, with a scan speed of 1.60 °/min. Mineral phases of each X-ray diffraction spectrum were identified with the Philips X-pert Graphics and Identity software program.

Table 1: Plaster samples collected from the excavation archieves and their original locations

Sample name			Structure	Layers
Anaia site				
An1			Substructure of Anaia Church	1
An2			Substructure of Anaia Church	1
An3			Substructure of Anaia Church	1
An4.1	An4.2		Substructure of Anaia Church	2
An5			Substructure of Anaia Church	1
An6.1	An6.2		Substructure of Anaia Church	2
An7.1	An7.2		Substructure of Anaia Church	2
An8			Synthronon of Anaia Church	1
An9			Substructure of Anaia Church	1
An10			Substructure of Anaia Church	1
An11			Substructure of Anaia Church	1
Olympos site				
O1.1	O1.2	O1.3	Başpınar Church	3
O2.1	O2.2		Başpınar Church	2
O4			Başpınar Church	1
O5			Başpınar Church	1
O6			Başpınar Church	1
O7			Başpınar Church	1
O8			Başpınar Church	1
O9			Başpınar Church	1
O10			Başpınar Church	1
O11.1	O11.2		Başpınar Church	2
Aigai site				
Aig1.1	Aig1.2		Iron Gate region – Byzantine settlement	2
Aig2.1	Aig2.2	Aig2.3	Bottom of the western fortification wall	3
Aig3.1	Aig3.2		Iron Gate region – Byzantine settlement	2
Aig4.1	Aig4.2	Aig4.3	Byzantine Chapel	3
Aig5.1	Aig5.2	Aig5.3	Byzantine Chapel	3

3 RESULTS AND DISCUSSIONS

One of the important factors affecting the characteristics of plaster layers in Byzantine wall paintings is the painting technique and the requirements for this technique. The fresco and secco techniques were both widely used for Byzantine wall paintings. Depending on the painting technique used, the workmanship and the material of the surface to be painted, the number and thick-

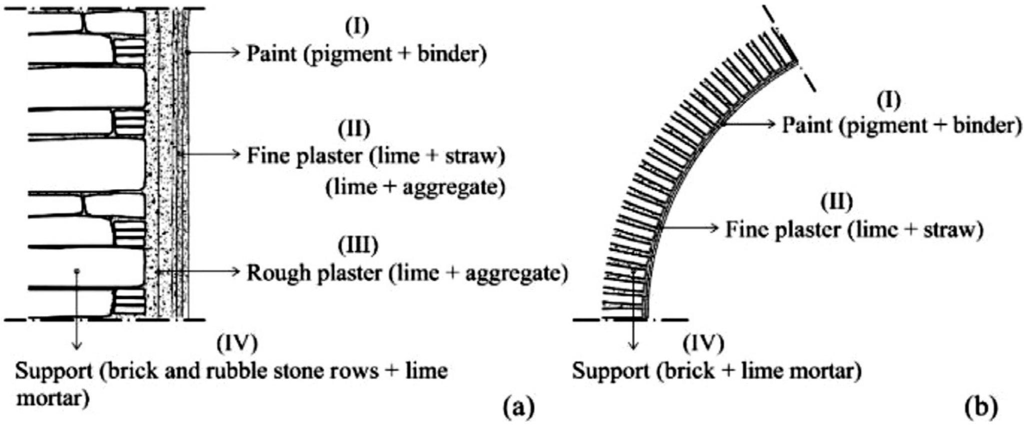

Figure 2: Schematic sections of the wall paintings: a) walls of the Başpınar Church, b) vault of the substructure of the Anaia Church

ness of the plaster layers vary. For the fresco technique, it is necessary to prevent rapid drying of the plaster so that the working time can be extended. Therefore, multi-layered plasters were used and the thickness of the plaster layers was increased if the surface was constructed of brick or similar materials that absorb water. In the secco technique, a painting was executed on dry plaster and it was important to obtain a smooth, white surface, to which the painting could be applied. In this case, thinner and fewer layers of plaster were used as there was no need to prevent rapid drying of the plaster.

In a comprehensive study, which is part of this paper, the painting technique used for the wall paintings was determined by evaluating the diffusion of paint layers into the plaster layer and the presence of a carbonation line between these layers.[16] It was observed that the samples taken from the Anaia Church consisted of a single thin layer, covering a brick vault surface, while the samples taken from the Başpınar Church and Aigai Byzantine settlement were composed of multilayered rough and fine plasters, covering stone wall surfaces (**Figure 2**). It was determined that all the samples, except for one, taken from the Anaia Church were executed in the secco technique; the paintings from the Olympos Başpınar Church were painted in the fresco technique, but these were sometimes completed in the secco technique; and the samples from the Byzantine settling of Aigai were painted in the fresco technique.[16] The pigments used for the painting were earth-based inorganic pigments: ochres for red and yellow, green earth (celadonite and glauconite) for green, natural ultramarine (lapis lazuli) and Egyptian blue for blue, calcite and kaolin for whites, carbon black for black and grey formed the palette of these paintings.[16]

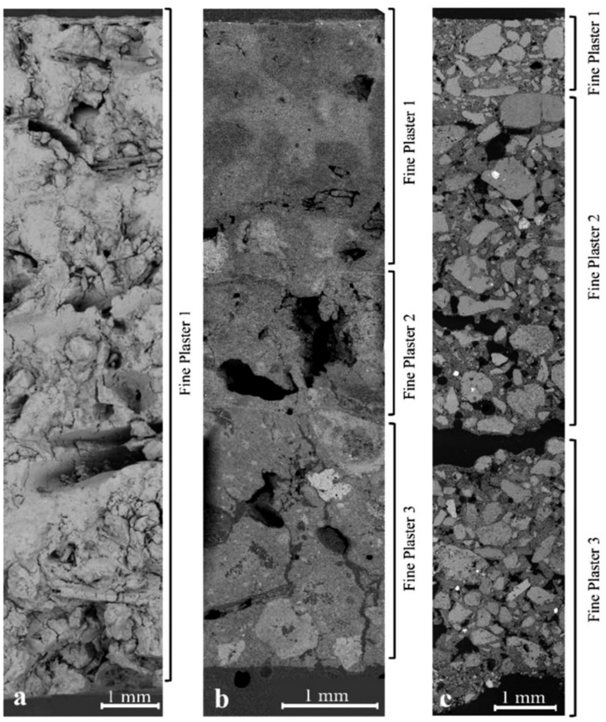

Figure 3: SEM images of the cross-sections of plaster samples from: a) Anaia (An3), b) Olympos (O1), c)Aigai (Aig4)

Although the stratigraphy and microstructural characteristics of the fine plaster layers from the three sites vary, they exhibit similarities in some parts (**Figure 3**). For all the samples, the thickness of the fine plaster layers decreases from the one on the wall to the surface layer. The layer on the surface contains the finest aggregates or no aggregates and generally has a less-porous structure. The interface of the plaster layers has a rougher surface than the surface of the painting, providing good adhesion of the layers. In some of the samples, fine plaster layers could only be distinguished with microscopic methods.

Table 2: Elemental compositions (*w*/%) of the binders of fine plaster layers determined with SEM–EDX

		Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	FeO
Anaia	An3	–	3.4	–	3.7	–	92.9	–
Olympos	O1.1	0.1	6.9	1.1	8.6	–	79.9	0.6
	O1.2	0.3	8.9	0.8	2.9	–	85.5	0.3
	O1.3	–	6.3	0.8	3.8	–	87.0	–
Aigai	Aig2.1	1.4	0.8	–	–	–	96.9	–
	Aig2.2	0.7	0.5	5.3	18.9	2.7	71.1	–
	Aig2.3	0.6	0.7	3.7	10.4	0.3	81.9	1.2

The chemical compositions of the binder of plasters determined with SEM-EDS for the Anaia and Olympos samples are similar (**Table 2**). They mainly include CaO and MgO due to the lime binder and SiO_2 due to the superfine aggregates. On the Aigai samples, the superficial fine plaster (FP1) is mainly made of pure CaO, while other plaster layers that lie under this layer are made of fat lime and aggregates.

In the substructure of the Anaia Church, two different plaster implementations were detected. In most of the samples, fine plasters consist of one or two layers with similar characteristics (**Figure 3**). The thickness of these layers is generally between 6–10 mm. In one sample (An-05), it is 15 mm. Pores, developed due to the decay of the organic tows (straw or chaff), dominate the microstructure of these plasters. Microcracks, small amounts of aggregates and residues of organic fibers are also visible. Secondly, in one sample (An-04) a compact and white fine plaster layer (2.5 mm), mainly composed of lime and marble dust, over a lime plaster layer, composed of lime, sand, and a small amount of organic fibers, was detected. These two layers adhere well to each other. Fine plasters of the Başpınar Church are composed of successive layers of roughly 1–3 mm in thickness. In the microstructure of the plaster layers, microcracks and pores, developed due to the decay of organic fibers, were detected. The adhesion of the plaster layers to each other is sound. The absence of distinct carbonation line in the interface shows that the plaster layers were executed while the underlaying layer was still wet.

The samples from Aigai consist of two or three layers of fine plasters. The thickness of fine plaster 1, located on the surface, is in a range of 1–3.5 mm. The thickness of fine plaster 2 is in a range of 4–7.5 mm. The thickness of fine plaster layer 3 is in a range of 4.5–7 mm even though it is not certain that it comprises the whole layer. The particle size of the aggregates used in the plasters has a wide range between 2.2 mm and 45 μm. Although semi-rounded aggregates were observed in the plaster matrix, the majority of the aggregates have sharp edges. The aggregate types used in the plaster layers of Aigai were determined with PLM and elemental mapping (**Figure 4**). Except for one sample (Aig3), the paint layer was applied on a fine plaster composed of lime and marble powder (marmorino). Under the marmorino, one or two fine plaster layers composed of lime and sand (intonachino) are present. On one of the samples, the use of cocciopesto was observed. Tow (straw or chaff), which is an important ingredient of Byzantine lime plasters,[4] is absent in all layers. Both the stratigraphy of fine plasters and the use of marble powder "in intonaco" are consistent with the suggestions by Vitruvius and Pliny. All of the samples selected from the Byzantine settlement, together with the one sample taken from the fortification

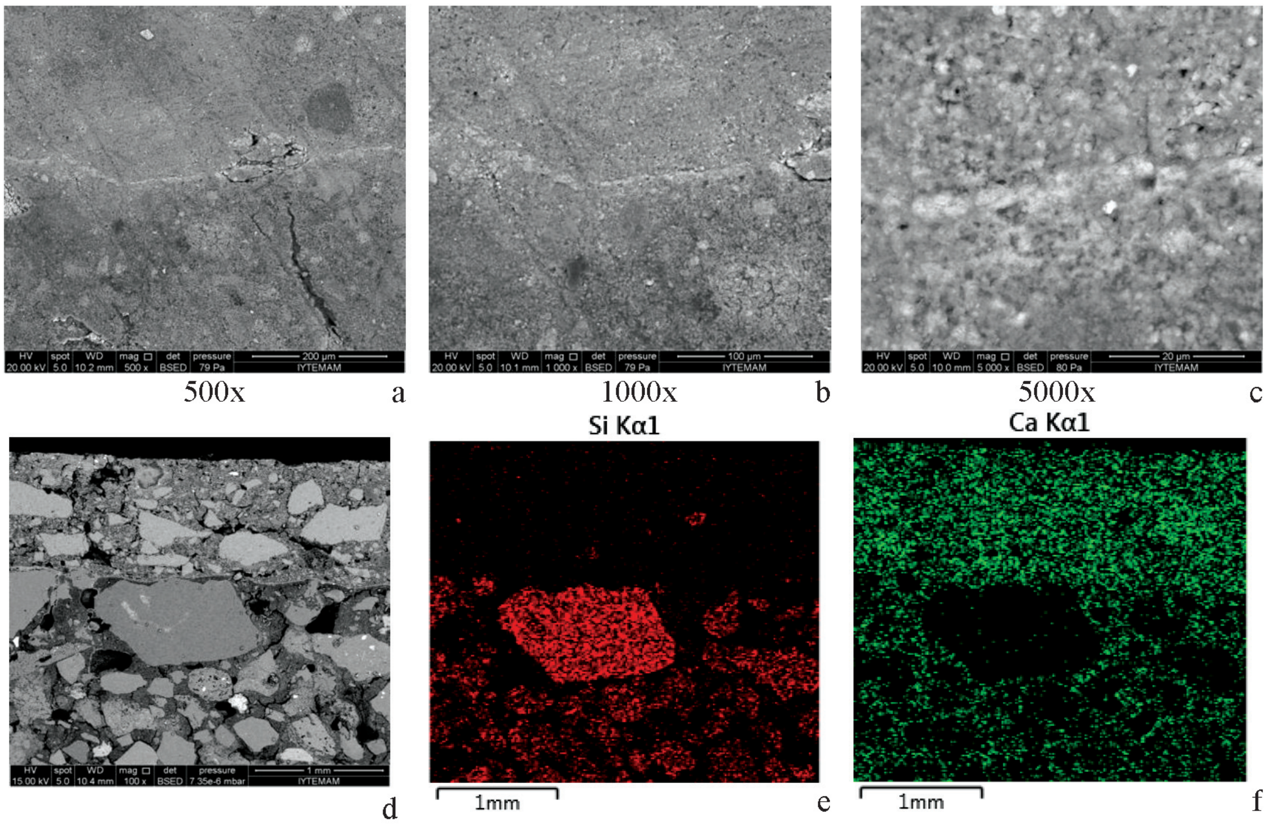

Figure 4: a, b, c) SEM images of the interface of the successive fine plaster layers (O1) from Başpınar, d) SEM image of the polished section of marmorino and intonachino layers (Aig2), e) elemental mapping (Si) of marmorino and intonachino layers of Aig2, f) elemental mapping (Ca) of marmorino and intonachino layers of Aig2

wall (2nd century AD), represent similar stratigraphies, raw material usage, chemical and mineralogical characteristics.

Table 3: Mineralogical compositions of the plasters

	Minerals								
	calcite	aragonite	vaterite	dolomite	magnesite	diopsite	andesine	albite	quartz
Sample	Anaia site								
An1	+++		+						
An2	+++	+	+						
An3	+++								+
An4.1	+++								++
An4.2	+++								+
An5	+++								+
An6.1	+++								
An6.2	+++								++
An7.1	+++								
An7.2	+++								++
An8	+++								
An9	+++		+						+
An10	+++	+	+						+
An11	+++								
	Olympos site								
O1.1	+++		+	+					+
O1.2	+++		+		+				+
O2.1	+++		+						+
O2.2	+++		+		+				+
O4	+++			+	+				+
O5	+++				+				++
O6	+++		+		+				++
O7	+++		+						++
O8	+++		+		+	+			+
O9	+++				+	+			+
O10	+++			+	+	+		+	+
O11.1	+++		+		+	+			+
O11.2	+++		+		+				++
	Aigai site								
Aig1.1	+++								
Aig1.2	+++						+	+	+
Aig2.1	+++							+	
Aig2.2	+++						+	+	+
Aig2.3	+++						+	+	+
Aig3.1	+++						++	+	+
Aig3.2	+++						+	+	+
Aig4.1	+++								
Aig4.2	+++						+	+	+
Aig4.3	+++						++	+	+
Aig5.1	+++								+
Aig5.2	+++						+	+	+
Aig5.3	+++						+	+	+

The number of (+) represents the abundance of mineral peaks.

Mineralogical characteristics of the fine plaster layers were determined with an XRD analysis (**Table 3**). In the XRD patterns of the samples from the substructure of the Anaia Church, $CaCO_3$ in the calcite, aragonite and vaterite forms and quartz were detected (**Figure 5**). Quartz peaks are due to small amounts of aggregates present in the plaster. Aragonite and vaterite are polymorphs of calcite that may be formed as a result of self-healing of plasters in the presence of magnesium.[17] Elemental composition of the samples determined by SEM -EDS revealed that the MgO content of the plasters is in a range of 2.99–9.42 %. The presence of these polymorphs may be attributed to the recrystallization of dissolved calcite due to the wet-dry cycle occurring in the substructure of the Anaia Church. In the 12th century, the church was surrounded by the walls of a citadel, enclosing all the openings of the substructure, except for the entrance. Afterwards the entrance of the substructure was covered by the earthquakes in the middle of 13th and 14th century. The rising damp from the ground and the water drained from the vaults of the substructure created a humid atmosphere and wet surfaces that may have caused this phenomenon. In the SEM analyses, a different type of crystallization of $CaCO_3$ was observed in the voids. But, since the sizes of the cracks and voids are so wide, due to the loss of tows, it is not possible to attribute this to self-healing. A thin calcium carbonate layer that covers the original paint surface and decreases the legibility of the wall paintings is also linked to the recrystallization of dissolved calcite.[16]

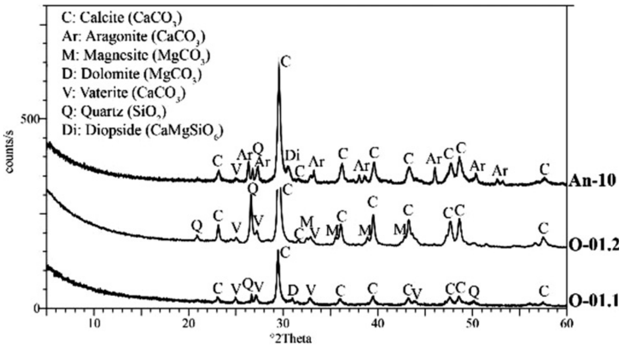

Figure 5: XRD patterns of the Olympos and Anaia samples display different polymorphs of $CaCO_3$ (calcite, vaterite, aragonite) formed with the recrystallization of dissolved calcite due to the wet-dry cycle in the humid atmosphere

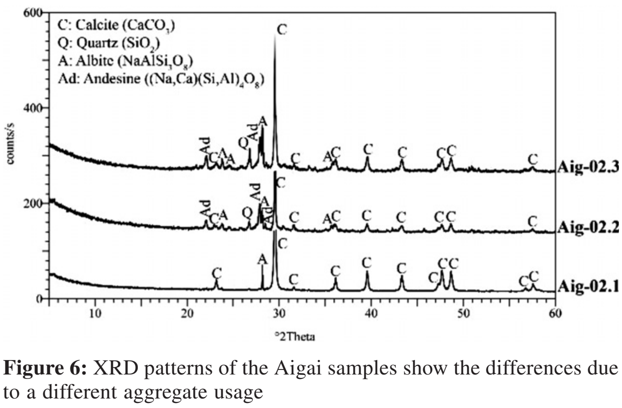

Figure 6: XRD patterns of the Aigai samples show the differences due to a different aggregate usage

Table 4: Possible dating of the plaster samples based on the raw-material compositions

Site	Anaia													Başpınar-Olympos											Aigai				
Sample name	An-01	An-02	An-03	An-04	An-05	An-06	An-07.1	An-07.2	An-07.3	An-08	An-09	An-10	An-11	O-01	O-02	O-03	O-04	O-05	O-06	O-07	O-08	O-09	O-10	O-11	Aig-01	Aig-02	Aig-03	Aig-04	Aig-05
Before icono-clasm (8–9th cen. AD)				✓																					✓	✓	✓	✓	✓
After icono-clasm (8–9th cen. AD)	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					

In the XRD patterns of the Nif-Olympos samples, calcite, quartz, dolomite and vaterite peaks were determined (**Figure 5**). The mineralogical compositions of the plasters of the Aigai samples show the differences depending on the type of the aggregates (**Figure 6**). In marmorinos, sharp calcite peaks derived from the carbonated lime and marble aggregates were detected. In the Intonachino and cocciopesto samples, quartz, albite and andesine due to the aggregates, and calcite due to the carbonated lime were detected.

The raw-material compositions of the plasters and pigments can be used for date estimations. Since the technology has not changed dramatically throughout the centuries, the information gathered as a result of the experimental studies intended for the determination of raw-material compositions could only define approximate time intervals. In this respect, fine plaster samples of the three sites were divided into two groups. In the first group, only lime and aggregates of different origins (marble, silicates or crushed brick) were determined. The plasters of the second group were composed of lime, negligible amounts of aggregate and large amounts of organic fibers. These differences in the plaster characteristics may indicate that the samples may belong to different periods. The samples from Aigai and one sample from the Anaia Church were dated to the period before iconoclasm. The samples from the Başpınar Church (Nif-Olympos) and ten samples from the Anaia Church were dated to the period after iconoclasm (**Table 4**).

4 CONCLUSIONS

In this study, stratigraphy, chemical composition, mineralogical characteristics and microstructural characteristics of the Byzantine wall paintings from three sites (Anaia, Başpınar and Aigai) from western Anatolia were determined. Furthermore, dating of the plasters was suggested by comparing the material characteristics and execution techniques.

Lime plaster types, composed of pure lime and fine marble, brick and sand aggregates, known as marmorino, cocciopesto and intonachino, were used in Aigai.

The samples from the Byzantine settlement of Aigai show strong similarities with the 2nd century wall-painting sample from Aigai. Considering different raw materials used for the 12–13th century samples from Anaia and Olympos and various post-iconoclastic samples from the literature survey, we can notice a confusion regarding the layering of the Aigai settlement. The samples so far thought to belong to the Late Byzantine period may actually belong to the Roman period. The most probable explanation for this confusion is the fact that Roman painting fragments were carried out down the slope and filled the ruins of the Byzantine period.

The plasters of the Anaia Church and Başpınar Church were mainly composed of magnesium-rich lime and straw that were common plastering materials of the post-iconoclastic period of Anatolia. The main conservation problem with these plasters is the pores that occurred due to the decay of the organic tows. The adhesion of the plaster layers to each other is generally sound, but the layers are detaching from their supports.

Vaterite and aragonite, the polymorphs of calcite, are present in the fine plasters of the Anaia Church. Vaterite is also present in the samples from the Başpınar Church. These polymorphs may be the indicators of the recrystallization of dissolved lime in the pores of the plasters due to a water penetration and humid environment. A thin layer of calcium carbonate deposits present on the paint surfaces is an indicator of this process.

One sample from the Anaia Church shows similarities with the pre-iconoclastic period wall paintings with the presence of a superficial marmorino layer and aggregates, without any tow in the subjacent plaster layer. A single picture layer was observed in the excavated part of the substructure. However, the presence of a plaster fragment from the early period is important as it shows that there may be more than one paint layer in the parts of the building that have not been excavated yet. This information may help the future excavations that will be carried out at the site.

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