

## 2.1. The origins of the Ottomans

The Ottoman state was a small seigniorship on the borders of the Islamic world. Byzantine territories in Anatolia and Balkans were conquered. Arabic lands were conquest and added to the borders country by Ottomans in 1517. After this period of time the Ottomans were the most powerful country in Islamic world ( *nalçık, 1973*).

The violent crises happened between Oxus and the Danube. The Ilkhanid Empire in Persia, the Golden Horde in Eastern Europe and the Byzantine Empire in the Balkans and western Anatolia had big crises in the early 14th century. The founder of the Ottoman dynasty was Sultan Osman and his descendants were stretching the borders of the Ottoman dynasty from Danube to the Euphrates at the end of 14th century. Sultan Beyazıt (1389-1402) who was battled with crusader army of Europe knights for defended the cities of Mamluk Sultanate in 1396. At the end of the battle he routed the army of Europe knights. And he captured the cities of Euphrates ( *nalçık, 1973*).

Invasions the Muslim Middle East by Mongols in 1220 was the first developments of these historical stages. The Anatolian Seljuk's lost the battle against the Mongol's in Kösedâ war and they became the vassal state of Ilkhanids in Iran. The immediate result of the Mongol invasions, powerful nomadic Turkish tribes immigrated to the westward. These Turkish tribes were move from Middle East to Iran and eastern Anatolia. And some of these tribes were moved west and located the mountain regions between Byzantine and Seljuk's ( *nalçık, 1973*).

There was a rebellion against the heathenish Mongols in 1271. The Muslim Mamluk forces helped the rebellions and entered the Anatolia. However the Mongols pressed the uprising. After this uprising Mongol's kept their forces permanently in Anatolia. However in the following fifty years of time there were uprisings to Mongols in Anatolia. The frontier regions became a place for the refuge of troops of Mongol's in Western Anatolia and the population was increased. These troops were provoked the villagers for a battle to Byzantine Empire for settling rich plains. After these incidents happened in Western Anatolia, the local people were gathered around the "Gazi" leaders and prepared a Holy War against Byzantium. The invasions to Byzantine territory were become frequent ( *nalçık, 1973*).

The "Gazi" leaders of the troops were established seigniorships in Western Anatolia between 1260 and 1320. The Byzantines were dealing with the problems in Balkan's therefore they do not given enough importance to the eastern Byzantine thus making a way to the Turkish invasions into the Western Anatolia. In 13th century Turkish invasions were increased and they become incursion ( *nalçık, 1973*).

North – West part of Anatolia was belonged to the Osman Gazi. According to the Byzantine historian G. Pachymers; Osman Gazi laid a siege to znik (Nicaea). The Byzantine emperor sent against to the siege for two thousand soldier which ambushed by the troops of Osman Gazi in 1302 in Koyunhisar (Bapheus). The defeat of the Byzantine army by Osman Gazi were spreaded his fame in Anatolia. Ottoman and Byzantine sources described how to gather all of the other Turkish seigniorships under Ottoman command. The exact establishing date of the seigniorship of Ottoman was after 1302 ( *nalçık, 1973*).

The "Gaza" ideal which defined as "the holy war against the Byzantines" was very important to establish and developed of the Ottoman Empire. The society in the western borders of Anatolia was in a harmony with the ideal of "Gaza". The civilization of Anatolian Seljuk's was established with Sunni Islam religion, scholastic theology, palace literature with artificial language and "eriyat" law. After establishing the seigniorships in Western Anatolia, the frontier lands convert Seljuk's culture to heretical

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religious orders, mysticism, epic literature and customary law. In this period of time Turkish was become an administrative and literary language ( *nalçık, 1973*).

Some of the Byzantine troops called “akritai” near the western borders of Turkish seigniories were contact and cooperated with Muslim gazis and they changed the side. For instance Gazi Mihal was a Greek warrior and joined to Ottomans ( *nalçık, 1973*).

The ideal of “gaza – holy war” was not intended to destroy. It was intended to subdue the regions. Ottomans were established their country by subdue Muslim Anatolia and Christian Balkans. Sustaining “gaza” was the main ideal of the Ottomans however empire and the Catholic Church were protecting millions of Orthodox Christians life in the border lines of the country. The Orthodox Christians, Jews were under the protection of Ottomans with the condition of paying their tax and obedience to the government. Also they practiced their religion rituals and live according to them. These rules in Islam brought great liberty and tolerance between Muslims and Christians. In the first periods of Ottomans, these principles inside of the society pursued a voluntary submission of the Christians and their lands without any warfare ( *nalçık, 1973*).

Ottoman Empire was treat all the religions races as one and these factors convert the Ottoman Empire as become a true “Frontier Empire” and a cosmopolitan state ( *nalçık, 1973*).

### 2.1.1. Frontier seigniory to empire

Ottoman seigniory was firmly established its superiority after gaining critical region which was prospects of unlimimted expansion the Balkans and the west in 1352. The initial crossing from Anatolia to Europe was difficult. There were so many risks for Ottomans to land to Europe because Dardanelles were under the control of Christians and Ottoman troops could be annihilated by Byzantines. The Karasi seigniory which was located on the eastern side of the Dardanelles be the solution of this problem ( *nalçık, 1973*).

The success of the Ottomans was depended on some reasons. The struggle for the throne of the Karasi seigniory was gave an occasion for Sultan Orhan to occupy this country in 1345. The troops of Karasi seigniory wanted conquest to west, across to the Dardanelles. Ottoman troops were under the command of Süleyman who was the son of Sultan Orhan and prepared for this conquest. The events happened on the benefits of Ottoman success. Sultan Orhan married with Theodora who was the daughter of John V Cantacuzenus. This marriage was come true because of alliance with John V Cantacuzenus that he wanted the throne of Byzantine Empire and needs the support of Ottomans. This occasion was given an opportunity to the Ottomans to intervening the domestic problems of Byzantine and be a part of the war in Trace. In 1352, Ottomans went to the Edirne (Adrianople) for supporting John V Cantacuzenus against the troops of Bulgarian and Serbian forces. At the same time Ottoman troops under the control of Süleyman and he decided to lay siege to the fortress of Gelibolu “Gallipoli” despite the insistent request of Cantacuzenus. In 1354, an earthquake happened and destroyed the fortress walls of Gelibolu “Gallipoli”. The Turkish troops were integrated to the castle and conquest the region. Thus Ottomans were established their troops firmly into the European soil ( *nalçık, 1973*).

The Ottoman property in Europe aroused a great anxiety in Byzantium and the Western Christians. The Venetian delegate in Constantinople wrote that Constantinople was under the big danger and needed a support of strong Cristian country ( *nalçık, 1973*).

For strengthening the European front line, Süleyman transported Muslim’s from Anatolia to Europe. However the sudden dead of Süleyman in 1357 and his brother Halil’s capturing by Foçalılar “Phocaeans” forced Sultan Orhan to made a piece with Byzantium. After released of Halil in 1359, the

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Gazi's realized that to delay conquests put into a risk of gained soils in Europe. The Gelibolu "Gallipoli" commander, Sultan's son Murat and his tutor Lala Şahin dedicated a conquest to Edirne "Adrianople" and the city captured in 1361 (*nalçık, 1973*).

The conquest in Trace was followed in the same patterns in Anatolia. The Turkish tribes were encouraged to live in Europe and settled. The dervish's built a dervish lodges in this regions. These Turkish villages were creating a strong base for the Ottoman expansion in Europe (*nalçık, 1973*).

The Ottoman conquest patterns in Balkans determined by the geographical contexts. Ottoman followed the historical road "Via Egnatia" and captured the Albanian coast in 1385 and followed with Serres, Monastir and Okhrida. Albania and Macedonia accepted the Ottoman dominance. Second road for expansion of Ottomans was opened after the captured of Selanik "Salonica" in 1387 which was followed line to Thessaly. Third road was followed the road of İstanbul "Constantinople" to Belgrade. The invasions were continued as followed by Ottomans; in 1365 Meriç "Maritsa" valley, in 1385 by using the passes of Balkan's entering the Morava valley and invasion of Sofia and Nish. On the following year in 1386, Ottomans reduced the Kingdom of Serbia to vassalage. The king of Bulgaria and Despot of Dobrudja became Ottoman vassals (*nalçık, 1973*).

Ottoman controls the main routes of Balkan Peninsula after invasion of these regions and countries. The Turkish nomad groups were brought into the big cities and the roads in Balkans. Big settlements were established near Meriç "Maritsa" and Tunca "Tundzha" valley. The local territories of Balkan and the lords of them were accepted the sovereignty of Ottoman Sultan (*nalçık, 1973*).

The reasons of the easy invasions of the Balkans were explained with political fragmentation in that period of time which was affected many local Balkan principalities with struggle to each other and did not hesitate to seek an outside for solving their local problems. As well the Ottoman's was followed a consistent policy with military strength and centralized authority (*nalçık, 1973*).

The Yeniçeri "Janissary" corps was provided superiority to the Ottomans Europe which was founded by Sultan after the invasion of Edirne by foreign prisoners of the war. Yeniçeri "Janissary" corps was the first standing army in Europe. The second advantage of the Ottoman's was the inner conflict in Balkans principalities. In general nobel class who were upper class priesthood, aristocracies, men of letters and courtiers looked to western Christendom for the assistance. However Orthodox populations in Balkans were opposed to the Christendom for the assistance that Ottomans supported them (*nalçık, 1973*).

During the early period of Ottoman Empire, there was no major state threated the Ottomans either in Balkans or in Anatolia. In 25th December 1366, the pope declared a crusade against the Ottomans. In this period of time the strongest opponent of Ottoman's was the Kingdom of Hungary. The frailty of the Ottoman's was the fleet power (*nalçık, 1973*).

The expansion of the Ottomans in Balkan was not only related to the political conditions as well it was related to social situations. In Balkan's Monasteries and influential people were got the gaining possessions of the lands. They were used these lands as their own till the end of their lives. The tax revenues of the lands belonged to the army. Thus the villagers should obey the rules and the tax that the land owner brought to them. The lands captured by Ottomans were controlled by government or given to the Turkish villagers according to their military service or converted into "timar - a Turkish fiefdom in the time of the Ottoman Empire". The laws applied by Ottoman government to the villagers were very simple according to the laws that were applied by local governments. For instance the Serbian Monarch, Stephan Dusan was required from the villagers two days' work in a week for his lord in

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contradiction Ottomans was required three days of work in a year. Ottoman laws were protected the villagers against the local authority (*nalçık, 1973*).

Ottomans were not seen themselves as representative of any specific social creed. They preferred agreeable politics against the Christians which provides them to extend the borders of their country. Besides the opposed ones, all the other soldiers of the conquest countries were integrated to the Ottoman army which was called “voynik”. By this fact, in Bulgaria, Serbia, Albania, Macedonia and Thessaly, Ottoman kept many local troops in their domination under the command of their own princes or overlords without accepted Islam (*nalçık, 1973*).

Ottoman distributed timar “timar - a Turkish fiefdom in the time of the Ottoman Empire”, to the upper class of the society that they conquers their land. However they divested their feudal privileges. They served the Ottoman army without changing their religion. In 15th century there were still timar holders whose families had remained Christian through three or four generations. The Ottomanization of the regions was not transformed suddenly however it distributed to the time (*nalçık, 1973*).

When the Ottomans were get into the conquest of the regions in Balkans in 14th century, they were established a strong country stretching from Ankara to Çanakkale “Dardanelles”. In Balkans, after the disintegration of Stephan Dusan’s Serbian Empire and the kingdom of Bulgaria, there were no country could compare with the strength of Ottomans. The extensions of the soils of the Ottomans were grown parallel with their west and the east borders. The Ottomans were very careful not to battle in two sides of the country (*nalçık, 1973*).

In the second half of the 14th century, there were two opponent countries against to the Ottomans which were seigniory of Eretna and the seigniory in Karaman. The capital of the Eretna seigniory was located in Sivas and the capital of Karaman seigniory was located in Konya. The Ottomans were conquest Ankara in 1354, however there were a strong alliance between Eretna and Karaman opponent to Ottomans (*nalçık, 1973*).

In the period of Sultan I.Murat (1362-1389), Karaman troops were marched against the Ottomans. The Ottomans claimed that this act was against the idea of “gaza – holy war” as well the Karaman troops were act against the faith, therefore according to the “eriat” rules; it was pious duty to remove Karaman’s troops. Ottomans were used the similar kind of tactics for blaming the Islamic countries in east part of the country while the extension of the country and attached to them. Similar tactic were used in Mamluks of Egypt, Uzun Hasan and the Safavids of Iran and they distributed this rule trough “fetva - a legal opinion, decree or ruling issued by a mufti or other Islamic lawyer” to the entire Islamic world (*nalçık, 1973*).

In 1387, Sultan I. Murat met the attacked of Karaman’s troops with the forces of Cristian vassals in the Balkans who were Serbian despot and Serbian princes. Karaman troops were defeated and seigniory of Karamans in middle Anatolia, seigniory of Çandarlı in Kastamonu “Candarids” and the branch of Hamid dynasty in Antalya recognized the Ottomans sultan as their leader (*nalçık, 1973*).

While the Sultan I. Murat was dealing with the problems in Anatolia, in Balkans Serbia, Bulgaria and Bosnia united against Ottomans and the troops of the Ottomans were defeated in Ploshnik by Bosnians in 1388. However the Ottomans were prepared a battle for the troops of Serbian and Bosnian armies in Kossovo which was very hard-fought battle and end up with the victory of the Ottomans in 1389. This war firmly established the Ottoman rules in Balkans (*nalçık, 1973*).

Finally in 1389, the Ottomans were established empire of vassal seigniories in the Balkans and in Anatolia (*nalçık, 1973*).

### 2.2. Ottoman art and building program in 14<sup>th</sup> century

For enlightening the architecture and art in early period of Ottoman Empire, the historical evaluation contexts had been interactively determined. In this sense, the first component was the figures and images that remained the imaginations of Turkish tribes. As well the shapes for form the physical context of the environment were the other part of the first component. The traditional routines and orders were dependent on economic aspects as well cultural parameters. The utilization behavior of the buildings and the artifacts such as value of dwellings, the importance of the tombs and the decisions of the special part of the society determined these parameters (*Kuban, 2007*).

The second component was determined by the classes of the society such as the seigniors and their dependents with the people that have relations with each other. These people had a strong links to the paradigms of history which were decisive for the second component. The madrasa, caravanserai, bath etc. were built in a similar plan typology before the Ottoman Empire. This aspect showed the strong link of the society to its history (*Kuban, 2007*).

The third component was the demands of the new conquest regions and the government which were supplied by the domestic society as well the protection of the traditions by local society. This protection of the traditions had an economic benefit for the local society. As well the governors needed traditional techniques and local workforce for their success. For instance the routines and the demands for the people; using local sources such as agriculture products, potteries, building materials and the building techniques were the best economic way to sustain the daily life (*Kuban, 2007*).

When the Ottoman Empire conquest the Söğüt and Eskişehir region in 13th century, they were used the traditional materials and traditional building techniques. However, only the building programs were decided by the seigniors and patrons. The symbol of the building such as the motives that were used under dome was not caused a problem for the half transmigrate patrons. However the masons were found in the cities that were migrate from the east and familiar with the Islamic motives. In every part of the Ottoman periods as well in the classical part the people and their cultures under the cosmopolitan structure, geography of the cities and the image of the empire formed design of the buildings (*Kuban, 2007*).

The development of Ottoman art was occurred in two hundred years and finished in 16th century. This development of the art depended the improvements of creativity of Anatolian people from 11th to 14th century. The Ottoman architecture and art seemed that they were detached from the building and art experience from the East was Anatolia. However it was not true. The plan typologies were sustained in different dimensions and interpretation. The main differences between Ottoman and Seljuk's were the encouragement of the innovation, different cultural intentions of Ottomans. The nomadic people in East Anatolia, brought their thoughts about images and forms of images to the West Anatolia. These import images were getting new forms in the development of the West Anatolian cities (*Kuban, 2007*).

In Orhan Bey period of time in 1324-1362; the building activity were very dense. However in this period, the art and culture could not widespread all of the country and the symbols were not reached high values unless the life perspectives of the people were developed and matured. After conquest of İstanbul, the Ottomans were formatted the culture and the homogeneous architectural and art style (*Kuban, 2007*).

According to Braudel; after the conquest of Bursa and Edirne, these cities were based of nomadic people. However İstanbul was the location of absolute hegemony of the city life. In the border lines of Ottoman Empire the cultural hegemony was never established. However it could be said that, the culture of the Ottoman based in İstanbul were occurred after the two hundred years of establishment of empire (*Kuban, 2007*).

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In the beginning of the Ottoman Empire, buildings and art were used to fulfill the demands of the society. The demands of the dominant population in the society became more symbolic. Old traditional models received response from the society. These models were formed by the remembered old traditional models that were remained in the patron's thoughts and the manufacturer interpretation between the techniques and the deformation of the figures that could be used. These formations developed by the visual experiences while conquest of the new towns. As well the artists that were coming from the east cultures contributed these formations in art (*Kuban, 2007*).

Also the development of art depended to the change. For instance;

- A seignior converted the church to mosque in his town,
- A sultan who had a victory of conquest of town brought the masons to Bursa city,
- A mason who was looking for a job in Konya city build a pulpit to mosque of Sultan,
- Byzantine masons were used for building a new castle,
- Daily pottery made by local masters however the more beautiful one was imported.

The Ottoman Empire was continuously conquest a new locations and towns. There was a movement in nomads. Therefore transformation of the production of art to a homogenous production of the unity of the art did not be done in a short period of time. It took time to reformation of the cultural environment of production and the life style organization of the people. After nomads were transformed their life style to settled city life and the locations became a city, the cultural, political and economic transformations determined functions for the new buildings (*Kuban, 2007*).

In these towns nomads and settled people cultures were differentiated with subculture and superior culture mixture. The religion of the nomad's people had heterodox religion and settled people was continued the rituals of Sunni Islamic religion. Both of the group continued the life style and the rituals of their religions. However the Islamic Sunni's were dominant according to heterodox religion. The dwellings, mosques, small dervish lodges, madrasah were the part the religion Islamic Sunni's. The relation between these buildings determined the character of art. All these facts were shaped according to the needs of the Islamic society in the later period of the Ottoman Empire. However in the beginning of the Ottoman Empire religion was interpreted differently by the half settled nomad Turks. Islamic Sunni's accepted the routines and the rules of their religion to the other part of the country took time till the 16th century. With these judgments and facts were the main issues that the early period of Ottoman Empire architecture was shaped (*Kuban, 2007*).

### 2.2.1. The architectural program in 14th century

Syncretic thought between the religions was begin in east and middle Anatolia in beginning of the 12th century. The art of syncretic thought was appeared in the same period of time in Anatolia between the essences of Seljuk's traditions and memories. This syncretic art was formed the fundamental of the art and architectural images in early period of Ottoman Empire. A new type of architectural building virtually did not appear in that period. On the other hand Byzantine people were participated to the community life. After a while both cultures were mixed and they formatted the Anatolian people (*Kuban, 2007*).

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In the end of the 13th century, there was no evidence about the construction of the buildings. In the first conquests period; there were only evidence about the small castles and small dervish lodges. On the other hand there were timber framed and stone masonry residence tradition (*Kuban, 2007*).

In Sultan Osman period for the religious practice, the churches were converted to mosques. Consequently, the buildings were enough for the society to do their religious practices. The administrative people in that period gave importance to the other needs of the society and they were built different functions of buildings. For instance, according to the behalf of Sheik Edebali, houses, shops, bazaars and baths were built in Bilecik city (*Kuban, 2007*).

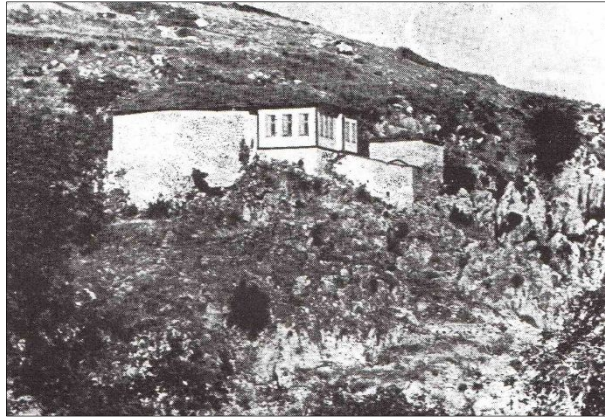


Fig 2.1: eyh Edebali and Mal Hatun Tomb (*Ayverdi, 1989*).

In that period of time small dervish lodges were the main buildings. The traveler, Battuta was proof this idea. All of these small dervish lodges were appeared in 12th century in the control of Turkish administrative regions. Many of these small dervish lodges were disappeared today because of their low quality building techniques. Most of them built stone masonry strength with timber ties by the local masons. Small dervish lodges were the first religious buildings in Ottoman society characteristics. When these buildings were constructed behalf of the Sultan in 14th and 15th century these were the most prestigious buildings (*Kuban, 2007*).

Sultan Orhan preferred a small dervish lodge inside of the Bursa Bazaar rather than building a mosque. The main ideal of his behavior was the usage of this building in religious practices and rituals beside of that as a dervish lodge. In that period of time in Bursa city the population of Muslim was not very big. Therefore small dervish lodge was enough for the religious activities (*Kuban, 2007*).

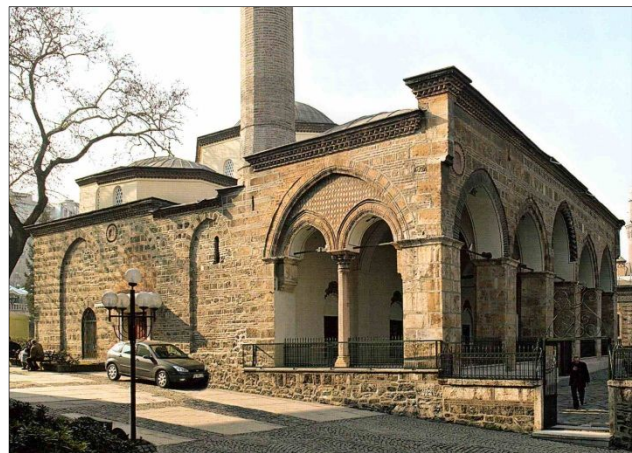
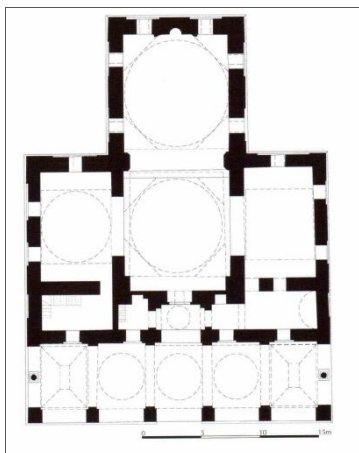


Fig 2.2: Orhan Bey Imaret, Bursa. Plan (1360) (*Aslanapa, 2004*). Fig 2.3: Orhan Bey Imaret, Bursa. (1360) (*Aslanapa, 2004*).

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In Bursa, Orhan Bey imaret is important for being the first important still standing Ottoman building. The oldest documentation related with “Orhan Bey” was in 1491. The lost document related to this endowment of Imaret building which was dated in 1360. This building and surrounded buildings which were functioned as madrasa, bath, bazaar, caravansary were constituted the city center of Bursa city. However these buildings were not oriented in an order in planning but this typology was being the first represented the complex building type of dependent mosque building in cluster (Kuban, 2007).

At the beginning of the XIVth cent, adverse ‘T’ plan shape of Orhan mosque in Bursa was built as multi-functional buildings where political, economic and social problems of the state were discussed in the presence of the Ottoman ruler. At second half of the 15<sup>th</sup> century they lost their function when a state government is established with sultan and viziers (ministers) and started to be used as mosques. This plan shape provides to cover spaces with bigger dome without piers. The main design concept was the closure of spaces without any prohibitive architectural elements.



Fig 2.4: ‘Bursa Ye il Camii, Fronth elevation (1404) (Aslanapa, 2004).



Fig 2.5: ‘Bursa Ye il Camii (1404) (Aslanapa, 2004).

After the invasion of the Karasi Seigniory, for twenty years the building activity in Ottoman was very high. After invasion of the Bithynia, the building program Ottoman Empire included all the building typologies of Seljuk’s such as masjid, madrasa, tomb, small dervish lodges, caravanserai, imaret and baths. All of these buildings were built with converted plan typology of early Ottoman in half century. For the building production, the native people and the masons put the identity of their culture to the architectural designs. These identical architectural design productions of the buildings were become more evident in this period of time. The bath buildings were built in larger scale after this period of time (Kuban, 2007).

The architectural designs of the buildings in Orhan period was belong to the intensions of upper class of the society. However the prototypes of these buildings were not the extensions of the Seljuk’s architecture that came from the eastern part of the country. The design of the buildings were differentiated from the Seljuk’s with usage of widespread structures as domes, the order of the windows, the local details of buildings. The building plans were contained the historical context of the plans however there was a strong tendency for the new orders and precisions. This new architecture was also affected from the Byzantine architecture. However this architecture was almost different from the monumental Byzantine middle age traditional architecture. For instance Yıldırım small dervish lodge was totally different building if it was compared to the Seljuk’s and Byzantines. May be there was some similar buildings in Iran and Egypt. Before establishing the Ottoman society, the identity of its future was defined with these buildings. As well as the originality of early Ottoman architectural design, decorations such as ceramic, gypsum and muqarnas were used in continuity in the scope of Islamic religion (Kuban, 2007).



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Development of early period Ottoman, shaped with the monumental style architecture that converted in Sultan Yıldırım time. However directive applications in architecture were started form Sultan Orhan time (Kuban, 2007).



Fig 2.6: Sultan Orhan Mosque in Bilecik (Aslanapa, 2004).

The tomb of Sultan Orhan and his father Osman had some similarities with Byzantine chapel. This architectural decision showed that there were no previous examples of tombs for the leaders of the society in Seljuk's or previous times of the Turks. Seljuk cupola converted to domed Ottoman tomb in this period of time with these buildings. In 13th century, the architecture typologies of the tombs were developed magnificent in Anatolian Turkish architecture. However similar tomb architecture was not continued in later periods of Ottoman architecture and they converted to domed architecture which was an evidence of occurrence new cultural environment (Kuban, 2007).

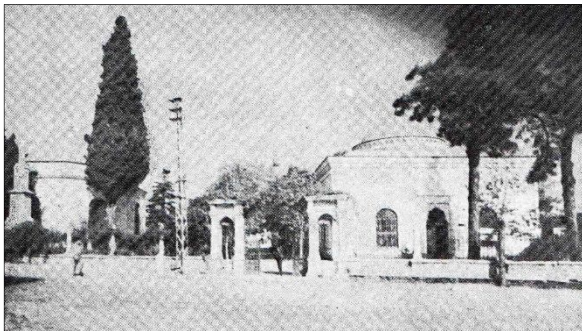


Fig 2.7: Osman and Orhan Gazi Tombs (Ayverdi, 1989).

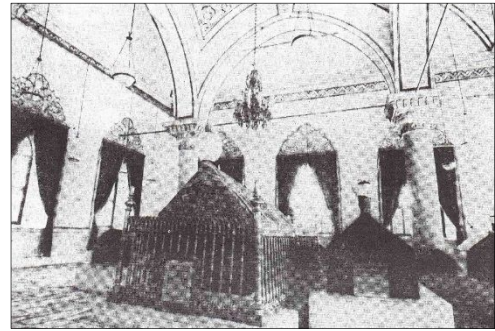


Fig 2.8: Interior of Orhan Gazi Tomb (Ayverdi, 1989).

The building techniques that were used in late period of Roman Empire in Anatolian region, reused in small scale with far perfectionism of masonry craft in different functions of buildings. For instance the conversion of church buildings to mosques put in the same category of this reusing. Some of the architectural elements were used frequently in that period of time. This caused sympathy of society to the forms of architectural elements. These are the first steps in designing of monumental buildings in early Ottoman after that period of time these techniques were developed and formed a new style in Ottoman architecture (Kuban, 2007).

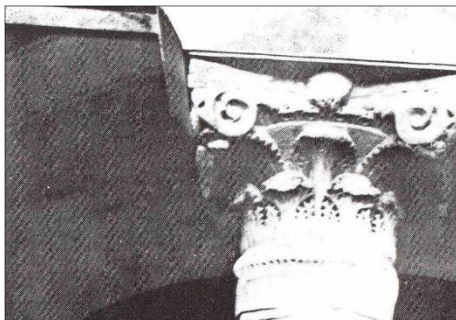


Fig 2.9: Byzantine head of the column in Orhan Mosque (Ayverdi, 1989).

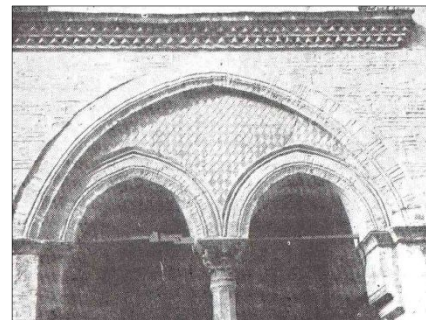


Fig 2.10: Riwaq side arch in Orhan Mosque (Ayverdi, 1989).

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After the death of Sultan Orhan, the developments of architecture specify the cultural development of people in the cities. In the period of Sultan I. Murat (1362-1389), there were larger Muslim populations inside of the cities. Three big mosques which were the evidence of that idea, built in his period of time. The mosques were designed with the closure structures like dome and vault as well they looked like basilica which was built in Bursa, Filibe and Gelibolu. In this development process, the monumental architecture of Ottoman was progressed in the period of Sultan Yıldırım (*Kuban, 2007*).



Fig 2.11: Filibe Hüdevendigar Mosque (*Aslanapa, 2004*).

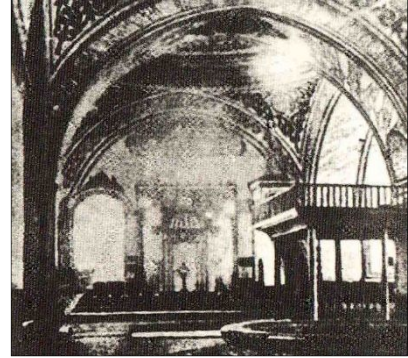


Fig 2.12: Filibe Hüdevendigar Mosque, interior (*Aslanapa, 2004*).

### o Early period of Ottoman dwellings

The historical traditions of architecture in Anatolia and their influences continued now days. The community of the Ottoman Empire in Northern Anatolia was constituted an architecture design with timber structural elements which was called “çatma ev”. Due to the lacking of durability of the timber material, early examples of these buildings were not remained. However from the 17th century, a new typology of houses was occurred in Anatolia. After 16th century, Turkish houses were gained their identity with “hayat - court yard inside the house”. This character was gained with; gallery house type in near east Anatolia, Sasanian, Hittite and Abbasid essences in iwan “eyvan beyt” type, the traditional and local Anatolian building techniques and the multi-functional usage of room that idea brought from nomad people (*Kuban, 2007*).

There were no strong evidence about the palaces and dwellings in early period of Ottoman Empire even there were no existed building in that period of time. However in later periods of Ottoman, the archives of the endowments contain the information’s about the Turkish houses (*Kuban, 2007*).

The evidence of the timber structures in Northern Anatolia were proofed with the notes of Ibn Battuta in 14th century in Mudurnu region. Timber construction was a tradition in Northern Anatolia in houses as well in mosques. According to the tradition of the timber construction in that region, the Turkish houses were started to get formed in 14th century. However, the progress of the Turkish houses needed time to the exact usage of Ottoman-Turkish people (*Kuban, 2007*).

### o Building technology

In Osman bey and Orhan bey period, the building activities were limited with economic situations. The workmanship was local as well the masonry wall construction techniques, domes and brick vault were brought from Byzantine. Turkish triangles, muqarnas and tromp used as transitional structural elements which placed between the masonry walls and the domes. These buildings were differentiated with the scale, mass, interior space and proportion from Seljuk’s in middle Anatolia which were the reason of the local masons worked in those buildings. Especially in domed structures, they were used different style for emphasize the weight of the dome to the visitors (*Kuban, 2007*).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

Many of the building examples in early period of Ottoman emphasized different architectural origins. For instance; the pendentive covered rooms in Hacı Özbek Mosque in İznik and Bey bath in Bursa. This period was passed with the collection of architectural essences. The architectural style of this period was unassuming, functional and fascinating in the beginning periods of rough picturesage. However the buildings in that period were not under the essences of one architectural style. The construction and the workmanship of the masonry walls were rough, “kirpi saçak – stylish brick eaves” were used, the head of the columns were designed with the essences of Byzantine buildings. The design of the buildings mainly functional and formed a guidance for the future plan typologies (Kuban, 2007).

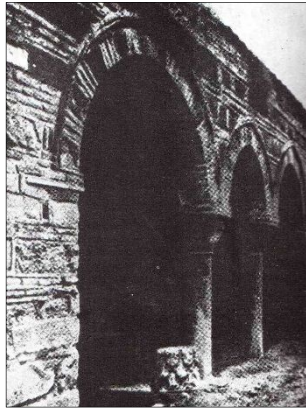


Fig 2.13: Hacı Özbek Mosque in İznik (1333), riwaq (Ayverdi, 1989).

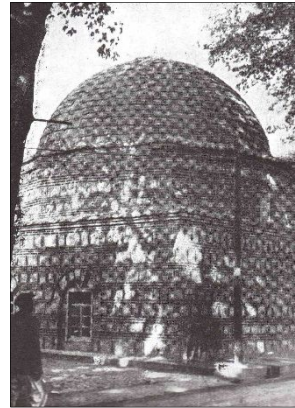


Fig 2.14: Hacı Özbek Mosque in İznik (1333), perspective view (Ayverdi, 1989).

The building techniques of that period were determined by local Muslim masons and local not Muslim masons which were work on the progress of the construction together. Therefore administrative organs of that time tried to prevent import constructions which were done by not local people (Kuban, 2007).

### o The differentiation of Ottoman architecture in Turkish seigniory period

In Turkish seigniory period after the Anatolian Seljuk's, the architectural style was not paused or cut off with the integration of new styles which were imported. The new Islamic architectural style was formed with the essences of the middle Asia and Iran on the other hand other essences of styles were coming from the regions under the control of Turks. In addition some of the interpretations on the buildings were done by Cristian masons. With all of these facts, the progress of Ottoman architecture was taken four hundred centuries (Kuban, 2007).

Birgi Ulu Mosque (1312) was built behalf of Aydınolu seignior Mehmet Bey. Its timber roof supported by columns and there was a dome in front of mihrab. This mosque was the oldest one in Seljuk's region and it was the most analogous example of oldest mosque typology.



Fig 2.15: Birgi Ulu Mosque (1312) (Türkiye Kültür Varlıkları ve Müzeler Genel Müdürlüğü, 2015)

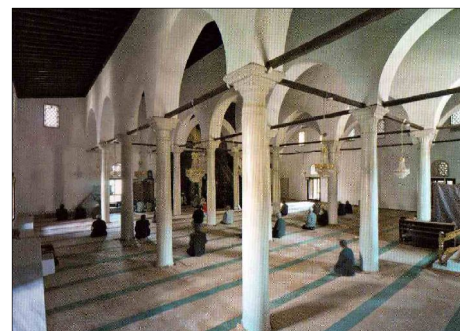


Fig 2.16: Birgi Ulu Mosque, interior (1312) (Kuban, 2007)

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

The specific points of this mosque were: The oldest example of Western Anatolian mihrab with geometrical pattern of ceramic cover, Rumi geometrical patterns of leaf on the minbar and windows cover, the oldest dated brick minaret in Western Anatolia (*Kuban, 2007*).

Syncretic design of building construction could be taught in Birgi. Islamic mosque schema with local construction technique and using of general fragment of the surrounding buildings were the components of syncretic architectural design (*Kuban, 2007*).

The bath buildings which were built in the same period in Western Anatolia, did not classified as Ottoman, Mente eli, Aydio lu or other seigniories. They were classified as bath buildings in Turkish seigniority period (*Kuban, 2007*).

After the end of 11th till 15th century, until the absolute domination of the Ottomans in Anatolia, Turkish seigniories composed new life style in this region. Turkish nomads were converted their life style as settled society which was effected all the parts of Eurasia (*Kuban, 2007*).

Ihanlı State was invaded Anatolian Seljuk's in 1308. After a short period of time, Ihanlı State was collapsed and divided in 1335. Near the border line of Byzantine Empire, the Ottoman seigniority was dominant firstly in West Anatolia and after it sovereign in east Anatolia. The Anatolia was united with the control of Ottomans (*Kuban, 2007*).

All these Turkish seigniories were the dominant for converting the religion and ethnicity of Anatolia which were very active in building construction in their own regions in 14th and 15th century. This building construction activity contains the Seljuk's building program, constructions techniques and building typologies in some variations. The architectural designs in Seljuk's were affected by Syria, Mesopotamia, North of Iran and Azerbaijan. And also these intensions of Seljuk with the building traditions before the Islam in Turkish communities were affected the architectural design in Turkish Seigniority period (*Kuban, 2007*).

In Anatolian Seljuk's brought their architectural culture from their homeland 'Maveraünnehir' to Anatolia. Nevertheless they faced with different architectural cultures which were formed in many years ago in Anatolia. Architectural interactions between Seljuk's and ancient cultures in Anatolia formed a new Seljuk's architecture (*Tayla, 2007*).

However Anatolian Seljuk's not only brought their architectural culture but also they brought their masons and master builders to Anatolia. When they were constructed their buildings, they used local architectural elements (*Tayla, 2007*).

In mosque architectural design, they used multi column planning scheme for general structure and soil-straw composite material in roof structures. Plan schemes of the mosque structures were rectangular. The main entrances of the mosques were dominant and minarets were built up on curvilinear brick elements (*Tayla, 2007*).

Madrasah were designed with one main courtyard and they were covered with student accommodations. Most of them were designed with four iwan which were opened to courtyard. Some of the Madrasah's were built two stories. Main entrances of the Madrasah's were designed same concept as dominant as mosque structures. Heights of minarets were disproportionate with madrasah dimensional features. In addition to this design characteristic two minarets were located two side of the main entrance (*Tayla, 2007*).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

Some of the Madrasah's were designed with different aspects. Their courtyards were covered with pyramidal dome structures. Further these structural elements were used Anatolian Seljuk's monumental tombs. In Ottoman periods these tombs were constitute new character of tomb architecture (Tayla, 2007).

Beside soil-straw composite material in roof structures and small-medium size dome structures, most type of the vault structures was used. Pendentive, Turkish triangle, squinch and muqarnas were used efficiently in Seljuk's period. Muqarnas ornament was highly developed in Ottoman period. Seljuk's ceramic ornamentation was carried out the special character of the era (Tayla, 2007).

On the below figures which one was built in Seljuk period 'Diyarbakır Silvan Meyyafakirin Ulucamii' (1152-80) mosque's picture, perspective drawing and plan were seen.



Fig 2.17: 'Diyarbakır Silvan Meyyafakirin Ulucamii' mosque picture (Tayla, 2007).

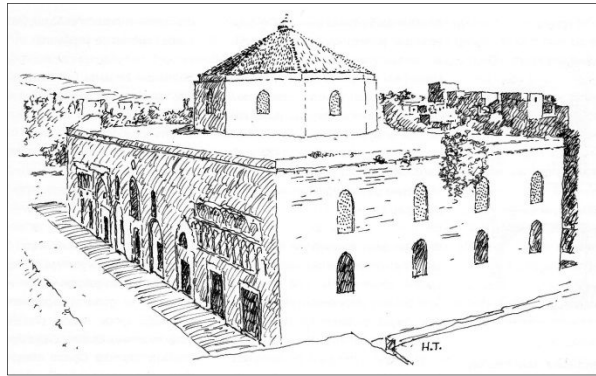


Fig 2.18: 'Diyarbakır Silvan Meyyafakirin Ulucamii' mosque picture (Tayla, 2007).

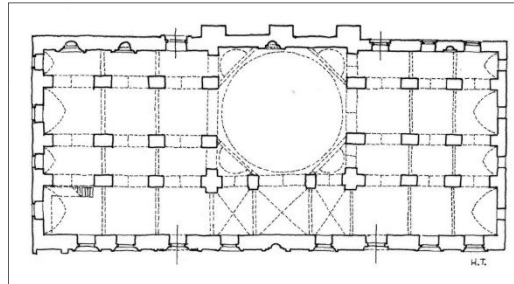


Fig 2.19: 'Diyarbakır Silvan Meyyafakirin Ulucamii' mosque plan (Tayla, 2007).

The lack of political control mechanism unity in Turkish Seignior period, the building construction was sustained randomly with local attempts in construction besides the inheritance of Seljuk's tradition. For instance on the behalf of Artuko ulları seignior, Ulu Mosque in Diyarbakır was constructed by mason who was came from Damascus. This mosque was become well known by its form that looks like Ümeyye mosque in Damascus. Definitely essences of the cultural environment in Efes, effected the masons to presented their talents and abilities (Kuban, 2007).

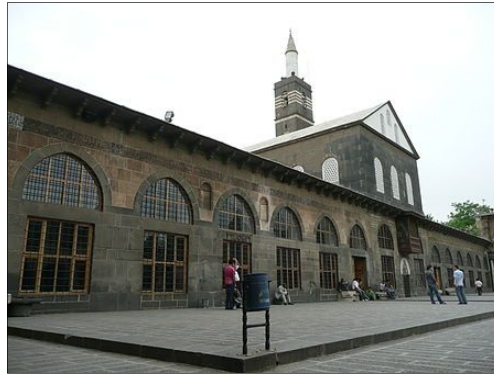


Fig 2.20: Ulu Mosque in Diyarbakır (1091) (Wikipedia, 2015).

After 14th century the architectural style of Seljuk's were not disappear. In the sovereignty period of İhanlı Dynasty in Anatolia under the power of Olcaytu Hüdabende Khan; the building named as Amasya Darü İifa – Amasya Hospital (H.708) 1308/9, was sustained the plan same of the Seljuk's madrasa (Kuban, 2007).



Fig 2.21: Amasya Darü İifa – Amasya Hospital (H.708) 1308/9 (Geziklubu.com, 2015).

The prestigious buildings were built in Eastern Anatolia in 14th century which were sustained the dome tradition. The region near Van Lake under the control of Karakoyunlu seigniory in (H.760) 1358/59, the building which was called Halime Hatun tomb and Erzen Hatun tomb showed that the tradition of the tomb were sustained from the Seljuk's and the details on the masonry were showed that the Cristian masons constructed these two building. These two tombs were seen as synthases of Eastern Anatolian architecture style (Kuban, 2007).

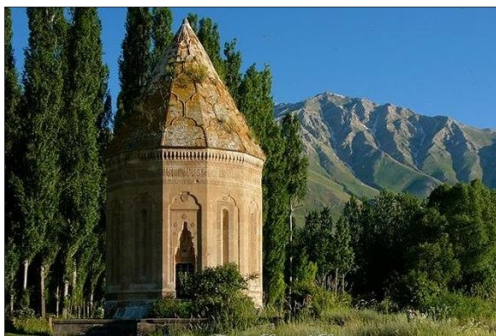


Fig 2.22: Halime Hatun tomb (Turkiye-resimleri.com, 2015).

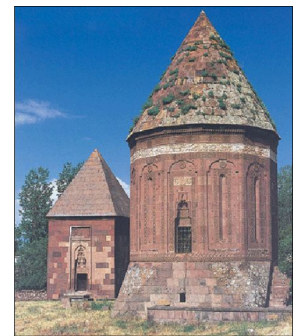


Fig 2.23: Erzen Hatun tomb (Resimcity.com, 2015).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

The Karakoyunlu and Akkoyunlu Seigniories had the sovereignty of Eastern Anatolia which were sustained a building program of traditional construction techniques. However sometimes incidental constructions happened in that region as mentioned on the upper paragraph. Akkoyunlu seignior had the sovereignty of Diyarbakır city. Nebi mosque in Diyarbakır and Sultan Kasım Madrasa in Mardin were built with the traditional construction techniques of “alma ık”. The colorful “alma ık” walls with simplifies profiles and the workmanship of Muqarnas and plan typologies parallel with Syria. All these specifications proofed that the local traditional construction techniques were used. On the other hand half - nomad Turkish seigniories building tradition and architecture were not sustained for a long time. For instance in Hasankeyf, the seignior of Akkoyunlu, Uzun Hasan Bey’s son Zeynel Bey tomb was built in the second half of 15th century which was built under the architectural traditions of Azerbaijan and upper Mesopotamia. On the other hand in Ahlat, a tomb was built for the Emir Bayındır in (H.890) 1485 which was designed as Armenian architectural style. These two tombs were constructed in different building typology. In Seljuk’s period, syncretic approach in architecture was continued. The tomb in Hasankeyf was built by the masons who were qualified in Islamic perspective. The tomb in Ahlat, the tomb was built by Cristian masons who were sustained their traditional construction techniques. However in the same period of time in the borders of Ottoman, the tombs were constructed in a standard building tradition (*Kuban, 2007*).

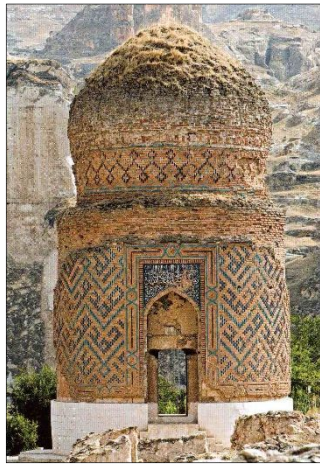


Fig 2.24: Zeynel Bey tomb, Hasankeyf (*Kuban, 2007*).

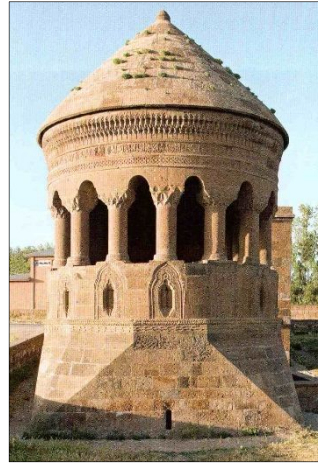


Fig 2.25: Emir Bayındır tomb, Ahlat (*Kuban, 2007*).

Anatolian Seljuk architectural essences were very effective in middle Anatolia. There were many building examples remained from Anatolian Seljuk’s. Before the collapse of Ihan Dynasty, the governor of Ihanlı Dynasty, Ertena was established Ertena seignior (1343-81) in Sivas and Kayseri. He constructed buildings such as Kö k Madrasa in Kayseri, G üdük Minaret in Sivas (*Kuban, 2007*).



Fig 2.26: Kök Madrasa in Kayseri (*Wowturkey.com, 2015*).

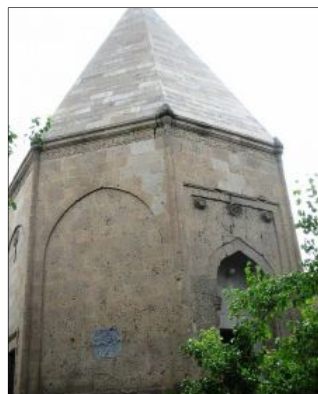


Fig 2.27: Kök Madrasa in Kayseri, inside (*Wowturkey.com, 2015*).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

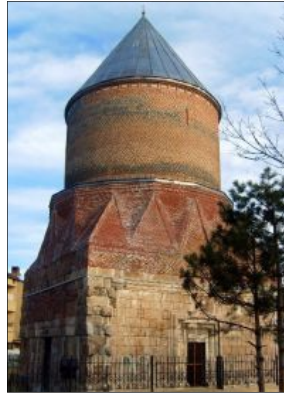


Fig 2.28: Güdük Minaret in Sivas (*Wowturkey.com, 2015*).

The Karaman seigniory was sustained the Seljuk's architectural style. Before addition of this seigniory into the borders of Ottoman seigniory, the important buildings and constructions were done. The architectural style of Karaman Seigniory was the continuation of the Seljuk's style (*Kuban, 2007*).

In the period of Turkish seigniories, the West and the East of Anatolia had to be divided in to two categories according to the architectural interaction between them. The buildings in Karaman, Konya, Aksaray and Ermenek which were built in 14th century were continuity of the architectural styles in Seljuk's. For instance in Ni de, Akmedrese and Sungur Bey Mosque, in Karaman brahim Bey Imaret (1433) were built with the architectural style of Seljuk's. In the same period of time in West Anatolia in Bursa city, Çelebi Mehmet complex building and in Edirne Üç erefli mosque were built (*Kuban, 2007*).



Fig 2.29: Ni de, Akmedrese (1409) (*Panoramio.com, 2015*)



Fig 2.30: Sungur Bey Mosque in Ni de (*Panoramio.com, 2015*)



Fig 2.31: Karaman brahim Bey Imaret (1433) (*Panoramio.com, 2015*)

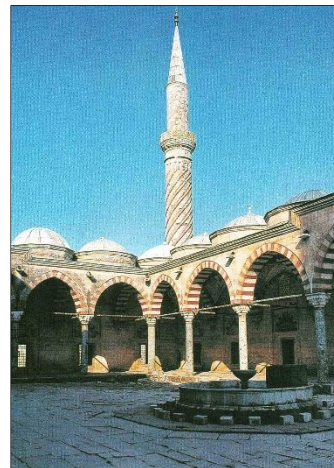


Fig 2.32: Üç erefli Mosque (1437-1447), Edirne (*Aslanapa, 2004*)



## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

In Western Anatolia before all the sovereignty of the Turkish seigniories were not taken from the Ottoman in the beginning of 14th and 15th century, in some of the building types the architectural intentions were similar. For instance, Antalya Yivli Minare Mosque (H.774) 1373, was followed the domed “Ulucamii” typology. Ye il imaret in Tire, was followed the plan typology of Ottoman region buildings which evoked the Beylerbeyi imaret in Edirne. Antalya Mevlevi dervish convent, was the most characteristic example of this type of building in whole regions which was organized of dome closure middle space surrounded with iwans. These building examples were the evidence of the continuity of architecture from Seljuk to Ottoman periods. This formation of architecture was the outcome of Turkish - Anatolian cultural environment (Kuban, 2007).



Fig 2.33: Antalya Yivli Minare Mosque (H.774) 1373 (Kuban, 2007).



Fig 2.34: Ye il Imaret, Tire 845 (1441) (Aslanapa, 2004).

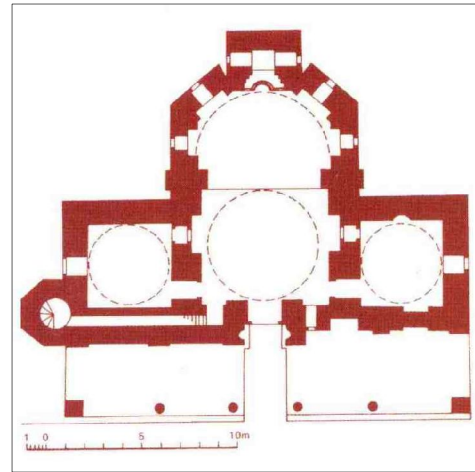


Fig 2.35: Ye il Imaret, Tire 845 (1441), Plan (Aslanapa, 2004).

Some of the examples of monumental buildings were the outcomes of Ottoman architecture that developed in Anatolia. They were not carried any architectural essences related to the Seljuk's period of time. For instance, Firuz Bey Mosque in Milas, Ilyas Bey Mosque in Balat and Ye il Mosque in znik were the examples of these types of buildings (Kuban, 2007).



Fig 2.36: Firuz Bey Mosque – 797 (1394) (Milas Prefecture, 2015).

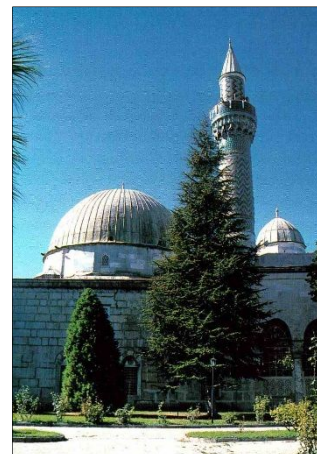


Fig 2.37: Ye il Mosque, znik – (1378) (Aslanapa, 2004).

Starting from Sultan I. Murat period, the Ottoman was expanded in Balkans and became rich. The architecture was developed and reached in monumental level in 14th century by the effect of the previous experiences in Anatolian architecture and this wealthy environment. Therefore the early period of Ottoman architecture was not just depended on the borders of Anatolian architecture as well it was depended on all the regions that were conquered by Ottomans (Kuban, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

In Sultan Orhan period of time in Anatolia many of the buildings were constructed according to the style of Seljuk's. Muqarnas, glazed brick and ceramic were the specific ornament techniques that were brought to Western Anatolia with craftsman. However new design techniques in architecture were developed in Western Anatolia in the same period of time. The main turn in architecture was the repetition of dome structures in buildings. Dome structures were known by eastern before Islam even though in Seljuk's period of time the dominant structural design element in buildings was not dome, it was "taç kapı" portal (*Kuban, 2007*).



Fig 2.38: Yakutiye Madrasa, Erzurum (1310) (*Snipview.com, 2015*).

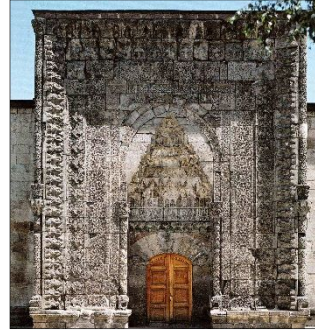


Fig 2.39: Yakutiye Madrasa, Erzurum (1310) "taç kapı" portal (*Kuban, 2007*).

Another specific character of early Ottoman period was using "alma ık" masonry construction techniques rather than cut stone cladding technique. This technique was definitely used by local masons in Anatolia (*Kuban, 2007*).

From the beginning of 14th century, Ottoman architecture was progressed and new architectural style was developed in the region of eastern Trace, Istanbul and Marmara region. Especially in Bursa, Edirne and Istanbul the development of architectural style was seen on the building designs. However in middle Anatolia the continuity of the past architectural styles and Eastern Anatolia the heterogeneity of the architectural styles was seen. These variances in architectural styles in Anatolia were the evidences of cultural diversity and prosperity in Anatolia as well Ottoman Empire (*Kuban, 2007*).

### 2.3. Seignior and early periods of Ottoman Empire

#### 2.3.1. Seignior Period (1243-1483)

In 11<sup>th</sup> century, the Turkish tribes were settling down to the Anatolia. In this century all the Turkish tribes were reached to the Anatolia. However their sovereignty was lasted in a very short period of time. When they settled down to the region they had to move to the East of the Anatolia. The Turkish tribe's inflows to the Anatolia were continued in 12<sup>th</sup> century. The Turkish tribes were settled down to the Anatolia since 13<sup>th</sup> century and the beginning of the 14<sup>th</sup> century. Because of the infestation of Mongol's, the Turkish tribes were inflow into the Anatolia. The existed Turkish governments in Anatolia dispatched the new Turkish tribes to the West of the Anatolia near the border line of Byzantine Empire. And some of them reached to the Aegean Sea and constituted their own tribes with the name of the head of the seignior (*Kolay, 1999*).

After the second period of 13<sup>th</sup> century, the administration control of Anatolian Seljuk's was become weaker. This situation was occurred development of small independent seigniories all around the Anatolia. This period of architecture until the founded the Ottoman Empire was called seignior of period of architecture. In this period of time in different regions of Anatolia, different quality of architectural works was done. In general, researchers divided 14<sup>th</sup> century architecture and art in four

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

different regions. Eastern, South-Eastern, Middle and Western Anatolian architecture were differentiated to each other. In first three group of architecture were continue of the Anatolian Seljuk's architecture. However the west part of the Anatolia was tried to created differentiated architecture style. At the end of these different kinds of architectural styles combine in one common area that was called Ottoman style. Therefore it was necessary to understand to western Anatolian styles for understanding the classical Ottoman architecture (Kolay, 1999).

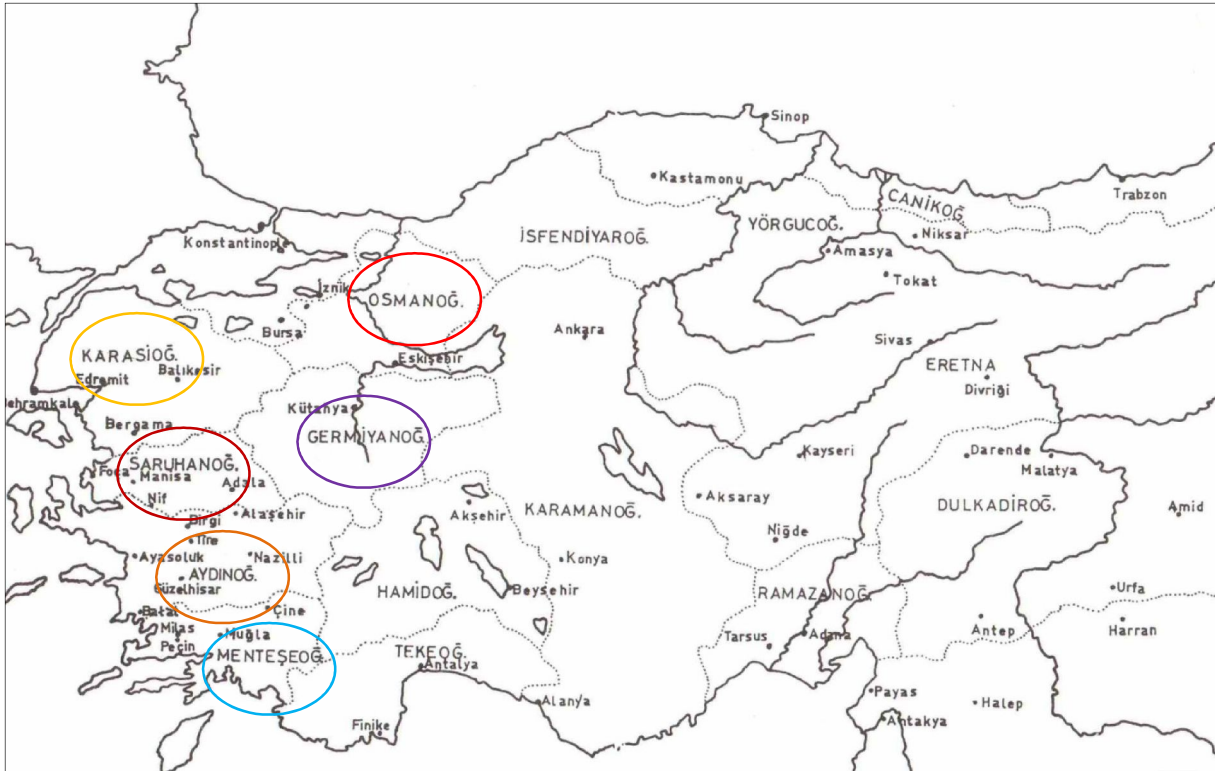


Fig 2.40: H. 730 (1299-1300) Anatolian Seigniories (Kolay, 1999).

The Western Anatolian architectural styles were especially seen in Mente o ulları, Aydıno ulları, Saruhano ulları, Germiyano ulları, Karasio ulları, Osmano ulları seigniories. All these seigniories differentiated from Ottoman seigniory which was located in different vernacular cultural location. Mente o ulları, Aydıno ulları, Saruhano ulları, Germiyano ulları, Karasio ulları seigniories located in areas which were very rich in culture. West Anatolia was hosted Archaic, Hellenistic, Roman and Byzantine cultures. The building techniques were received from these cultures. However in Byzantine era these building techniques were differentiated in Marmara region. In Western Anatolia, building techniques were developed in centuries. For instance in 14<sup>th</sup> century, nomadic Turkish tribes constituted Seigniory architecture. In this style, nomadic Turkish tribes mixed construction techniques that were brought from the east and the techniques that they learned in West Anatolia. These mixed construction techniques were used and brought a new and immature architecture however this architecture was dynamic. Therefore in this period of time the architectural works were not just belonging to the east or the west, they were new approach for the architecture (Kolay, 1999).

### o The relations between Turkish tribes and Byzantine in Seigniory period

In this century, the Turkish tribes Mente eo ulları, Aydıno ulları, Saruhano ulları, Germiyano ulları, and Karasio ulları had soldiers with on foot and cavalier. All these tribes without Germiyano ulları had a fleet. In the beginning of the 14<sup>th</sup> century the capacities of the army of the tribes were listed on the below. The data's were received from Al-Umari who enlightened the 14<sup>th</sup> century in Anatolia (Kolay, 1999).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

- Mente o ulları, had got three thousand cavalier,
- Aydıno ulları had got more than sixty cities and more than three hundred castles and seven thousand cavalier equipped with sword and lance.
- Saruhano ulları had got fifteen cities, twenty castle and ten thousand soldiers. His brother Nif who was the seignior of the Kemalpa a had got eight cities, thirty castles and many soldiers, eight thousand cavaliers and fleet.
- Germiyan seigniorship had got seventy cities and castles with forty thousand cavaliers.

These seigniorships fleets and armies had invasions to the countries in Morea, Trace, Aegean Islands, Cyprus, Bulgaria and turned back with booties to their country. In some time these seigniorships had been a part of the army between the wars with Byzantine Empire. As well sometimes they were fight side of Ottoman's army. They join the wars in Trace with Ottoman's. The seigniorships in the west side of the Anatolia were disturbed the Byzantine Empire. Especially Aydıno ulları seigniorship invasions to Trace and Balkans were disturbed the Christians in Europe. Therefore Pope VI Clement decided to organize a crusade. Between 1344 and 1346, the wars between zmir and surrounding were finalized to the loss of the Latin's (Kolay, 1999).

Egypt-Syrian Mameluke and Anatolia had got a strong financial, trade and cultural relations ships between 13<sup>th</sup> and 14<sup>th</sup> century. However there was very few evidence related to their relations with West Anatolian Seigniorships (Kolay, 1999).

The economic life in that period of time was known in a limited perspective. In these period of time Ayasuluk "Efes and Selçuk", Balat and zmir were the important trade seaport which exported wheat, saffron, sesame, honey, beewax, acorn, alum, morocco, leather, carpet, eel. These goods sold to the western traders and they brought them to the Cyprus, Egypt, Rhodes and Europe. In the same way the goods which were soap, tin, fabric, lead and other products were import to the country. The importance of the trade and the relations between Western countries could be understand by the consulates in Balat and zmir which belonged to Venetian and Genoa. On the other hand Mente e, Aydın and Saruhano ulları seigniorships printed coins which were similar to the Cristian's "gillati" coins (Kolay, 1999).

According to Ibn Battuta<sup>1</sup>; all the Turkish tribes in West Anatolia were settle down in 1330's. In that period of time; places, mosques, madrasas, baths and small dervish lodges were built in the cities of the West Anatolia. Out of the cities nomadic Turkish tribes were existed. The locations and the cities in Anatolia were named in Turkish language therefore it could be understood that the Anatolia was Turkized (Kolay, 1999).

Turkish tribes in 14<sup>th</sup> century there was cultural interaction. The Turkish tribes gave importance to the culture and education. For instance, in the capital of Mente e seigniorship there was three madrasa. In Mente eo ulları seigniorship madrasas " İyasiyye-Medical science book" was written (Kolay, 1999).

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<sup>1</sup> Abdallah Ibn Battuta; was a Moroccan Muslim traveler, lived between 1304 and 1368. He crisscrossed the Eastern hemisphere in the second quarter of the fourteenth century and with the help of a literary collaborator, wrote a lengthy account of what he saw and did. For his extensive travels the Rihla "Journey" was published. Over a period of thirty years, Ibn Battuta visited most of the known Islamic world as well as many non-Muslim lands. His journeys included trips to North Africa, the Horn of Africa, West Africa and East Europe and to the Middle East, South Asia, Central Asia, Southeast Asia and China. He was known as the greatest travelers of all time (Dunn, 1989).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

In 1361, West Anatolian seigniory Karasio ullaı lands were added to Ottoman seigniory. In 1381 most of the lands of Germiyano ullaı was given to Ottomans. The remained lands were taken by Ottomans in 1390. In 1402, Timur had a victory gained through battle with Ottomans and he established the built the government of Mente eo ullaı, Aydıno ullaı, Saruhano ullaı and Germiyano ullaı seigniories. However in short period of time, in 1410 Saruhano ullaı, in 1425-1426 Mente eo ullaı and Aydıno ullaı, in 1429 Germiyano ullaı seigniories were occupıes by Ottomans. All these seigniories were become provinces of the Ottomans (*Kolay, 1999*).

### 2.3.2. Early period of Ottoman Empire (1299-1505)

In the early period of Ottoman architecture was the synthesis of east-Islam, east-Mediterranean and Byzantine architecture. In the first half of 14th century, the Ottoman's gave importance to conquest of the regions, colonization and mission ideals. Therefore the architecture was based on pragmatic solutions. Such as the importance was given to reconstructions of the Byzantine buildings which were in placed captured cities. The construction techniques were not developed; the building techniques and the elevation orders were transformed form the built ones. For instances, Osman Gazi was buried into the Byzantian chapel in Bursa and Hagia Sophia in znik was converted to mosque. After settling down the local architectural inputs, materials and building techniques; the early architectural period program was determined (*Ersen 1986*).

After the second half of the 14th century, the higher quality of construction materials and techniques, the interpreted elevations, form of building elements and orders, new structural trials were seen. The early Ottoman architecture were started to shaped at the end of the 14th century according to the perspective of local materials with construction techniques and the elevations which were affected by the architectural environment of that period of time (*Ersen 1986*).

In the west Anatolian seigniories as well in Karaman seigniory, the mosques which were constructed with multi columns and flat roofed. However in Ottoman seigniory, the squared planed with domed form was an integral part of the buildings. The square form single space structures were lean the history in middle Asia. The fastest transformations of the mosques with domes were done in Ottoman seigniory in contrast with others seigniories (*Ersen 1986*).

In the seigniory of Karaman, the traditional early periods of architectural plan and structural shames were conserved. However in the end of 15th century forms of elements, architectural ornamentations and some of the structural and elevation forms were derived from early period of Ottoman architecture (*Ersen 1986*).

The Ottoman seigniory was get into the high progress of architecture in a long period of time with the direct relation in Byzantine and the valuation of the existed architectural data's' in their region. The syntheses of Ottoman architecture were done according to the three steps:

- Direct transfer,
- Interpreted transfer,
- Progress of architecture within the limits of its own and formed synthesis.

By the guidance of these steps, synthesis of Ottoman architecture was shaped. In 14th century in Ottoman architecture first two steps were seen. In contrary in Karaman seigniory, Persian and Anatolian Seljuk's syncretic thoughts were seen. These syncretic thoughts were collected as; massive, rough plastic form patterned influential elevations and orders were visualized. In addition cut stone outer leaf

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with rubble stone inner filling masonry walls were used. In contrary, in early period of Ottoman architecture “alma ik” masonry wall and brick ornamentation had an interaction with local architecture. Seljuk’s architectural intensions did not continued in Ottoman seigniory in comparison with Karaman seigniory (*Ersen 1986*).

After founding the Byzantine brick fields in Ottoman seigniory, the construction of the masonry walls and ornamentation techniques were differentiated. The geometric grift in Karaman architecture, and curvilinear branches were joined ornamentation patterns were visualized very few buildings in the early period of Ottoman Empire. The elevations of the buildings were constituted with; stone and brick “alma ik” masonry walls, “alma ik” arches, plasters, blind arches formed recessed spaces, zigzag brick eaves and “alma ik” brick ornamentation with different forms and different colors of applied surfaces (*Ersen 1986*).

### **2.4. Overview of building traditions in Western Anatolia before the Turkish civilization**

The people in Western Anatolia were always in a strong relationship in trade and culture between Aegean islands and Greek peninsula. In addition Western Anatolia faced with big demand of settlements of tribes because of fertile lands and easy access between the locations. Therefore many different cultures of groups were migrated to Western Anatolia and it caused a mixture of culture synthesis (*Kolay, 1999*).

According to the data’s that were gained from archeological parameters, in Western Anatolia B.C. 2000 the first settlers used timber tie beams with adobe and rubble stone patterned walls. For the closure of the spaces, folded roof with clay roofing tiles were used. This information gained from pieces which were found in the archeological excavations (*Kolay, 1999*).

B.C. 9<sup>th</sup> century, the migration of people coming from the west to the cities Efes, Milet, Priene, zmir in the West of the Anatolia. Therefore there were important monumental architectural pieces built in these areas. As well as the monumental architectural pieces, the building techniques were developed in that region. The most important buildings were constructed with dry patterned techniques cut stones with clamps. The columns were used affectively beside of the load bearing masonry walls in those buildings (*Kolay, 1999*).

B.C. 546, the Persians were prevailing the Anatolia for two centuries. They did not affected from the western techniques substantially. They continued their eastern building techniques (*Kolay, 1999*).

B.C. 334, the Alexander the great was been possession whole Anatolia caused to developed ancient Greek language in that area. In Hellenistic period of time, the traditional building techniques were not changed however the elevations of the buildings were richening with ornamentations (*Kolay, 1999*).

B.C. 133, The Kingdom of Bergama lands were gave up to the Roman Empire that caused the influence of Roman culture in those areas. In this period of time the new functional building applications in Italy were similarly built in Anatolia. For instance, gymnasiums, aqueducts, amphitheaters, victory ornaments. However amphitheaters, victory ornaments were not to take up seriously from the Anatolian people therefore the examples were very few. In this period of time masonry pattern techniques were differentiated according to the building in Italy. Rather of using dry cut stone wall, they started to use three leaves masonry with two cut stones layer outside facing and rubble stone fill inside of the wall. In this period of time, the building innovations in Italy were transferred to Anatolia. Instead of cut stone building pattern technique, brick work seen in the stone masonry walls. In brick and cut-stone “alma ik” pattern technique used walls, core layer was filled with rubble stone and mortar and topped with marble

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plates. Complete brick work walls were not common in Western Anatolia except the Kızıllavlu building in Bergama (Kolay, 1999).

The first examples of Roman engineering were existed in Italy however the knowledge of building and construction were used in Anatolia too, as it mentioned in before. Bridges, aqueducts and arch construction for passing the wide openings and vault, dome structures for closure of the wide openings were used separated widely. The arch unit was used in wide openings as well it was used for the window, door and niche openings with using of cut-stone, rubble stone and brick materials (Kolay, 1999).

After the Roman Empire was officially accepted Christianity in A.C. 330, architectural values for Hellenistic and Roman Empire period was seen Western Anatolian cities. The traditional building techniques and orders were used in Western Anatolia in early Christianity period. The masonry walls were constructed with cut stone and brick patterns order “alma ık”. Up to a certain height of masonry wall marble finishing were used. On the slabs mosaic and marble tiles which were the classical Roman era construction materials were used. As a closure building structures; folded roof with timber beam support covered with gouge tile, vault and dome were used. These construction techniques were continued till the Justinian period of time for 6 century. These techniques were affected Constantinople architecture. As well, these building techniques were developed in Constantinople and affect the other parts of the empire. In late period of Roman Empire, the building techniques were the beginning specifications of the Byzantine architecture. For instance, in the masonry wall structure brick and stone pattern techniques with horizontal strips of brick patterns, for the closure structures cross vaults and dome structures, for transitional elements frequent use of pedentives were the main changes of new styles in Byzantine architecture (Kolay, 1999).

After 8<sup>th</sup> century most of the commercial and cultural events were collected in Constantinople. Arabic invasions were the results of the decline of the Western Anatolian populations. In this period of time, importance was given to construction of the city walls and castles. The other types of the buildings were constructed in sloppy, ordinary and unexceptional way such as antique materials were used for constructing the masonry walls without any ornamentation (Kolay, 1999).

In 11<sup>th</sup> century, Turkish tribes had an invasion to the West Anatolia that caused instability of political conditions. Venetians and Genoese established colonies in Western Anatolian ports which were Halikarnasos ‘Bodrum’, Efes, Smyrna ‘ zmir’, Foça, Çandarlı, Edremit, Ku adası, by the reason of the weakness of the Byzantine Empire in 12<sup>th</sup> and 14<sup>th</sup> centuries. As well these colonies built castles in those cities which were built by cut stone with materials taken from ancient buildings (Kolay, 1999).

In the beginning of 14<sup>th</sup> century, Turkish people captured whole Western Anatolia and from that period of time those locations passed cultural synthesis in a parallel with Muslim religion (Kolay, 1999).

Before the end of the 14<sup>th</sup> century, Ottoman Empire was under the essences of building techniques in late Byzantine architecture. There was a strong essence of the Byzantine Empire in Anatolia. The builder in Ottoman was used the techniques in the previous times however they effected the building and construction techniques, materials and also the order of the elevations of Byzantine Empire buildings. The new needs of the Islamic society exposed the buildings such as mosque, madrasa, bath, tomb and those buildings were built with the building techniques, materials and the elevation orders of previous practices in Anatolia and some essences from the Byzantine Empire (Ersen 1986).

In the beginning of the 14<sup>th</sup> century, the formats of the shapes of the architecture were giving an essence as transferred from different styles. However in the second half of the 14<sup>th</sup> century, the Ottoman architecture was formed with more subjective to its origins (Ersen 1986).

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The complexity of the Byzantine architectural forms was not built similarly as original with new settled society in early Ottoman. Turkish architecture was affected under the essence of many cultures till Classical Period of Ottoman. Therefore it could be said that Ottoman architecture was the heritor of many cultures living in Anatolia (*Ersen 1986*).

The effects of the strong essences of Byzantine architecture on early period of Ottoman architecture have to be examined with the data's of plan typologies of buildings, structural specifications, the general approaches of interior architecture, the shape of elevations and their style formations in course of time (*Ersen 1986*).

The middle age of Byzantine Empire's massive two dimensional walls essence with materials that taken from ancient structures, the types of specific Byzantine architectural shapes and their groupings and the application of "alma ik" masonry wall technique that were frequently used by Ottoman architects. The usage of these techniques and architectural forms were the signs of the sustainability of the essences from the Byzantine in early Ottoman architecture (*Ersen 1986*).

In early periods of 16th century, Cristian building workers who were skilled workers, carpenters, masons and painters left signs of building techniques, from of the shapes and ornamentations from their culture. The renegade masons in early Ottoman Empire were worked in mosques, madrasa, tomb, and bath structures. They taught their building techniques to their apprentices as well they have special tools for shaping the construction materials in site. The brick material in the "alma ik" masonry wall technique, ornamentation elements, circular brick arch, the closure of the dome with brick elements (*Ersen 1986*).

### 2.4.1. Byzantine architecture in Anatolia

The religious buildings of the Byzantine Empire and general thought about the plan shapes of these buildings were resolved with the integration of plan, structure, closure and elevation formations. The religious buildings in Byzantine Empire and their planning principles were placed east and west direction with centered plan. The second formation of the plan placed in the same directions formed with cross shape in the square. In general the buildings formed with cross shape in the square were centered plan shape and centered naos. The dome emphasized the center of the naos. In the late period of the Byzantine Empire, the tendency of the perpendicularity of the building, the interior of the spaces were become more illuminated. In addition to that the subtraction of the dome of naos from the walls and formed openings give a unity of the interior spaces and higher the illumination levels of the interiors (*Ersen 1986*).

In the end of the middle era of the Byzantine Empire, the emphases were given to the exterior elevations of the buildings. The usual massif and plain elevations were enriched with the relation like light-shadow, rhythm-repetition, form orders and increased the openings on the elevations. In addition to that, excessive use of brick and stone masonry wall "alma ik", was made the elevations more colored (*Ersen 1986*).

In the late period of Byzantine Empire, the importance was given to narthex, exonarthex, parecclesions. The interior architecture of the narthex was done in a detailed way. The closures of these structures were built with cross vault structure as well the walls were covered with marble for removing the monotony inside of the church (*Ersen 1986*).

In every period of Byzantine, the churches were designed in square plan shape with cross. The structures of the churches were designed according to this schema. As well this plan scheme was limited the organization of the elevation. In the Byzantine architecture, developments of the church design were



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caused the differentiation of the building elements typology. However the main forms of the elements were not changed. For instance the arch was always curvilinear nevertheless it could be designed in different constructions techniques such as “alma ık” or brick (*Ersen 1986*).

The building design specifications and enrichment of form patterns in late period of Byzantine Empire were composed an inner section with early period of Ottoman architecture therefore they were very important to understand the interactions between both of them (*Ersen 1986*).

Plan layout, interior space, structure and the closure elements ideals of the late Byzantine Empire were not applicable in early period of Ottoman Empire. The early Ottoman buildings were composed of square units which were joined to gather side by side. The structural load transferring system was based on; transferring the loads to the external walls of the dome cell. The elevations were two dimensioned (*Ersen 1986*).

In the beginning of the early Ottoman architecture in 14th century, so many examples of Byzantine buildings and their remains were existed. The buildings which were still in the condition of use, utilized, repaired and additional components were added. In contrary the buildings which had big damages and partly collapsed, used as source of building materials in other buildings (*Ersen 1986*).

### 2.4.2. Construction techniques in Anatolia before Turkish civilization

#### ○ Construction materials

Limestone and andesite were widely used in historical period of time. Beside of that in in Archaic, Hellenistic, Roman and Byzantine monumental buildings as well in Turkish seignory period marble was used in constructing the masonry walls (*Kolay, 1999*).

Bricks were used widely in Roman era. Brick was used as a secondary material in masonry wall however in North part of the Western Anatolia in Bergama in “Kılavuzlu” building it was the dominant and sole material. In the late period of Roman Empire this material was used in Efes and Sardist in stone and brick “alma ık” masonry walls. In the south part of the Western Anatolia, brick crack pieces was used in inside of the mortar which was used in cut stone masonry wall in Priene, Milet and Heraklia buildings. However this type of using of the brick crack pieces was seen in Byzantine buildings and continued in Turkish period of time (*Kolay, 1999*).

The buildings which were remained from the ancient times, timber tie beams were used inside of the masonry walls. These beams were placed in grid form which was seen in masonry walls remains of Troya II (B.C. 2500-2200) and VI (B.C. 1800-1274). These types of construction technique were not seen after these periods however it was started to seen in Byzantine architecture (*Kolay, 1999*).

The mortar usage inside of the cut stone masonry wall was seen from the Roman architecture. In Anatolia, Roman mortar was mixed with high amount of lime with sanded soil which was softer compared with samples in Italy (*Kolay, 1999*).

In Byzantine architecture, the mortar mixed was formed with crushed stone, lime and sand. This type of mortar was lower quality related with the Roman buildings (*Kolay, 1999*).

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### ○ Masonry walls

In three leafed masonry walls middle leaf which was between the inside and outside leaves, filled up with mortar and rubble stone. This building technique was common in Western Anatolia till Roman period of time. In Roman buildings middle leaf filling were poured in different layers however in Byzantine and Turkish period's buildings this filling was poured randomly (Kolay, 1999).

- Three leafed masonry wall construction with cut stone patterned inside-outside leaves and pebble stone and mortar filled inner leaf

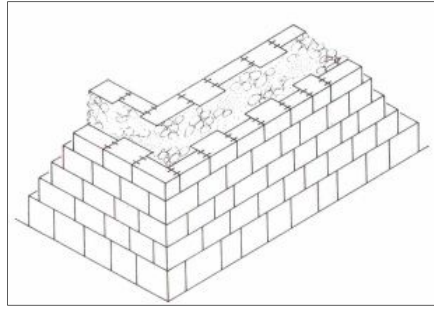


Fig 2.41: Bergama Traian Temple, three leafed masonry wall construction with cut stone patterned inside-outside leaves and pebble stone and mortar filled inner leaf (Kolay, 1999).

In this masonry wall technique was common in Roman period in monumental buildings. In Byzantine architecture this construction technique were seen in only two building. Seljuk fortress walls and Menderes Magnesia soldier building. In Roman buildings limestone and andesite stones were used on the outside and inside layers of the masonry wall (Kolay, 1999).

- Rubble stone masonry wall

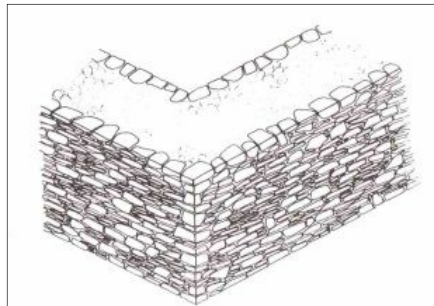


Fig 2.42: Priene Church, rubble stone masonry wall (Kolay, 1999).

These types of walls were seen on the buildings in south part of the zmir in late period of Roman Empire. Especially these walls were seen on fortress masonry walls in Priene, Milet and Herakleia. Stone patterns used randomly in this masonry wall type. The antique elements form other structures, crushed brick pieces were used in this type of wall constructions. This masonry wall construction continued in Turkish period (Kolay, 1999).

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- Cut stone masonry wall

Cut stone masonry walls were seen in West Anatolia since the Roman period of time. In these period the surface of these stone walls were covered with marble plates or plastered. In Byzantine period, the surfaces of the masonry walls in castles were not covered with any materials. However the houses and the other buildings wall surfaces were covered (Kolay, 1999).

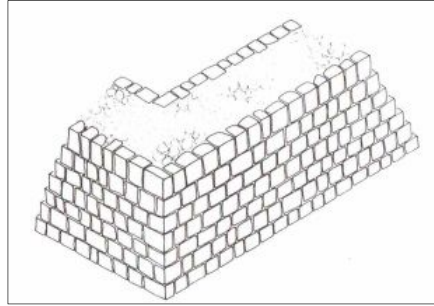


Fig 2.43: Milet Faustina Bath, cut stone masonry wall (Kolay, 1999).

- Brick and stone masonry wall structure “alma ık”

This technique was very special and frequently used in Byzantine and Ottoman Empire. In early period of Ottoman Empire architecture brick and stone “alma ık” wall structure were seen most buildings in Bithynia in 14<sup>th</sup> century. This fact was interpreted as the strong effects of Byzantine architecture directly to the Ottoman buildings. In early period of Ottoman architecture, the formation of the “alma ık” masonry wall was taken from the Byzantine architecture. However in the time sequence the formation of “alma ık” masonry wall technique was developed and became unique in Ottoman architecture (Ersen 1986).

Byzantine masonry wall building techniques, repetition of proportions, the differentiation of the dimensions of the building materials which were bricks, stone and mortar joints were done according to the principles (Ersen 1986).

The invasion of the İstanbul in 1204 by Latin’s, many of the masons was move to the provinces in Anatolia. They used the same construction techniques in İstanbul. For instance, a church in Zink was built behalf of Hagios Tryphon. This building includes the principal construction techniques of masonry wall similar buildings in İstanbul which was recessed brick and sloped mortar joints (Ersen 1986).

The analysis of “alma ık” brick and stone masonry wall was done with the relations of brick and stone such as their repetitions and placed directions of the masonry wall patterns. Diversity between two masonry walls which were built in similar building techniques were occurred with the differences of the ratio between stone and brick and different construction techniques in masonry walls. In the same masonry wall surface, there were fixed or variable repetitions of brick and stone patterns were existed. The directions of these patterns such as horizontal, vertical, sloppy, formed the variations between the masonry walls (Ersen 1986).

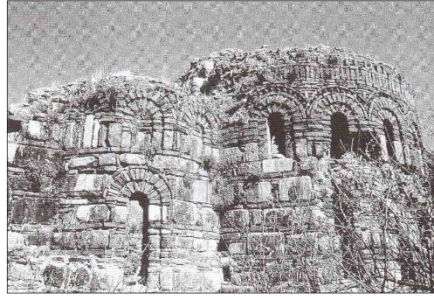


Fig 2.44: East elevation of the church on Kahve Asar Ada, Bafa Lake, variations of masonry knitting patterns (Ousterhout, 2008).

➤ Byzantine “alma ık” walls, used materials and dimensions

In the Byzantine architecture; “küfeki” stone type, as well stones with silica were used. Cut stone was well processed and the rubble stones were used according to the different valued buildings. However according the hierarchy of the elevations of the buildings, it was not found necessary to use more qualified materials on one elevation of the buildings. The dimensions of the stones were differentiated a large spectrum such as 11-56/16-22cm. Well processed cut stones in early period of the Byzantine which looked like Hellenistic stones of masonry units, became smaller and randomly processed after the middle period of the empire (Ersen 1986).

In the late Byzantine period, despite of the consistency proportional repetition and the joints construction techniques of the masonry walls, the quality of the materials did not developed. The dimensions of the stones were varied (35-42) / (35-42) / (4-4.5) cm. in early period of Byzantine Empire. Also half brick was produced in a harmony with the dimensions of the other bricks. In middle of the Byzantine Empire the dimensions of bricks were became smaller and the thickness of the bricks were thinner such as (33-38) / (33-38) / (3,5 -4)cm. The mortar joint thicknesses were 4-6cm which varied according to the dimensions of the brick and the horizontality of the joints. And also as a rule the thickness of the brick was always thicker than the mortar of the joints. In the late period of the Byzantine Empire, the dimensions of the bricks were (30-35) / (30-35) / (2.5-4) cm and the mortar joints were 4-7cm. The proportional order of the masonry wall pattern which became cliché was composed of four rows of stone and four rows of brick. Besides, the thicker dimensions of the mortar joints were occurred because of the bricks which were put inside of the mortar joints. The mortar joints of the stones were constructed thicker than brick mortar joints. According to the construction details of the masonry walls there were examples of the brick materials that were manufactured (Ersen 1986).

The mortar joints of the rubble stone masonry walls were irregular in contrast with in cut stone masonry walls these joints were more regular. When mortar joints were not recessed between the bricks, the thicknesses of the mortar joints were same with the thickness of brick. The construction techniques of the mortar joints were always recessed as it constructed flat or backward slopy. This feature brought three dimensions to the brick on the wall. As well there were never applied solo plastered mortar joints between the bricks. The buildings which were built in the center of the cities, bricks were not put inside of the mortar joints on the vertical directions. Despite in Greece and Bithynia this construction technique was used efficiently (Ersen 1986).

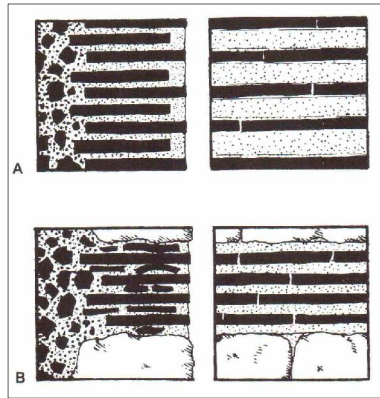


Fig 2.45: Diagrams of the recessed-brick technique (Ousterhout, 2008).

Stone and brick materials proportional order on the elevations of the masonry wall, caused to come out the appearance of material, color, dimension a long with form and direction of the materials. Especially the directions of the materials were specified in some city eole such as vertical – horizontal or they were patterned with the angles of 30, 45, 60 and sometimes in a curvilinear lines of patterns (Ersen 1986).

The bricks, manufactured according to the form of the wall such as niches and lunette. As well workability of the cut stone were determined limited according to the dimensions of the brick. Generally, ornament materials were brick. Two colored bricks were used in limited building's masonry walls in late period of Byzantine. For instance, south chapel in Fethiye mosque, stanbul (Ersen 1986).

Byzantine brick and stone masonry “alma ik” wall was composed of ornament patterns which placed on the outer leaves of masonry wall, were classified in three groups:

- Color ornament based stone and brick compose of masonry wall
- Stone and brick material color, scale and pattern direction
- Color ornament just based on stone. This specification was very rare in masonry walls. It was seen in the late periods of Byzantine Empire.

The used ornamentation elements were zigzag forms, blind arch, half circle plan with grift concave niches, broken pointed arches, half circled brick rings, draughtboard, symmetric ‘K’ forms etc. The Byzantine architecture has wide perspective of building ornamentation forms (Ersen 1986).

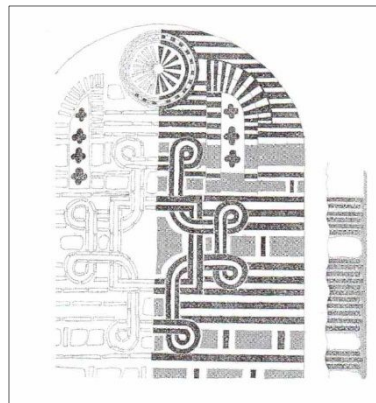


Fig 2.46: Church of the Virgin Eleousa, Veljusa, Elevation, detail of the ornamentations (Ousterhout, 2008).

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In Byzantine architecture, the brick strips on the elevations of the masonry walls could not be counted on as brick beams because they were not constructed deeply on the sections of the walls. The bricks were set inside of the masonry wall to 35-40cm. However statically, horizontal brick strips behaved like building elements which distributed the loads in a uniform way. As well they provided the horizontal balance of mortar joints in the periphery of the building walls. In Byzantine architecture, the brick patterns were used as unique ornamentation. The all the brick ornamentation patterns in Byzantine architecture were used as decoration of elevations of the buildings. The units of ornamentations were widely used on the elevations of the buildings from the middle of Byzantine architecture to the later periods. In every period of Byzantine architecture, three dimensions of stone and brick masonry walls were kept by recessing the mortar joints inside of the brick. As well similar recessing of mortar joints were done with rubble stones (Ersen 1986).

- Classification of stone and brick masonry wall “Alma ık” according to the knitting patterns of brick and stone

Stone and brick mixed used masonry walls built since the antique period of time in B.C. 4<sup>th</sup> century. Hellenistic and Roman period construction styles in masonry walls with mixed use of materials stone and brick were seen as a proportion of 1 or 1/2. In Manisa Yortüdüken Castle the masonry wall construction pattern was the same with Hellenistic and Roman period construction style which were used 1/1 stone and brick (Kolay, 1999).

First examples of mixed use with brick strip and stone pattern were seen in A.C. 3<sup>rd</sup> century in the late period of Roman Empire in Ephesus and Sardis. These types of masonry wall pattern were used in the Byzantine period which were grouped in three types (Kolay, 1999).

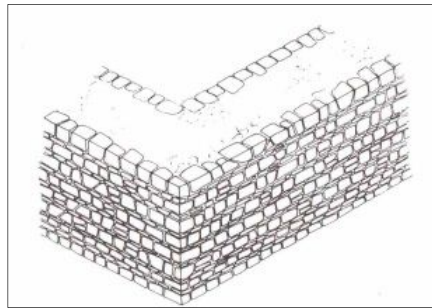


Fig 2.47: Manisa Yortüdüken Castle the masonry wall, brick strip and stone pattern (Kolay, 1999).

In the first type: Different thickness of masonry walls that were constructed in various orders of brick and stone patterns. Nif Place “Kemalpa a”, Aziz İoannes Church “Selçuk”, Church E “Sardis” were the examples of this construction (Kolay, 1999).

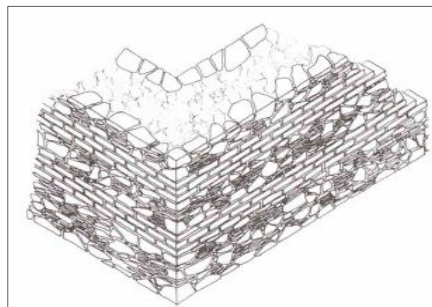


Fig 2.48: Seljuk Aziz İoannes Church, First type: Different thickness of masonry walls that were constructed in various orders of brick and stone patterns (Kolay, 1999).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

In the second type: One row of brick with stone pattern masonry wall. Bergama Akropol Fortress was the example of this type pattern masonry wall (Kolay, 1999).

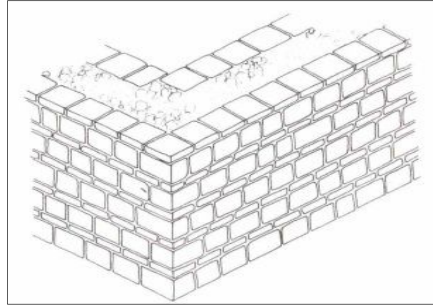


Fig 2.49: Bergama Akropol, Byzantine Fortress Wall, Second type: One row of brick with stone pattern masonry wall (Kolay, 1999).

In the third type: The stone was surrounded in a rectangular line with brick material. Seljuk fortress towers and fortress towers in Bergama were the examples of this type of construction (Kolay, 1999).

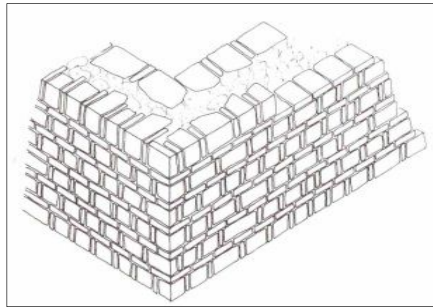


Fig 2.50: Bergama, Down City Fortress Wall, Third type: The stone was surrounded in a rectangular line with brick material (Kolay, 1999).

The most preferred construction type of the stone and brick masonry walls were straps of brick and stone type. However in Turkish period of times, 1 to 1 stone and brick pattern order was preferred (Kolay, 1999).

- Brick masonry wall

In Roman Empire in Western Anatolia, brick pattern masonry wall construction was only seen in Kızıllavlu – in Bergama and Celcus – in Efes. This brick masonry wall was constructed alone with brick material (Kolay, 1999).

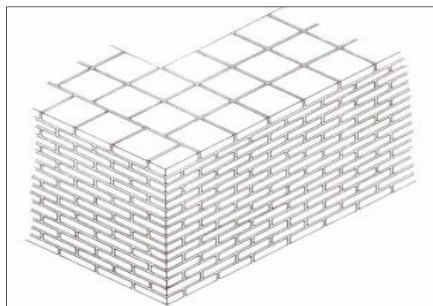


Fig 2.51: Bergama, Kızıl Avlu, brick masonry wall (Kolay, 1999).

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The brick construction was seen rarely in Byzantine Period of time. The brick construction pattern was seen in early period of time in Meryem Church baptistery in Efes, Scholastikia and Büyük Liman bath's additional parts (Kolay, 1999).

- Other construction techniques for masonry walls
  - Masonry wall corner construction with cut stone material

This type of construction was used on the corners of the masonry walls for reinforced them. The first examples of this construction were seen in Byzantine period near Priene in Atbugaz Castle which was built in 12<sup>th</sup> century. This type of construction technique was widely used in Mente eo ulları seigniory and the other seigniories in 14<sup>th</sup> century (Kolay, 1999).

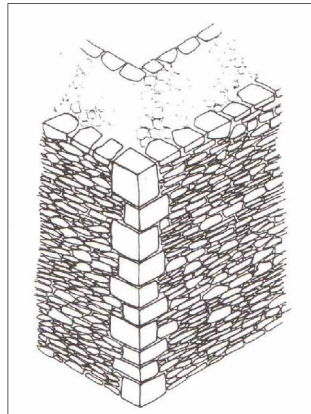


Fig 2.52: Priene, Burgaz Castle, masonry wall corner construction with cut stone material (Kolay, 1999).

- Scaffolding timber tie holes inside of the masonry wall

In Roman period of time; the cut stone masonry, rubble stone and brick pattern masonry walls height demanded the scaffoldings inside of the masonry construction. Therefore timber scaffoldings were set up inside of the masonry walls for the needs of the builders. After finishing construction of the masonry wall, these scaffoldings were removed inside of the masonry walls. These holes were filled with mortar or covered with marble after finishing the construction of the masonry walls. Scaffolding holes were still seen Roman buildings in Bergama and Milet. Bergama Traian Tample, Milet Faustina Baths were the examples of scaffolding holes that could be seen. As well this holes could be seen in Byzantine buildings such as Efes Meryem Church, Aziz Ionnes Church and Manisa Yo urtdöken Castle (Kolay, 1999).

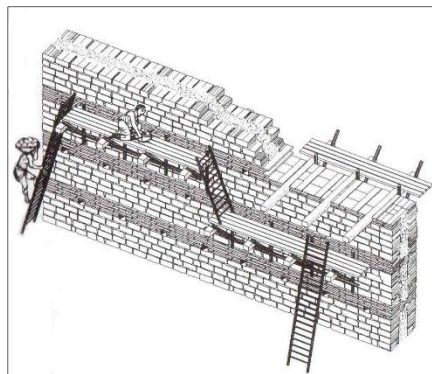


Fig 2.53: Scaffolding System in Byzantine architecture (Ousterhout, 2008).



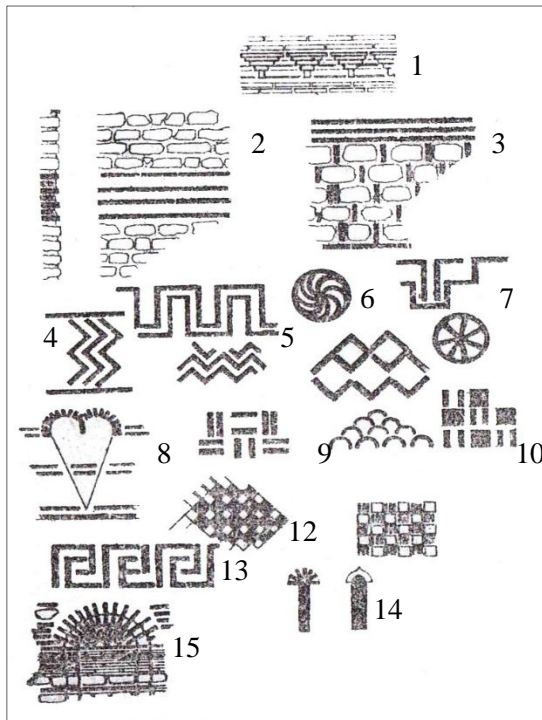


Fig 2.54: The ornamental patterns in Byzantine stone and brick "alma ik" masonry wall (Ersen 1986).

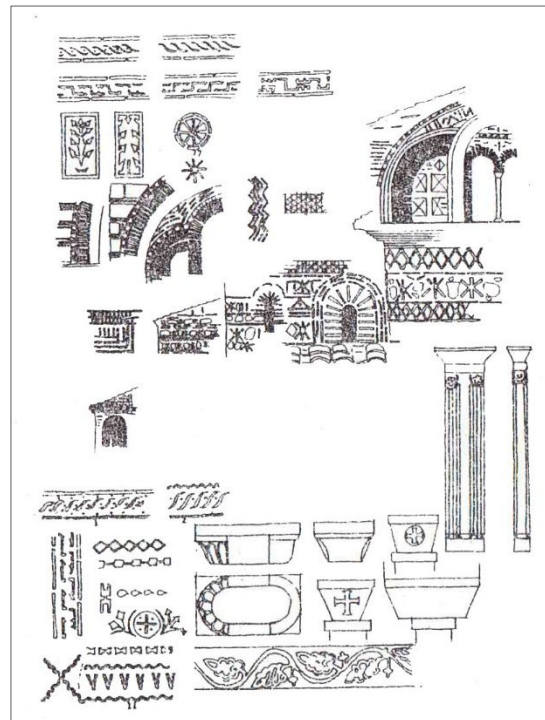


Fig 2.55: The ornamental patterns in Byzantine stone and brick "alma ik" masonry wall in Greece (Ersen 1986).

Fig: 1- Brick cantilever, 2- Late period knitting pattern, 3- Using vertical bricks on elevation of the masonry walls, 4- Hounds tooth, 5- Meander, 6- Rose, 7- Stair, 8- Hearth, 9- Fish scale, 10- Checkers, 11- Cut meander, 12- Double color inlaid stone, 13- Cut meander, 14- Vent holes, 15- Radial knitting patterns into the niches.

o Transitional elements

In Roman period, between the dome and the masonry wall structures an architectural element was discovered. This curvilinear triangle was developed in time sequence. In the region of West Anatolia, there were no sturdy dome was remained, all of them was collapsed (Kolay, 1999).

Lime stone and brick were used as construction materials in transitional elements in Roman period. In late period of Roman, the usage of stone materials was declined and the use of brick material was increased and widely used. Thus in Byzantine period of time, brick material was used solely (Kolay, 1999).

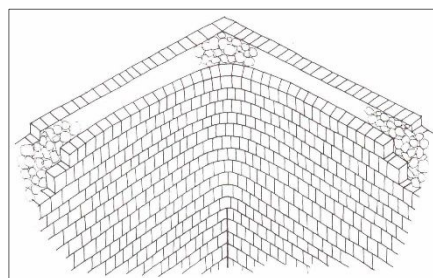


Fig 2.56: Keremos (Ören) A part of a transitional element of Roman building, cut stone knitting pattern (Kolay, 1999).

The curvilinear plans of the Roman domes were placed inside of the square and polygonal masonry walls. The curvilinearity of the Roman domes was occurred by smoothing the corners. The transitional elements of the buildings were built up with cut stone and mortar with similar techniques of masonry walls leaves. The inner fillings of the masonry wall were composed of rubble stone with mortar which

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

was continued behind of the pendentive and it was rise to the beginning line of dome and the masonry wall (Kolay, 1999).

The pendentives which were constructed with one row of bricks with thin mortar joints besides the masonry wall behind these pendentive was filled with rubble stone and mortar, used in Keramos in Ören (Kolay, 1999).

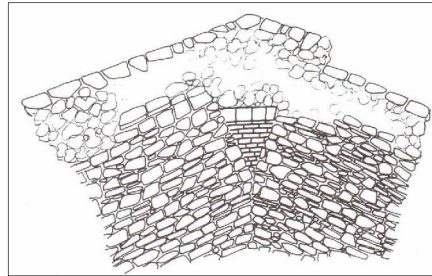


Fig 2.57: Keramos (Ören) A part of a transitional element of Roman building, brick knitting pattern (Kolay, 1999).

The radius of the pendentive was the same dimension with dome in early period of Byzantine buildings such as Meryem Church, Yedi Uyuyanlar building complex in Efes. In these buildings the brick patterns of the pendentive was composed with thick mortar joints and indicated the character of Byzantine architecture. After the second half of the 6th century, the radius of the pendentives was changed to different dimensions with thick mortar joints of brick pattern (Kolay, 1999).

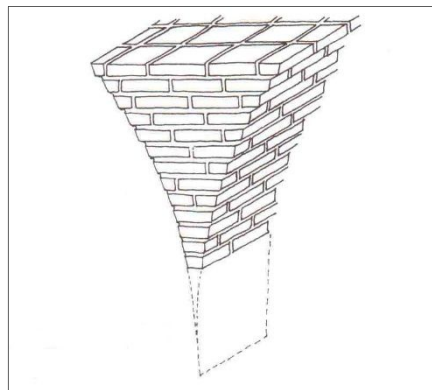


Fig 2.58: Selçuk Aziz İonnes Church, brick knitting pattern triangle remain (Kolay, 1999).

- Closure structures
  - Construction materials

Timber hipped roof was the used in Western Anatolia as a closure building element till Roman Empire. However in the end of Hellenistic period of time the corridors of the buildings were covered with vault structures. For instance Didim Apollon temple. Besides, dome and vault used instead of folded roof in Roman era. Thus in small spaces the use of vault structures as well in big spaces the use of dome structures were increased and become widespread. For instance Roman Bath buildings and gymnasiums. In some of the church buildings closure structures were built up folded timber roofs. However in 6th century these buildings were renovated and enlarged. Besides their closure structures were converted to vault and dome structures (Kolay, 1999).

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Timber rafters were covered with timber claddings and roof tiles for construction of the folded timber roofs. In vault structure; lime stone, marble and andesite types of stones were used in Hellenistic time. However in Roman time, the vault and dome structures were built up of lime stone and andesite, in Byzantine times these structures were built up types of lime stones (Kolay, 1999).

Form the Roman time, instead of stone material, brick was used in closure structures. Further in Byzantine period of time use of brick material become widely spreaded (Kolay, 1999).

- Building construction

- Folded roof

The folded roof construction technique was coming from the archaic period of time. In this technique timber rafters were covered with timber cladding and guttered roof tiles. As well instead of guttered roof tiles slab tiles were used (Kolay, 1999).

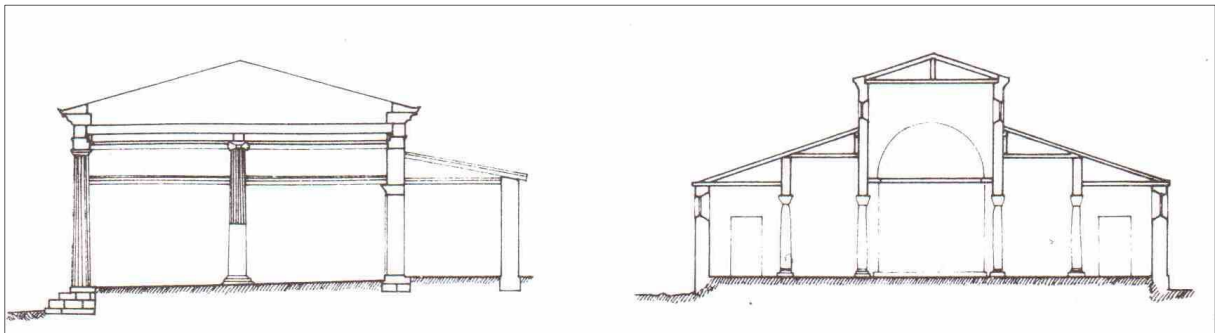


Fig 2.59: Folded roof: Left picture; Priene Agora, right picture; Aziz Ioannes Church in Selçuk (Kolay, 1999).

- Vault

The construction techniques for the closure structures for small openings; cut stone with non-mortar used joints and iron rods for connecting the stones were used in Hellenistic period of time. In these vaults, knitting of the stones were started from the sides of the vaults and ended on the top with lock stone on the intersection point (Kolay, 1999).

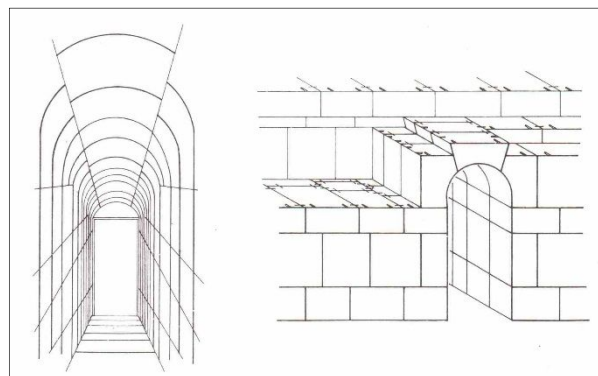


Fig 2.60: Vault structure in Hellenistic period of time, Apollon Temple in Didim, (Kolay, 1999).

In the Roman period of time, the usage lime mortar with rubble stone, cut stone or brick knitting were became widespread. Small size construction material for building the vaults were used for big openings vaults. The mold and the frame were constructed inside of the space for building the vaults which were

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

supported with beams. These beams were attached in masonry walls. The frame beams which were inside of the masonry wall were cutted after finishing the construction of the vault. These voids were seen in nowadays. For instance; Faustina bath in Milet, In Bergama: Asklepieon Kür building, amphitheater, Traian temple (Kolay, 1999).

The knitting of the vault structures were started to construct as radial. The construction of the first row of layer was done with lime mortar joints and brick, cut stone or rubble stone. After constructing the first row of layer which was constructed with stones or bricks, the construction were completed with filling rubble stone mortar mix with middle layers (Kolay, 1999).

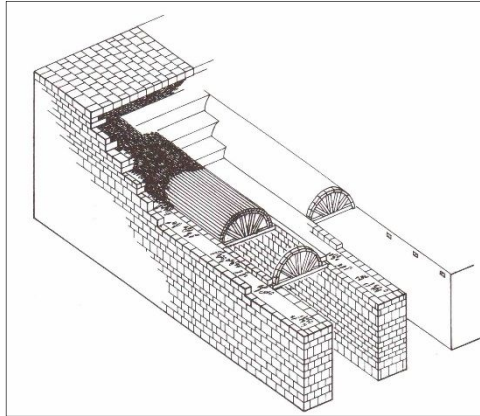


Fig 2.61: Roman period, vault structure (Kolay, 1999).

The usage of the radial construction of the vault with rubble stone knitting and upper layers filled with rubble stone lime mortar mix was become widespread since A.C. 2. After these period of time, radial brick knitting and upper layers filled with rubble stone lime mortar mix was used. For instance: Capito baths in Milet, Faustina baths, Hereoon, some tombs in Efes, Kızıl Avlu closure for the holes of the staircases in Bergama (Kolay, 1999).

In Byzantine period of time, the dominant material for the domes was brick. In this period of time, the vault structure was built more than one radial knitting of the brick layers and thick mortar joints (Kolay, 1999).

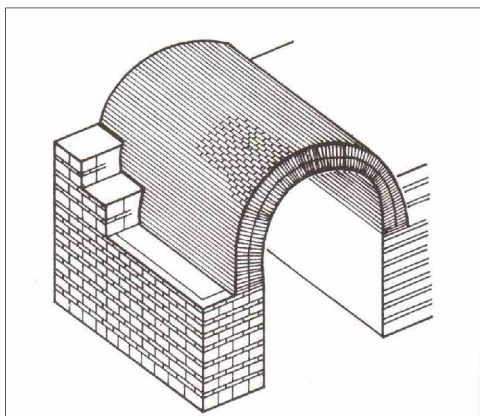


Fig 2.62: Byzantine period, vault structure (Kolay, 1999).

In Byzantine period of time, the beam voids on the masonry walls under the vaults were seen which were the evidence of the mold and the frame were constructed inside of the space for building the vaults

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which were supported with beams. For instance; Efes Aziz Ioannes Church closure structures, the voids of the beams were identified (Kolay, 1999).

In Anatolia before the Turkish civilization, the vaults were constructed with the form of half circle. The earliest examples cross vaults were in 5th century in late period of Roman Empire which was seen rarely in Efes – Anatolia (Kolay, 1999).

The knitting techniques of the bricks in early period of Byzantine were differentiated. For instance in Nysa “Sultanhisar” theater vault knitting techniques were used in 14th century Turkish buildings (Kolay, 1999).

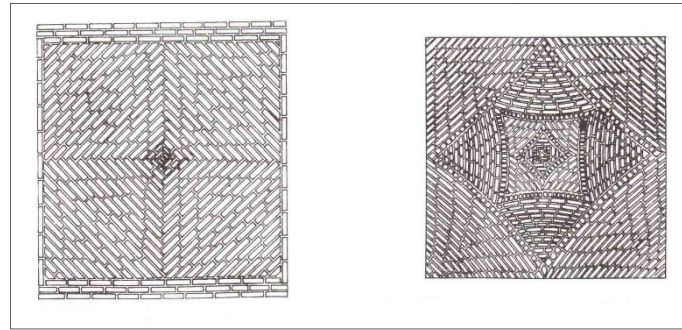


Fig 2.63: NYSA in Sultanhisar, vault brick knitting patterns (Kolay, 1999).

### ➤ Dome

Nowadays remained buildings before the Turkish civilization in Anatolia were very less. According to the building which were remained form the Romans; the dome structures were built up of cut stone. Only in building in Kızılavlu in Bergama the dome structure were built up of brick material in circular plan and Asklepieos temple’s dome were constructed with three layers of brick material (Kolay, 1999).

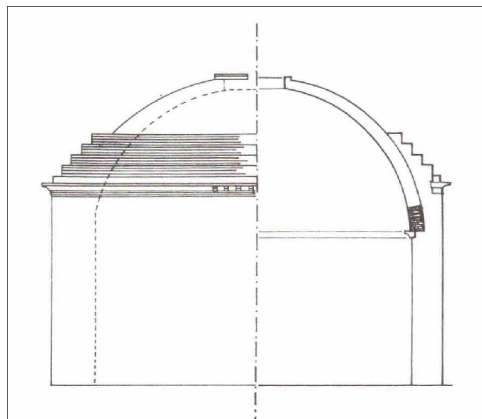


Fig 2.64: Asklepieios Temple restitution plan, dome structure in Roman era (Kolay, 1999).

In early periods; the dome structures were used on the circular masonry plans and after they were used on rectangular plans of masonry. Besides the dome structure was knitting from the base of the masonry wall and they were the part of the masonry wall structures (Kolay, 1999).

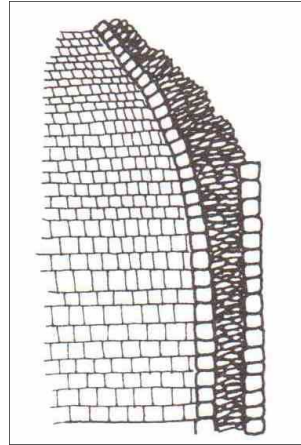


Fig 2.65: Keramos (Ören), Roman period dome structure (Kolay, 1999).

The Byzantine dome were stand on the tambour. From the middle of the Byzantine architecture, the structural development of the dome was not progressed. The most of the domes were constructed 5m diameter and some of them reached 7m. These big openings were exposed the structural problems. The tambours of the Byzantine dome structures were high and there were many window openings. The tambours of the domes which were built in the middle of Byzantine Empire were octagonal. In the late period of Byzantine Empire, the tambours were constructed in twelve sided which was the innovation of this period (Ersen 1986).

The middle period of Byzantine architecture was constructed with the directions of specifications such as, massive, receding and few windows. The circular elements on the corners of multi-lateral tambour were behaved like hinge for the dome and at the same they were the supported the arches of the window. In the late period of Byzantine architecture innovations were done in dome elements such as the sides of the tambour were increased, the windows arches were stepped up and the small columns were placed on the tambour. The construction material of the tambour was brick. The stone and brick “alma ik” pattern was not used on tambour because of the small dimensions of the brick elements, the unity of dome and the tambour. In whole periods of Byzantine Empire, tiles were used with horosan type of mortar (Ersen 1986).

In early period of Byzantine Empire the dome structures were knitting from the tambour and they were receding structures with half sphere section (Kolay, 1999).

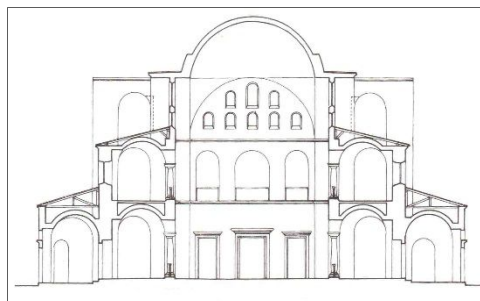


Fig 2.66: Aziz Ioannes Church restitution, dome structure in Byzantine era (Kolay, 1999).

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After 12th century, the tambour was keeping up and the dome was started from the highest level. This changed the visualization of the dome from receding structure to pure geometrical shape of element (Kolay, 1999).

The knitting of the dome structure was constructed thick mortar joints with brick material as similar with masonry wall constructions in Byzantine architecture. Furthermore the dome was constructed with a thick masonry brick work that was started from the tambour and became thinner when it was got close to the center. For instance; Aziz Ionnes Church in Efes, Meryem Church and Yedi Uyuyanlar complex building (Kolay, 1999).

In this period of time, the braced dome structures in Istanbul and Balkans were seen in Western Anatolian buildings (Kolay, 1999).

The double dome structure which was composed of two shells; dome structure inner side of the building and the conic structure outside of the dome and the building. This two shell closure structures were constructed on high tambour. As well these structures were seen in Persia and Anatolia in multi religious environment “Muslim and Cristian” with an extensive usage (Kolay, 1999).

### ➤ Types of dome and tambour combinations in Byzantine architecture

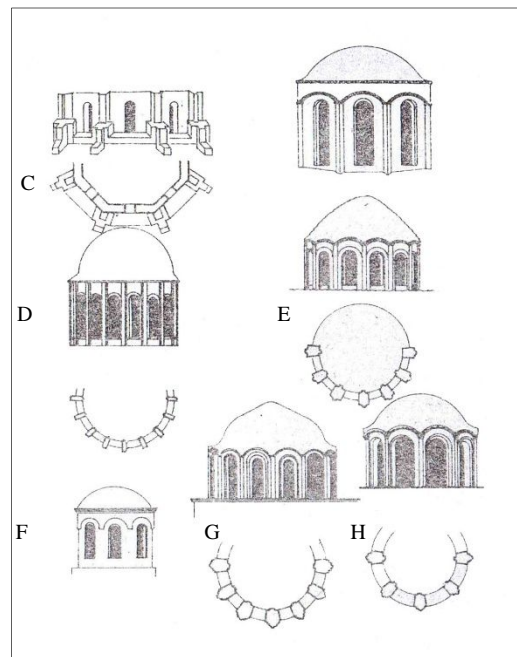
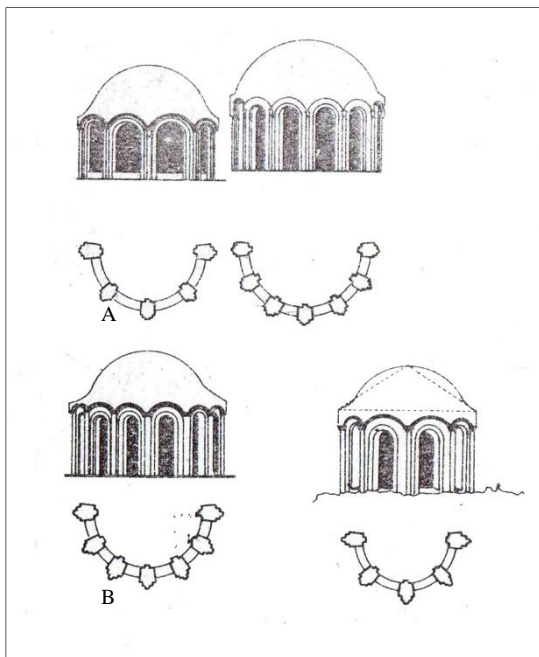


Fig 2.67: Byzantine architecture from 5<sup>th</sup> to 14<sup>th</sup> century, types of dome and tambour combinations in Byzantine architecture I (Ersen 1986). Fig 2.68: Byzantine architecture from 5<sup>th</sup> to 14<sup>th</sup> century, types of dome and tambour combinations in Byzantine architecture II (Ersen 1986).

A-Kariye Church south chapel, B- Vefa Church, C- Küçük Ayasofya Church, D- Pantekrator Church, E- Eski maret Church, F- Hiram Ahmet Pa a Church, G- Fethiye Church, north building H- Fethiye Church south chapel

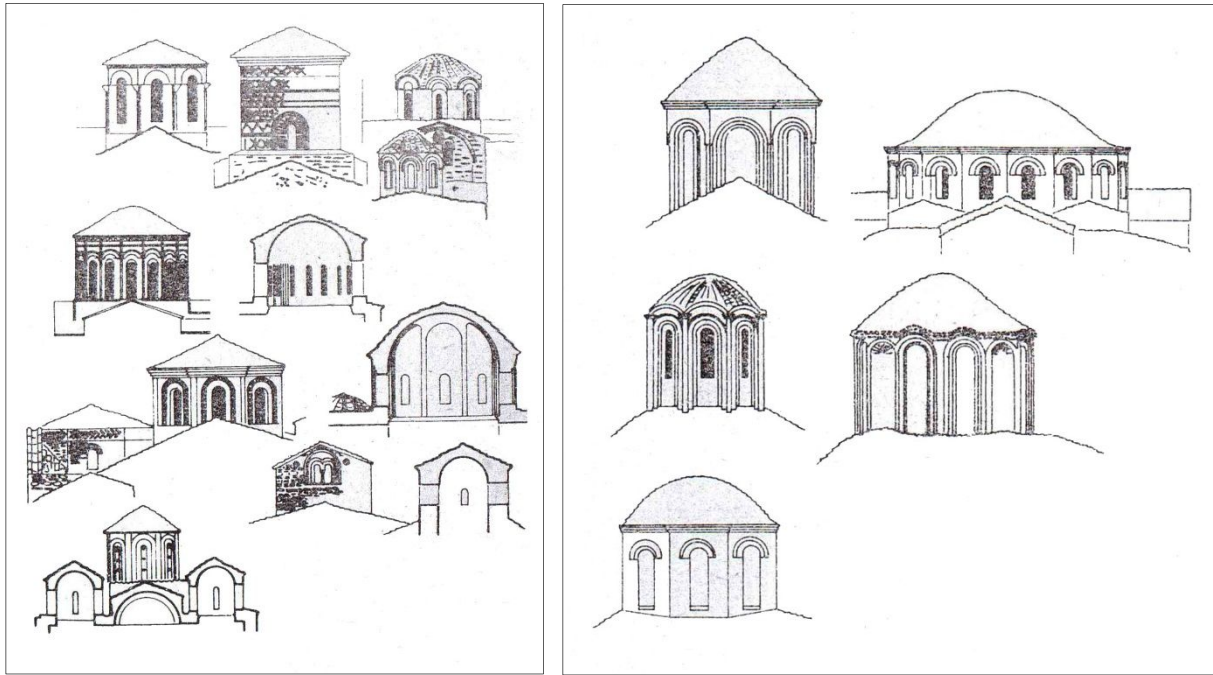


Fig 2.69: Byzantine architecture from 5<sup>th</sup> to 14<sup>th</sup> century, types of dome and tambour combinations in Byzantine architecture III (Ersen 1986). and tambour combinations in Byzantine architecture IV (Ersen 1986).

➤ The flat type of closure structures

This structure was constructed with the ideal of flat stone lintels which was first seen in archaic period of time in Belevi Tümülüsü first cell closure (Kolay, 1999).

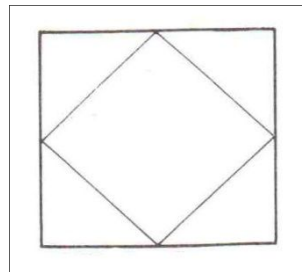


Fig 2.71: Belevi Tümülüsü Tomb, flat type roof structure (Kolay, 1999).

The same closure structures were seen in late Hellenistic and early period of Roman times in Milas Gümü kesen monument. The material of the closure structure was stone lintel (Kolay, 1999).

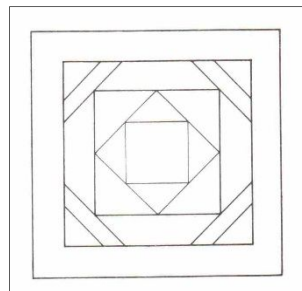


Fig 2.72: Milas Gümü kesen Tomb, flat type roof structure (Kolay, 1999).

Flat type of closure structures were used extensively used from the Chine to Anatolia with a usage of timber beams or stone lintel material construction (Kolay, 1999).



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The timber covering material in Western Anatolia started from B.C. 700. In this period of time alongside with using the gutter roof tiles, slab tiles were used widely. However in Byzantine period of time gutter roof tile using became extensive (Kolay, 1999).

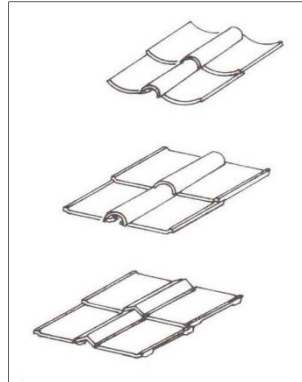


Fig 2.73: The closure tiles in antique period of time (Kolay, 1999).

Lead material was used as covering material in closure structures in Western Anatolia. According to the observation memories of Ibn Batuta, Wilhelm von Bodensele and Ludolph von Suchem, the covering material of Aziz oannes Church was covered with lead material (Kolay, 1999).

In Archaic period of time, under the folded roofs and its pediment the ornamentation was used. The density of the ornamentation was become higher at the end of the period. The ornamentations were generally used on the architrave, frieze and eaves. Generally plant figures were used as ornamentation. However on the frieze and pediments the mythological figures and reliefs such as god, humans and animals which remained from Hellenistic times, were used (Kolay, 1999).

The cantilever which was under the eaves of the roof was used as an area of ornamentation beginning from the archaic period of time to Roman, Byzantine and Turkish signiory architecture. For instance; Firuz Bey Mosque in Milas (1394), Üçlallı Mosque in Tire (Kolay, 1999).

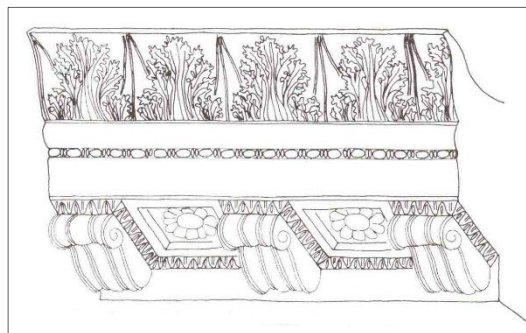


Fig 2.74: Bergama Asklepieion, ornated eave stone (Kolay, 1999).

Most of the buildings which remained from earliest civilizations in Western Anatolia were state in ruin. Therefore very few data's related to the ornamentation of these buildings were kept. In Roman period of time, there was no information about the ornamentation of the buildings. However in Roman times the masonry walls were constructed with solely stone rather than using stone and brick knitting ornamentation on the surfaces of the walls (Kolay, 1999).

From the Byzantine period of time, there were nothing remained from the buildings related to ornamentation. However from the mosaics on the pieces of dome and vault structure of Aziz oannes

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Church, indicated that the dome was covered with mosaics. Byzantine architecture in Istanbul and Balkan's buildings the mosaics were used inside and the entrance part of the dome structure. On these mosaics, plant motif series were used. As well in monumental churches; scenes from the Bible or geometric motives from plant figures were pictured inside surfaces of the building as mosaic or fresco (Kolay, 1999).

In time periods of history especially in religious buildings, in previous people were adored the God outside of the temples however in single God religious, adoring were done inside of the temples. Therefore the location of the ornamentation were changed according to the usage of the building, as outside to inside (Kolay, 1999).

### 2.5. Construction techniques in Anatolia in after Turkish civilization

#### 2.5.1. Turkish Seigniori period

##### ○ Masonry walls

In the north location of Western Anatolia, Saruhano ullahı and Karasio ullahı Seigniories used stone and brick for the masonry wall construction. Distinctively in Mente eo ullahı and Aydıno ullahı, brick was not used as an element in masonry however they were used as crashed pieces inside of the mortar. This type of brick usage caused a decorative appearance on the surface of the masonry (Kolay, 1999).

Timber tie beams were used horizontal and vertical inside of the masonry walls. For instance in Çerkez Musa Mosque in Perçin location, it could be seen that timber tie beams were used as mention above (Kolay, 1999).

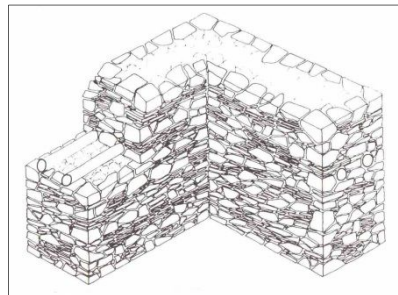
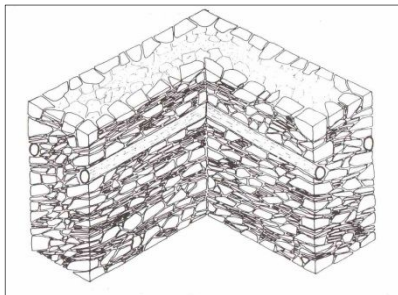


Fig 2.75: Tomb in Perçin, use of timber tie beam outside leaves of the masonry wall (Kolay, 1999). Fig 2.76: Tomb in Perçin, use of timber tie beam inside leaf of the masonry wall (Kolay, 1999). Fig 2.77: Tomb in Perçin, timber tie beam hole outside leaves of the masonry wall (Kolay, 1999).

The mixture of the mortar constituted with sanded soil and lime which was used masonry wall constructions. Mete eo ullahı seigniori in Perçin settlement buildings, Aydıno ullahı seigniori in Karacasu Hafsa Hatun Tomb and Tire Hafsa Hatun Mosque, mortar was strengthened with crashed brick pieces (Kolay, 1999).

- Outside layers constructed with cut stone and inside layer filled up with mortar and rubble stone

This type of masonry wall construction and patterning were differentiated according to importance of the building. The building which constructed by seigniors, were built in a detailed way. They were constructed in three layered. In the middle layer pebble stone fill, outside layers cut stone were used. These types of buildings were seen in Western Anatolia (Kolay, 1999).

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This type of buildings was built in an ordinary way. The masonry walls constructed with rubble stone, cut stone and in a few occasions “alma ık” stone and brick use were seen (Kolay, 1999).

Three layered masonry wall; outside layers constructed with cut stone and inside layer filled up with mortar and rubble stone. Outside layers were constructed with cut stone and inside layer filled up mortar with rubble stone. This type of construction was used important building in seigniories. In these buildings, masonry walls were patterned with tiny joints with well processed cut marble. For instance, Balat İyas Bey Masque (1404), Milas Firuz Bey Mosque (1394), Birgi Ulu Mosque (1312), Selçuk İsa Bey Mosque (1374), Kütahya Vacidiye Madrasa (1314-1315), Bergama Ulu Mosque (1399) (Kolay, 1999).

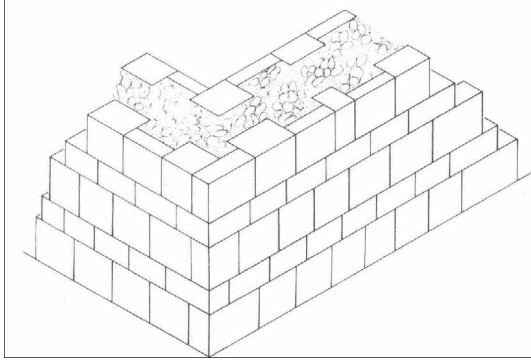


Fig 2.78: Selçuk İsa Bey Mosque, wall pattern (Kolay, 1999).



Fig 2.79: İyas Bey Mosque, wall pattern (Kolay, 1999).

- Outside layers with rubble stone, from place to place cut stone patters and inside layer, mortar with rubble stone

This type of masonry was three layered wall; outside layers with rubble stone, from place to place cut stone patters and inside layer mortar with rubble stone. In this type of masonry wall, the thickness of the joints was adjusted in two types. The first type the joints were tiny. The second type of joints was thick and constructed with crushed brick pieces mixed with mortar and strengthened with timber tie beams. These tie beams surrounded the masonry wall and joint on the corners (Kolay, 1999).

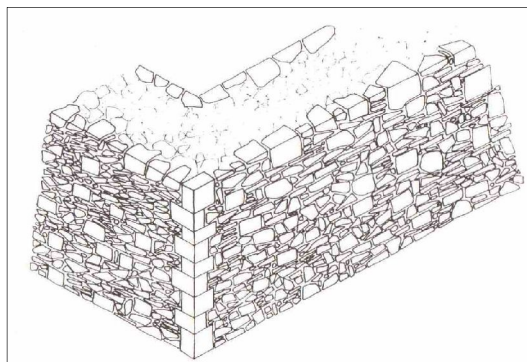


Fig 2.80: Perçin Kızıl Han, wall pattern (Kolay, 1999).

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- Joints of the masonry wall were adjusted with thick mortared and place to place cut stone patterned

Joints of the masonry wall were adjusted with thick mortared and place to place cut stone patterned masonry wall. This type of masonry wall; outside and inside of the wall leaves, patterned with tiny rubble stone and some place to place cut stone was used. In this masonry wall construction technique, middle layer was filled with mortar and rubble stone (*Kolay, 1999*).

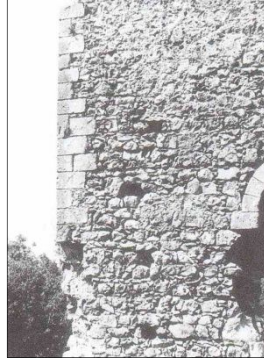


Fig 2.81: Yelli Mosque in Perçin, wall pattern (*Kolay, 1999*).

- Joints of the rubble stone masonry wall were constituted with crashed big pieces of brick and place to place cut stone patterned

Joints of the rubble stone masonry wall were constituted with crashed big pieces of brick and place to place cut stone patterned masonry wall. This type of masonry wall technique was constituted with thick joints compared with the other wall patterns. The crashed brick pieces were placed parallel to the joints and further void spaces filled up with mortar (*Kolay, 1999*).



Fig 2.82: Tomb in Perçin, wall pattern and pendentive (*Kolay, 1999*).

- Rubble stone masonry wall

In rubble stone masonry wall technique only rubble stone was used. The outer surfaces and the joints of the masonry wall were constructed more painstaking. The voids between joints of the masonry wall were filled up with small pieces of stone for getting smother surfaces. Moreover the inner layer of the masonry filled up randomly with rubble stone with mortar. For instance, Birgi Sultan ah Tomb, Bergama Tabaklar Bath, Tuzla Hüdavendigâr Mosque masonry wall structures were given (*Kolay, 1999*).

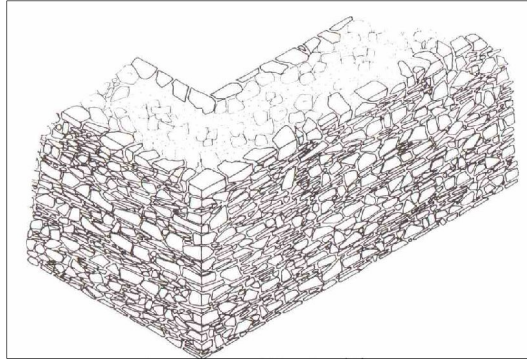


Fig 2.83: Gucur Mosque in Tire, wall pattern (Kolay, 1999).

- Cut stone masonry wall

In cut stone masonry wall, knitting patterns were done with tiny joints with 15x25 cm dimensioned cut stones. The inner layer of the masonry wall filled with mortar and rubble stone. For instance, Tire Mehmet Bey mosque, Manisa Revak Sultan tomb, Bergama Tabaklar bath, Tuzla Hüdavendigâr mosque were given (Kolay, 1999).

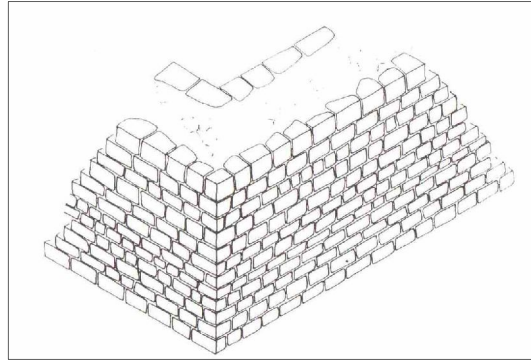


Fig 2.84: Tabaklar bath in Bergama, wall pattern (Kolay, 1999).

- Stone and brick masonry “alma ık” wall

Stone and brick patterned “Alma ık” masonry wall knitting pattern techniques were divided in to two categories. Stone and stone mixed patterned masonry wall and brick - stone patterned masonry wall. In the first category; stone to stone order was 1 to 1. This order was used on the walls in proper or randomly configuration. For instance; Balat İlyas Bey Mosque (1404), Milas Firuz Bey Mosque (1394), Birgi: Aydınolu Tomb (1334), Ulu Mosque (1312), Behramkale Hüdavendigâr Mosque was given (Kolay, 1999).



Fig 2.85: Karahasan Tomb in Tire, wall pattern photograph (Kolay, 1999).

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Stone and brick mixed patterned masonry order was 1 to 1. Brick material was used as a connection and tie element inside of the masonry. For instance; Tire Do an Bey Mosque, Karahasan Mosque and Tomb were given (Kolay, 1999).

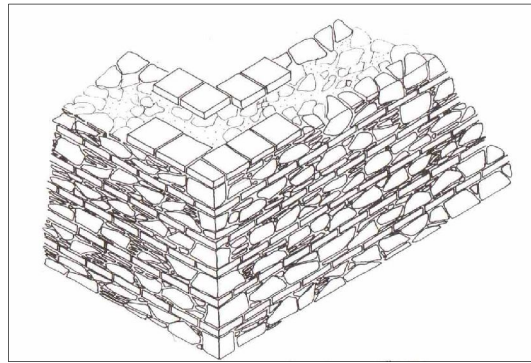


Fig 2.86: Karahasan Mosque and Tomb in Tire, wall pattern (Kolay, 1999)

- Brick masonry wall

In brick knitting patterned masonry wall technique was done with horizontal patterned bricks. The joints between the bricks and their maximum thickness were half of the height of the brick. These types of masonry construction were seen in Manisa Saruhan Bey and Yedikızlar tomb's on the upper walls of the arches which were located on the entrance elevations (Kolay, 1999).

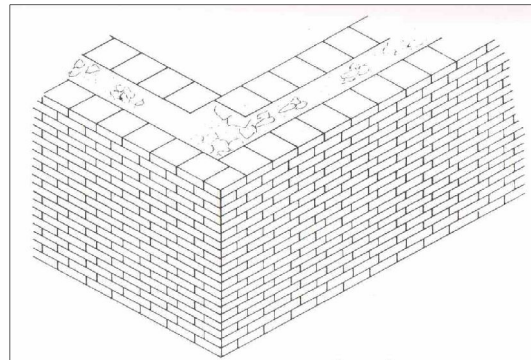


Fig 2.87: Saruhan Bey tomb in Manisa, wall pattern (Kolay, 1999).

- Different building techniques

There were other masonry wall construction techniques in Turkish seigniories period in Western Anatolia. In Turkish seigniories period in Western Anatolia; rubble stone masonry walls, rubble stone with from place to place cut stone masonry walls and their corners strengthened with vertical patterned of cut stones. This technique was used frequently for strengthening the masonry wall structures. For instance; Ahmet Gazi Madrasa in Perçin (1375-1376), Ahmet Gazi Mosque in Milas (1378), Saruhan Bey Tomb in Manisa, Küçük Bedesten in Kütahya were given (Kolay, 1999).

When the height of the masonry wall construction was pass the limits of human dimensions, the workers added extra height to the scaffold which was attached to the masonry walls. When the scaffold was disassemble, the attaching parts of the scaffold on the masonry walls were seen as voids. These voids were seen in Mente eo ulları seigniory buildings, especially these voids were seen in Milas Ahmet Gazi Mosque in Perçin (1378) and Menderes Magnesia Çerkez Musa Mosque (Kolay, 1999).

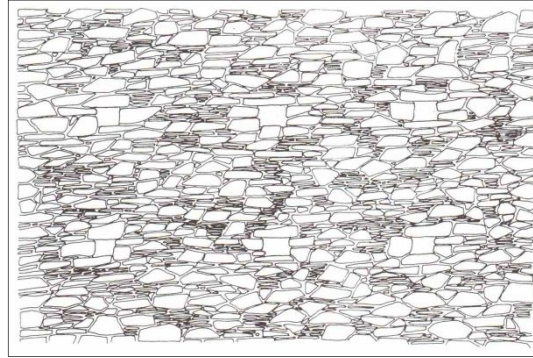


Fig 2.88: Menderes Magnesia Çerkez Musa Mosque, wall pattern and scaffold voids (Kolay, 1999).

- Ornamentations

The decorations on the masonry walls constructions were done with the logical or random arrangements of the patterns of stone and brick materials or decoration arrangements done with the materials which were taken from ancient buildings. In masonry walls; decoration materials arrangement were done with any wall parts of building (Kolay, 1999).

The figurative border line which were made up of bricks, inside patterns of the rubble stone masonry wall. This building was Hafsa Hatun Tomb in Karacasu in the border line of Aydıno ullaı seigniory (Kolay, 1999).

The ancient piece of lion sculpture was used on the walls of Ulu Mosque in Birgi (1312). A figure of horse shoe was used in Yedi Kızlar Tomb in Manisa (Kolay, 1999).



Fig 2.89: Ulu Mosque in Birgi, ornamentation on wall pattern (Kolay, 1999)



Fig 2.90: Yedi Kızlar Tomb in Manisa, ornamentation on wall pattern (Kolay, 1999)

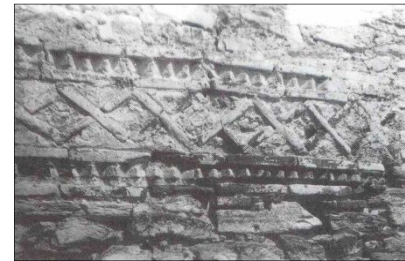


Fig 2.91: Hafsa Hatun Tomb in Karacasu, ornamentation on wall pattern (Kolay, 1999)

- Transitional elements

In Western Anatolian Seigniories, some of the transitional elements were differentiated from the regional Turkish architectural tradition. The origins of these transitional elements were coming from Eastern Anatolian architecture such as Anatolian Seljuk's architecture (Kolay, 1999).

- Essences from Anatolian Seljuk's

Anatolian Seljuk's architecture was affected from its region and an architectural aspect of it's around. As well the masons, who were coming from Persia, Iraq and Syria with differentiated construction skills in addition with their origins and traditions, formed the architecture of the Seljuk's. In Seljuk's the proportions of transitional elements were similar to each other however they were differentiated with their architectural styles. In early period of Seljuk's architecture; the Persian architectural essences of

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ornamentation were became dominant with detailed squinches, flat triangles with muqarnas and curvilinear triangles (Kolay, 1999).

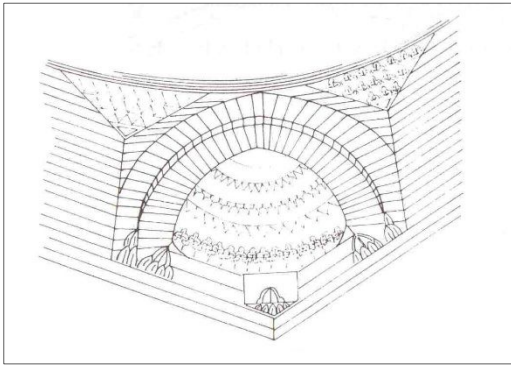


Fig 2.92: Kızıltepe Ulu Mosque, half sphere squinch with flat triangle (Kolay, 1999).

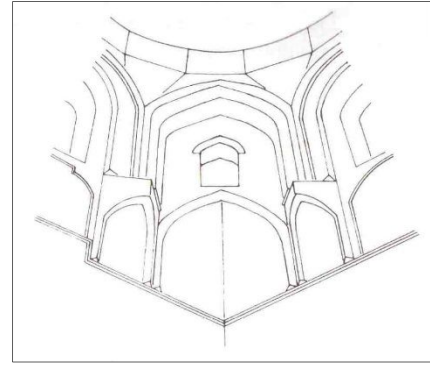


Fig 2.93: Malatya Ulu Mosque, detailed squinch with flat triangle (Kolay, 1999).

After these periods of time, transitional elements in middle Anatolia which were curvilinear triangles designed far from the essences of Byzantine architecture with plain and visualized structural specifications and as well squinches designed far from the effects of eastern architecture purify with high dense ornamentations elements were used (Kolay, 1999).

In Anatolian Seljuk's architecture; transitional elements from different cultures were used besides transitional triangular elements were created in 13th century. The first examples of triangular elements were seen in; Alaeddin Mosque in Konya, Melik Gazi Tomb in Niksar, Gök Madrasa in Sivas (Kolay, 1999).

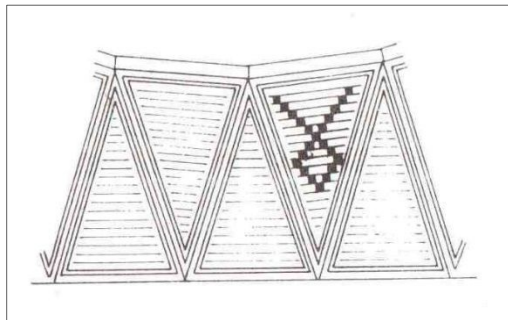


Fig 2.94: Sivas Gök Madrasa Masjid, flat triangular belt (Kolay, 1999).

In this period of time beside curvilinear triangle transitional elements, the peak points were upside down triangles which were arranged in an order with a form of punkah were applied as transitional elements. For instance Konya Karatay Madrasa and nce Minereli Madrasa were the examples of this transitional element (Kolay, 1999).

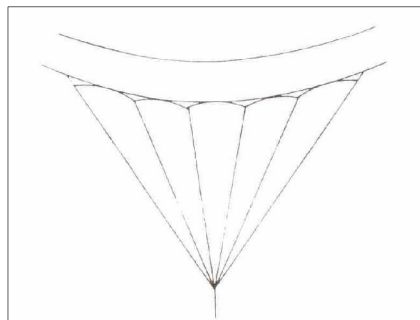


Fig 2.95: Konya Karatay Madrasa, transitional corners composed with flat triangles (Kolay, 1999).



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The first examples of triangular transitional belt were seen Anatolian Seljuk's architecture in the beginning of 14th century. In the middle of the 14th century, triangular transitional belt form was developed and it was varied into different combination of triangular elements, in particular it became a characteristic unit in early Ottoman architecture (Kolay, 1999).

In Anatolian Seljuk's architecture, construction materials that were used to build pendentive's, had regional characteristics. Stone was the construction material for pendentives in east and south-east Anatolia (Kolay, 1999).

According to the regions and the typology of the buildings, cut stone or rubble stone construction technique was differentiated. The transitional elements which were patterned with cut stone, had detailed tiny mortar joints. As well in rubble stone masonry, the mortar joints were not very thick and they were constructed with details. Transitional elements that were used in buildings were constructed with brick and closed mortar joints (Kolay, 1999).

The transitional elements were generally placed inside of the masonry. However in some buildings especially in tombs, these structural elements were placed top and outside of the masonry walls (Kolay, 1999).

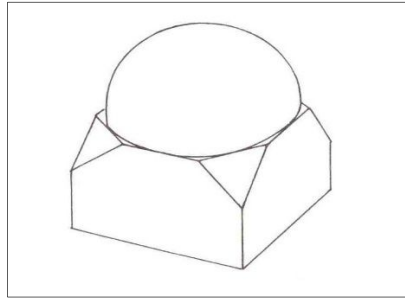


Fig 2.96: The transitional elements outside of the building (Kolay, 1999).

The transitional structural elements were whittled and get formed to muqarnas shape. The transitional structures were constructed with two colors of glazed bricks or ceramic cover or ornamented with gypsum muqarnas (Kolay, 1999).

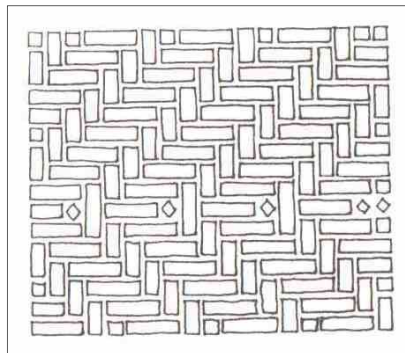


Fig 2.97: Malatya Ulu Mosque, squinch with glazed brick and ceramic (Kolay, 1999).

- Transitional structures in Turkish Seigniories

The buildings with dome structures; the transitional area was between the square plan of the masonry and the curvilinear dome structure. In these transitional areas, flat triangles, curvilinear triangles, Turkish triangular strip or squinch were used (Kolay, 1999).

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The transitional elements were placed inside of the masonry wall structures however in some of the Turkish seigniories such as Mente o ullaharı and Aydıno ullaharı seigniories these elements were started inside of the masonry wall and finished in tambour. For instance; Milas Firuzbey Mosque (1394), Eski Çine Ahmet GAzi Mosque, Balat İlyas Bey Mosque (1404), Selçuk sa Bey Mosque (1374), Birgi Aydıno lu Tomb (1334), Tire Üçlalalı Mosque (*Kolay, 1999*).

Transitional structural elements were placed inside of the tambour in Tire settlement. In some of the buildings in Tire, there were two tambours overlapped to each other and the transitional elements were placed on the lower one. For instance; Hüsamettin Mosque in Tire, Sultan Tomb in Birgi (1310) were constructed with single tambour. Karahasan Mosque in Tire, Karahasan Tomb in Tire, Mehmet Bey mosque were the examples of double tambour examples (*Kolay, 1999*).

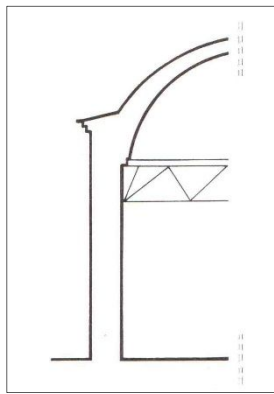


Fig 2.98: Manisa Saruhan Bey Tomb transitional element were inside the wall (*Kolay, 1999*).

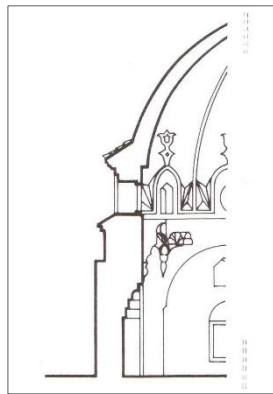


Fig 2.99: Tire Uçlalalı Mosque, transitional were located inside and continued inside of the tambour (*Kolay, 1999*).

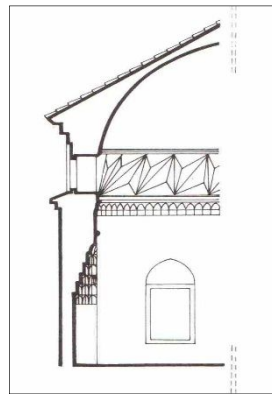


Fig 2.100: Tire Hüsamettin Mosque, transitional element were located inside of the tambour (*Kolay, 1999*).

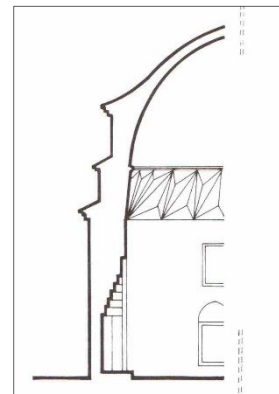


Fig 2.101: Tire Karahasan Mosque, transitional element were located on the lower tambour (*Kolay, 1999*).

In some of the buildings in Turkish seigniories especially Saruhano ullaharı Seigniory, the surface of the transitional elements were plastered. Therefore the details of the patterning and the construction details were not perceived (*Kolay, 1999*).

The buildings materials used in transitional elements were especially brick and some of the buildings stone was used. Cut stone and the rubble stone were used transitional elements in Mente o ullaharı seigniory in Tabaklar bath - Bergama in undressing area (*Kolay, 1999*).

The transitional elements in bath buildings were ornamented with muqarnas.

The transitional elements were generally took the form of flat triangle, Turkish triangle strip, curvilinear triangle and squinches in Turkish seigniories. Different attempts were used to shape transitional elements such as triangular and amorphous forms in Aydıno ullaharı and Mente eo ullaharı seigniories (*Kolay, 1999*).

The triangular forms for shaping the transitional elements were grouped in three sections such as flat triangle, Turkish triangle strip and curvilinear triangle.

### ➤ Flat triangle

Single triangle transitional element was used to integrate the square plan to the octagonal plan. The combination of octagonal to curvilinear dome plan was achieved with low tambour with smoothing the

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edges. For instance; Birgi Ulu Mosque (1312) and Selçuk sa Bey Mosque with its muqarnas ornamentation (1374) (Kolay, 1999).

The cut stone patterned transitional element in Peçin Kızılhan was flat triangle which was started from the low level of masonry wall construction and it continued to the end of octagonal tambour. For instance; Selçuk sa Bey Mosque (1374) (Kolay, 1999).

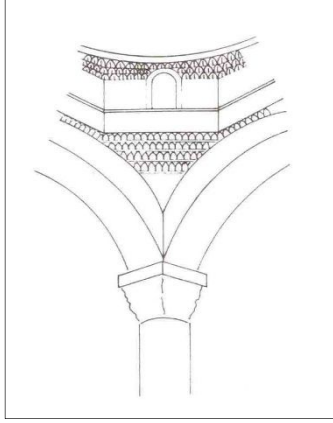


Fig 2.102: Selçuk sa Bey Mosque, flat triangle transitional element (Kolay, 1999).

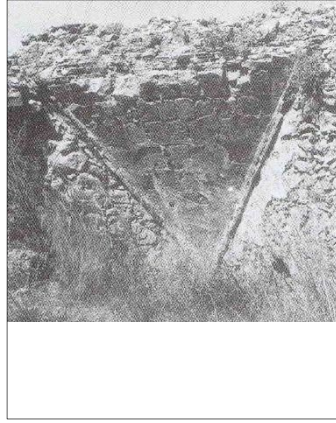


Fig 2.103: Peçin Kızılhan, flat triangle transitional element, picture (Kolay, 1999).

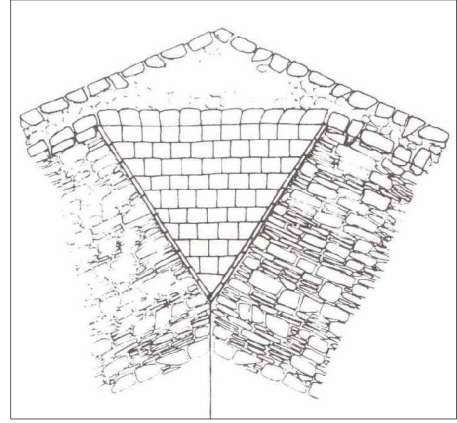


Fig 2.104: Peçin Kızılhan, flat triangle transitional element (Kolay, 1999).

### ➤ Turkish triangle strip

The triangles were used in two or three dimensional geometric prisms in Turkish seigniories time. The Turkish triangle strips were used in a single or double. The example of uses for the two dimensional flat triangle transitional element was constructed with thick mortar joints and brick material. This transitional element was the most commonly used type in Turkish seigniories. For instance; İlyas Bey Madrasa, ba odası in Balat (1404), Eski Çine Ahi Bayram Tomb, Hafsa Hatun Tomb in Karacasu, Süleyman ah Tomb in Tire (1344), Vacidiye Madrasa in Kütahya (1314-1315), Balat bath (Kolay, 1999).

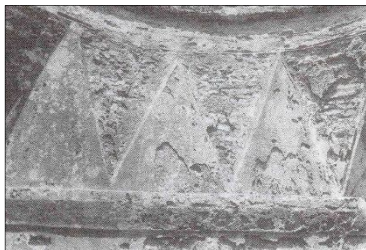


Fig 2.105: Balat bath, Turkish triangular transitional belt, picture (Kolay, 1999).

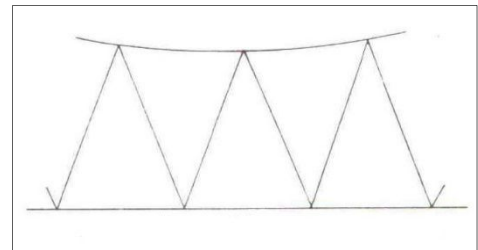


Fig 2.106: Balat bath, Turkish triangular transitional belt (Kolay, 1999).

### ➤ Turkish triangles that were composed of prismatic units

The prismatic units were formed with thick mortar mesh joints of brick patterns. Their corners were cut and plastered according to the forms of prismatic shapes. There were four types of transitional elements in this order (Kolay, 1999).

The basic prismatic strip was; the prisms that were placed on the strips with their base. The units that were placed on the walls were connected to the tambour of the dome with their corners. The spaces between the corners of these prisms were filled with flat triangular shapes. For instance, Peçin bath B, volume B (Kolay, 1999).

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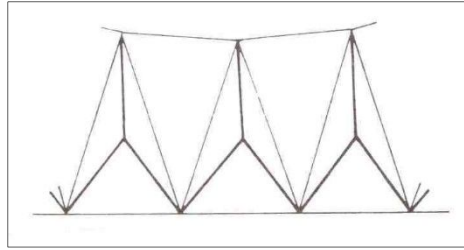


Fig 2.107: Peçin bath B, Turkish triangles that were composed of prismatic units I (Kolay, 1999).

The prismatic units that were mentioned above were used in different combinations such as their corners were attached the edges of them or they placed in row and attached their edges to the tambour. This was the second type of Turkish triangular strip. For instance, Peçin bath B volume C, Firuz Bey mosque - the room in west in Milas (1394), The bath building which was adjacent to Balat Delphinion, Selçuk bath (Kolay, 1999).

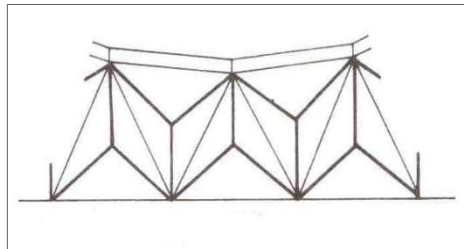


Fig 2.108: Peçin bath B, Turkish triangles that were composed of prismatic units II (Kolay, 1999).

The third transitional structural elements of Turkish triangular strip were composed of the prism units which their bases and the top corners were connected to each other and formed a unit. These units' base and top corners were placed on masonry wall or tambour of the dome. For instance; Selçuk bath, Mehmet Bey Mosque in Tire, Tabaklar bath in Bergama (Kolay, 1999).

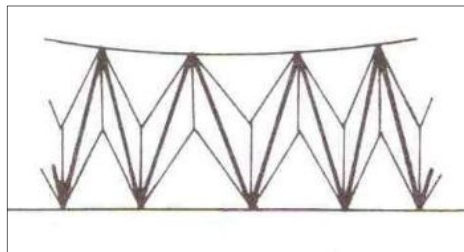


Fig 2.109: Tire Mehmet Bey Mosque, Turkish triangles that were composed of prismatic units III (Kolay, 1999).

The last typology was composed of the combination of second and third types of prismatic Turkish triangular strips. For instance; bath which was closed to Balat Delphinion (Kolay, 1999).

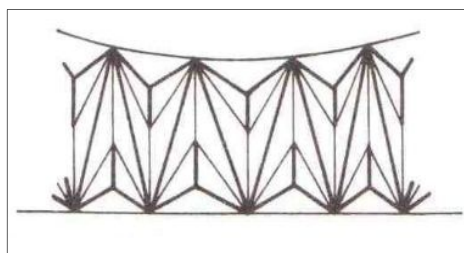


Fig 2.110: Balat bath, Turkish triangles that were composed of prismatic units IV (Kolay, 1999).

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The double Turkish triangular strip applications were used frequently in bath buildings. In double strip applications the transitional elements were covered larger areas than single strip applications. However in these applications it was easier to transition to the curvilinear plan. For instance; Peçin bath B, volume A, Tabaklar bath in Bergama (Kolay, 1999).

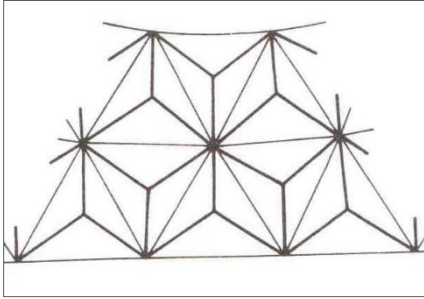


Fig 2.111 : Peçin bath B, double row of Turkish triangle strip (Kolay, 1999).

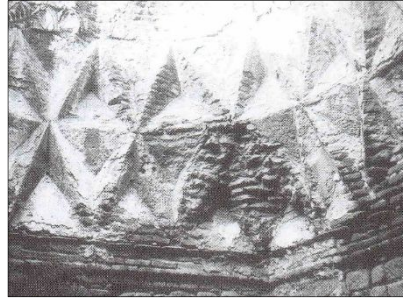


Fig 2.112: Bergama Tabaklar bath, double row of Turkish triangle strip, picture (Kolay, 1999).

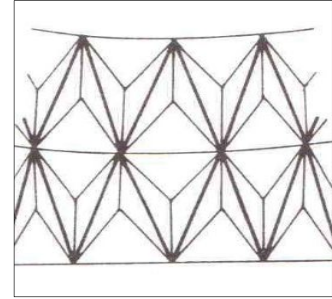


Fig 2.113: Bergama Tabaklar bath, double row of Turkish triangle strip (Kolay, 1999).

The main geometric problem of triangular strip was the corners of the square masonry while transition from square to curvilinear shape. Therefore Turkish triangular strip was started from the corners of the building. There were three used methods for adjust the triangles strips. The most applied method was placing the base line of the triangle to the tambour and attaching the corner of the triangle to the masonry wall. For instance; Peçin bath B, volume A and volume 3, Yelli mosque, Saruhan bey mosque, Yedi Kızlar Tomb, Çukur bath (Kolay, 1999).

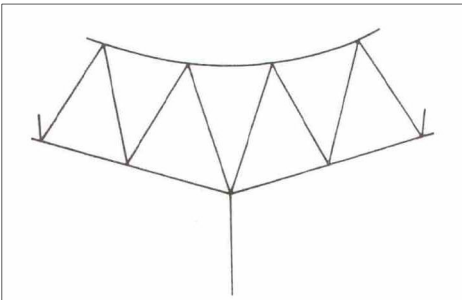


Fig 2.114: Manisa Yedi Kızlar Tomb, triangular transitional elements on the corner (Kolay, 1999).

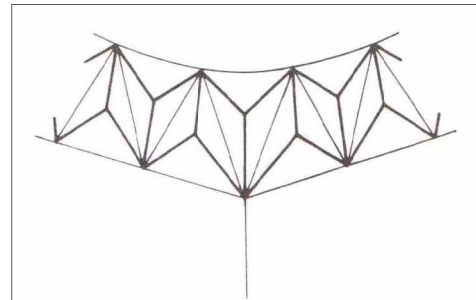


Fig 2.115: Selçuk bath, triangular transitional elements on the corner (Kolay, 1999).

The second application of the Turkish triangle strip was adjusted with the attachment of geometrical shapes ridge to the corners of the masonry wall, which were arranged in an order with flat triangles and prismatic forms. For instance; Eski Çine Ahi Bayram Tomb, Peçin Bath B, volume C and F, Selçuk bath, Çukur bath in Manisa (Kolay, 1999).

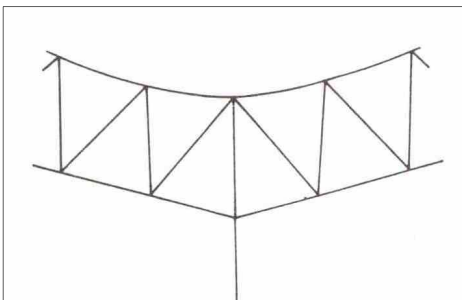


Fig 2.116: Manisa Çukur bath, the connection line of the triangular elements was on the corner of the walls (Kolay, 1999).

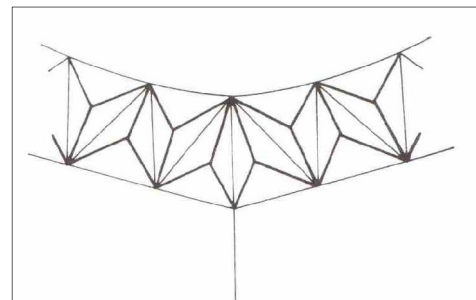


Fig 2.117: Selçuk bath, the connection line of the triangular elements was on the corner of the walls (Kolay, 1999).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

There was another application used similar Turkish triangular strip like above example which was differentiated according to its parallel edges to the ground on its corners of the masonry wall (Kolay, 1999).

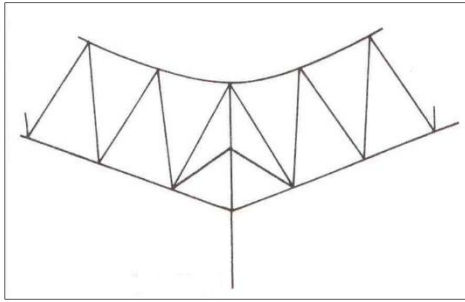


Fig 2.118: Balat bath, pyramidal element on the corner (Kolay, 1999).

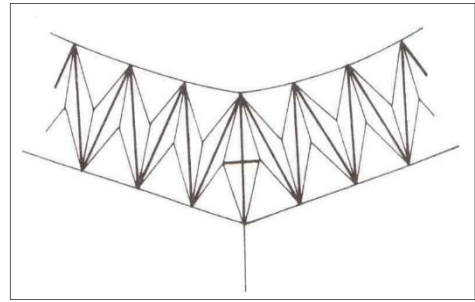


Fig 2.119: Bergama Tabaklar bath, pyramidal element on the corner (Kolay, 1999).

### ➤ Curvilinear triangle, pendentive

The pendentives were constructed with rubble stone, cut stone and brick meshed patterns in Turkish seigniories. The curvilinear surface was not suitable for the meshing without mold because of the irregular mortar joints. For instance, Peçin tomb C, Çukur bath in Manisa (Kolay, 1999).

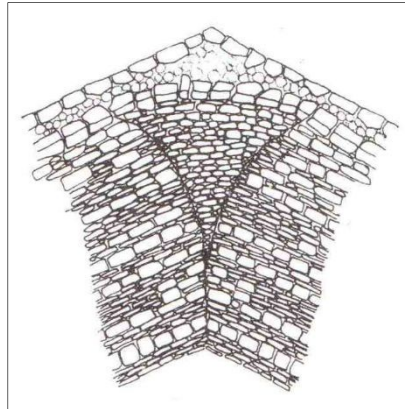


Fig 2.120: Peçin Tomb, rubble stone knitting pendentive (Kolay, 1999).

Cut stone pendentive structure was only seen in iwan space in Peçin Ahmet Gazi Madrasa (1375-1376). Thin mortar joint in small scale cut stone pattern curvilinear triangular structure 'pendentive' was meshed with mold support (Kolay, 1999).

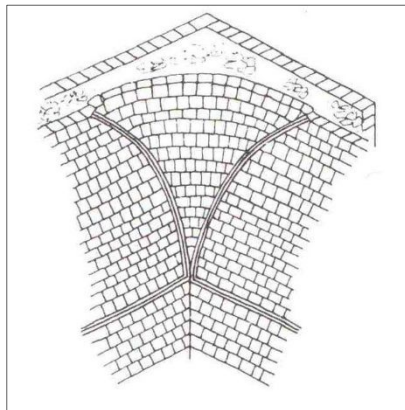


Fig 2.121: Peçin Ahmet Gazi Madrasa, cut stone knitting pendentive (Kolay, 1999).

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Thin mortar joint eccentric brick pattern curvilinear structure ‘pendentive’ was meshed without mold. The masonry wall buildings in Peçin settlement was meshed with one row thickness, behind of the brick leaf the wall was constructed in traditional technique of masonry wall. Between the curvilinear structure ‘pendentive’ and the masonry walls the bricks were used in edgewise to form a contour which was characteristic of the buildings in Peçin settlement (Kolay, 1999).

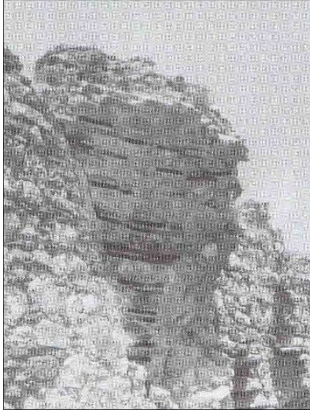


Fig 2.122: Balat dervish convent, brick knitting pendentive, picture (Kolay, 1999).

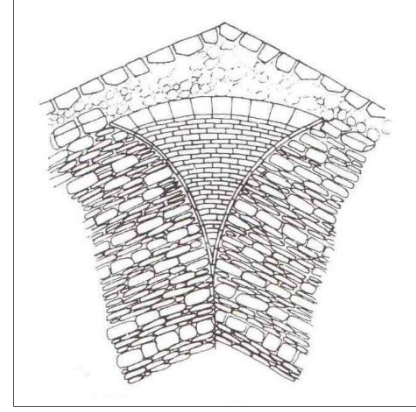


Fig 2.123: Balat dervish convent, brick knitting pendentive (Kolay, 1999).

In Turkish seigniories, squinches were differentiated and used into two types such as detailed and half-dome squinches (Kolay, 1999).

### ➤ Detailed squinch

Brick meshed detailed squinch in Peçin settlement tomb, was placed on thick mortar joint masonry wall arch which was rested 10cm cantilever marble stone and made 45 degree according to the masonry walls. The squinch was constructed with one leaf brick mesh with thick mortar joint which was placed in frontal leaf of the rubble stone and mortar mix masonry wall. As an example for detailed squinch buildings were; Karahasan Mosque tomb in Tire and İlyas Bey masjıt in Manisa (Kolay, 1999).

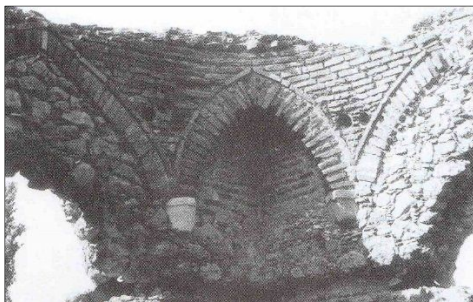


Fig 2.124: Peçin tomb, detailed squinch, picture (Kolay, 1999).

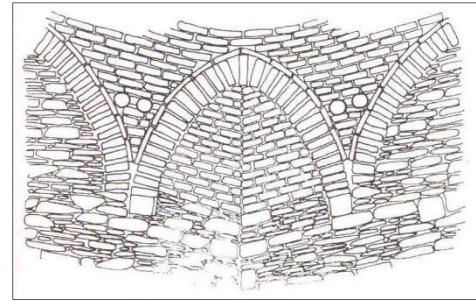


Fig 2.125: Peçin tomb, detailed squinch (Kolay, 1999).

### ➤ Half dome squinch

This type of squinches was meshed according to the construction technique of half-dome. The wall squinch arch placed 45 degree correspondingly to the masonry walls. This squinch was formed with growing arches while they were away from corner of the masonry walls. For instance; İlyas Bey mosque in Balat (1404), Firuz Bey mosque in Milas (1394), Çukur bath in Manisa (Kolay, 1999).

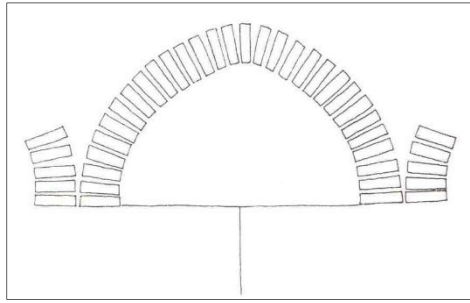


Fig 2.126: Manisa Çukur bath, half dome squinch (Kolay, 1999).

➤ Transitional elements construct without rules

For building purposes of the transitional elements, quick construction techniques were investigated. These kinds of approaches were seen in buildings in Mente o ulları and Aydıno ulları seigniories. Transitional elements construct without rules; were only had construction similarities with squinch. For instance in Ahmet Gazi mosque in Milas (1378), the transitional elements were built flat and deep arch with a flat surface on its top and muqarnas ornamentation on its below (Kolay, 1999).

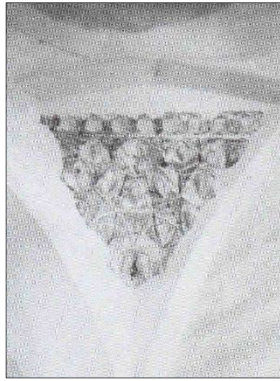


Fig 2.127: Ahmet Gazi Mosque in Milas, transitional element like squinch, picture (Kolay, 1999).

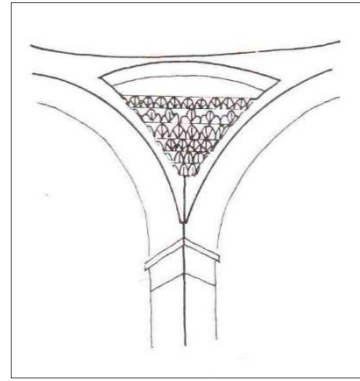


Fig 2.128: Ahmet Gazi Mosque in Milas, transitional element like squinch (Kolay, 1999).

➤ Lightening cubes

For lightening the transitional elements empty cubes and jugs were used in the examples of Yelli mosque, tomb A in Perçin settlement and the transitional elements dervish convent in Balat. These types of lighted transitional elements were used in Mente eo ulları seigniory (Kolay, 1999).

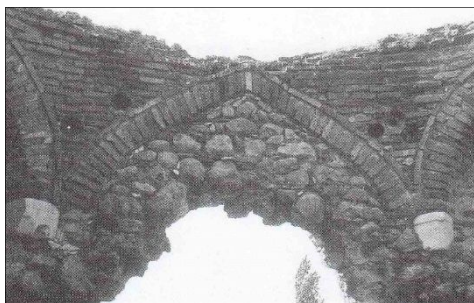


Fig 2.129: Peçin tomb, lightening cubes (Kolay, 1999).

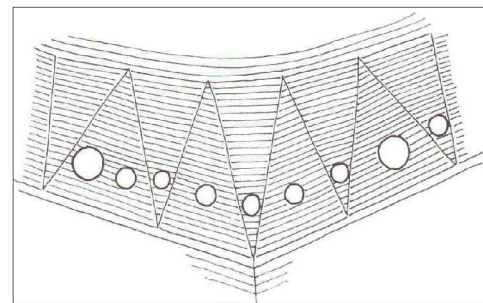


Fig 2.130: Peçin Yelli Mosque, lightening cubes (Kolay, 1999).



## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

### ➤ Ornamentation

The ornamentation on transitional elements was especially done to their front, perimeters and arch stones. The ornamentation of these elements was dense around the structural elements in Menteşoğulları seigniory. However these ornamentations were not used in Saruhanoğulları buildings, they were used as a plain structural elements (Kolay, 1999).

The transitional elements were bordered with ornamentation elements such as meshed edgewise bricks. Bath buildings A, B in Kızılhan, Peçin were the examples of this type of usage. Or bordure was used on the bottom line of transitional elements in Yelli mosque, Karacasu Hafsa Hatun tomb and Tabaklar bath in Bergama. In Peçin bath, an ornamentation of sawtooth was used in the connection line of dome (Kolay, 1999).

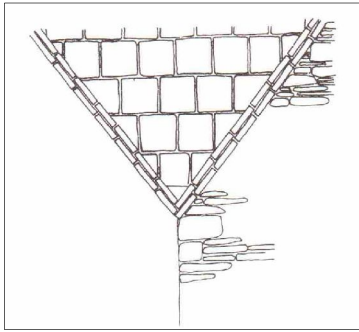


Fig 2.131: Peçin Kızılhan, ornated border line around Turkish triangle (Kolay, 1999).

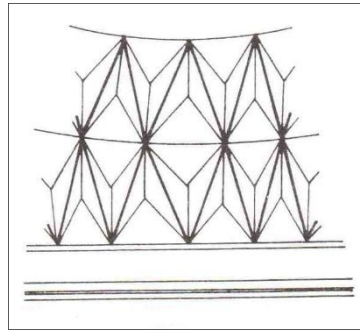


Fig 2.132: Bergama Tabaklar bath, ornated border line around the transitional element (Kolay, 1999).

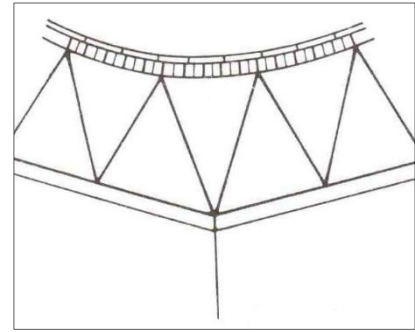


Fig 2.133: Peçin bath, ornated border line around the transitional element (Kolay, 1999).

Muqarnas ornamentation was used on the transitional elements in that period of time (Kolay, 1999).

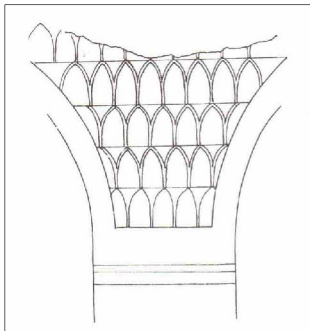


Fig 2.134: Peçin bath, muqarnas ornamentation on the transitional elements (Kolay, 1999).

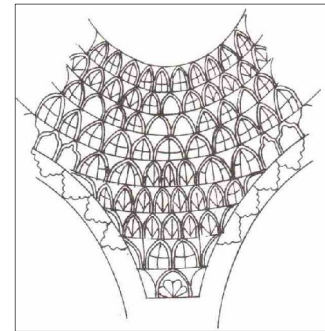


Fig 2.135: Bergama Tabaklar bath, muqarnas ornamentation on the transitional elements (Kolay, 1999).

Beside the typical ornamentation of the buildings, in some of the buildings special cases of application were seen. For instance in Peçin bath B volume A and sa Bey Mosque (1374); the covering the flat triangle with colorful ceramic. Çukur bath in Manisa; in hot area the surface of the squinch was formed a shape of oyster (Kolay, 1999).

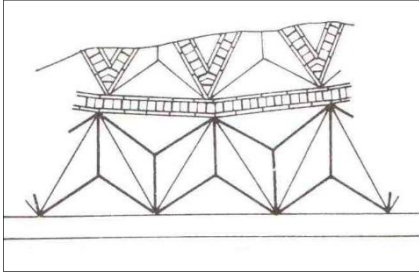


Fig 2.136: Peçin bath, colorful ceramic patterns used on the transitional elements (Kolay, 1999).

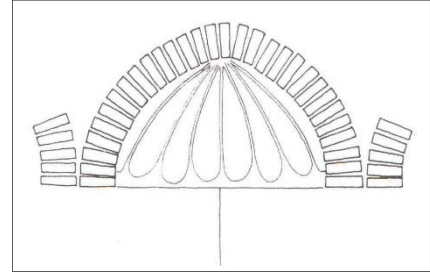


Fig 2.137: Manisa Çukur bath, form of oyster was used on the surface of squinch (Kolay, 1999).

- Closure structures
  - Essences from Anatolian Seljuk's

In Anatolian Seljuk's architecture, the dominant used closure structures were vault and the dome. The most common closure structure was two centered pointed arch vault structure. As well cross vault and types were developed similarly with Syria and Palestine and they were extensively built in Anatolia in this period of time (Kolay, 1999).

Barrel vault was used in all kinds of building typologies. However cross and star vaults were used only specific functional use of spaces and emphasis axis. The dome structure was used in similar purposes for emphasizing the volumes such as mosques, tombs, caravanserais; for lightening the middle axe and some of the madrasa buildings (Kolay, 1999).

In Anatolian Seljuk's architecture, the materials for the closure structures generally were chosen from the local sources. However Persian brick tile material closure tradition was coming from Anatolian Seljuk's except the some of the regions in North and Southeast Anatolia. The construction techniques were differentiated between Seljuk's and Persians (Kolay, 1999).

The barrel vault was constructed with cut stone, rubble stone or brick on the mold. However the voids of the mold beams on the masonry walls could be monitored from half ruin and lost plastered buildings. For instance Konya nce Minareli Madrasa entrance iwan and Alara Han "rest house" middle area. For the long span barrel vault constructions, another type of method in Roman architecture was used. This method was the separations of the vault structure with arch supports that was seen in Anatolian Turkish architecture especially in caravanserai buildings. This arch support was seen in eastern part of the Anatolia as well this support was used dome and cross-vaults in middle age of Muslim and Christian architecture. For instance; Binbir church in Anatolia, Tolmeita-Ptolemais Church in Syria and it was seen some of the 6th century church's barrel vaults. The workmanship of knitting for cut stone support arches was more careful than vault structures which were generally knitting with rubble stone. For instance; Eli Kesik Han "rest house", Çakallı Han "rest house", Çiftlik Han "rest house" (Kolay, 1999).

The supports of the barrel vault construction were differentiated into two types. In the first type; the supports of the cut stone knitting vaults, were lean out from the interior surface of vault. For instance; Avanos Sarı Han "rest house", A ızkara Han "rest house", Sadettin Han "rest house". In the second type; the arch supports of the vault were continue with the thickness of the vault. This type of vault structures was seen in some of Artuklu seigniory buildings (Kolay, 1999).

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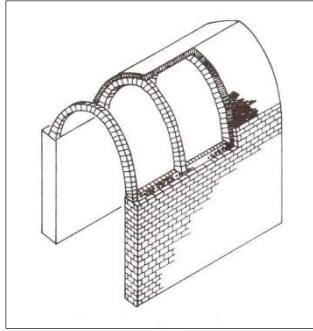


Fig 2.138: Arch was under the vault structure (Kolay, 1999).

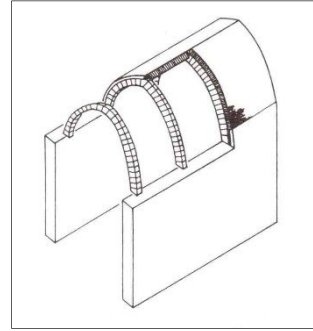


Fig 2.139: Part of the arch was inside of the vault structure (Kolay, 1999).

The cross - vault, star - vault structures in small square volumes were built up of cut stones. For instance; Divri i Ulu Mosque, Sivas Keykavus Darü ifası Entrance, Alara Han fountain iwan. In some of the buildings these cross - vault, star - vault structures were built up of brick material. For instance; Sivas Keykavus Darü ifası cell closure structure, Sivas Gök Madrasa entrance iwan (Kolay, 1999).

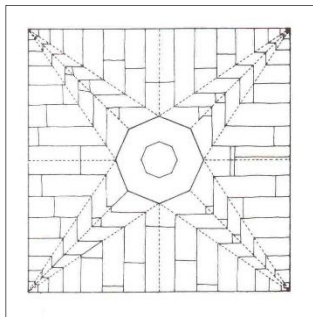


Fig 2.140: Alara Caravanserai, star vault plan view (Kolay, 1999).

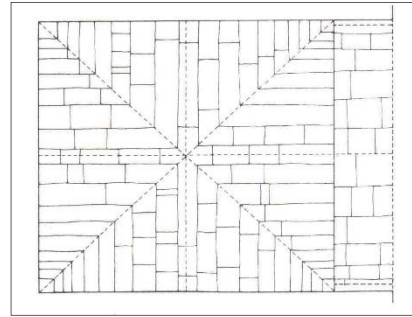


Fig 2.141: Sivas Keykavus hospital, cross vault plan view (Kolay, 1999).

Assembling of the cut stone materials was on the ground before complex knitting of cut stones on the barrel vaults. The brick vaults were knitting on the molds. The holes on the masonry walls were the evidence for the molds of brick knitting (Kolay, 1999).

In Anatolian Seljuk's buildings the dome generally had a form of half circled section and it was started from the masonry wall or tambour. For instance; Huand Hatun Mosque in Kayseri, Alaeddin Mosque in Ni de, Gök Madrasa Mosque (Kolay, 1999).

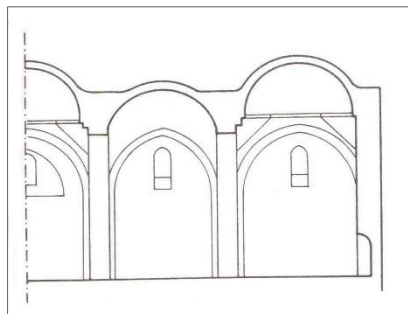


Fig 2.142: Gök Madrasa Mosque, half circled section dome (Kolay, 1999).

The domes which were built radial stone and brick were under the effect of local knitting tradition. Besides this approach the knitting ornamentation techniques which were seen in Persian architecture, were used in some of the buildings in Anatolian Turkish architecture in 13th century. The glazed bricks

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which was used in geometrical patterns with a brick tiles applied in Ulu mosque in Malatya, Gök madrasa in Sivas, Çay madrasa dome in Afyon. In other applications of brick which was used in different motifs such as herringbone. For instance; Karatay Mascit in Konya, Melik Gazi Tomb in Pınarbaşı (Kolay, 1999).

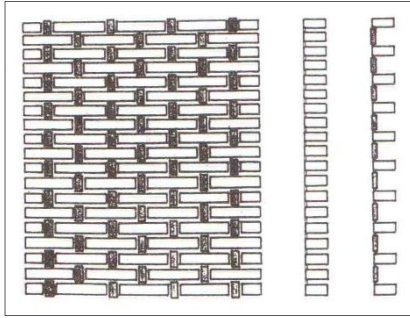


Fig 2.143: Ulu Mosque in Malatya, geometrical patterns with brick tiles (Kolay, 1999).

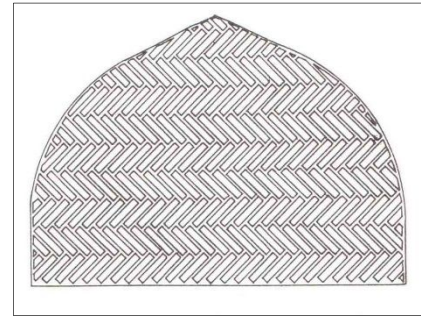


Fig 2.144: Pınarbaşı Melik Gazi Tomb, brick dome structure (Kolay, 1999).

In Persia and Anatolia in the region of both Muslim and Christian, one of the most extensive closure structures was placed on high tambour with double layer. The outer layer of the closure was pyramidal or conic, inner layer was composed of dome. This type of closure structure was mostly used in tomb structures. For instance; Nureddin bin Sentimur Tomb in Tokat, Gündük Minare in Sivas, Ali Cafer Kümbeti in Kayseri (Kolay, 1999).

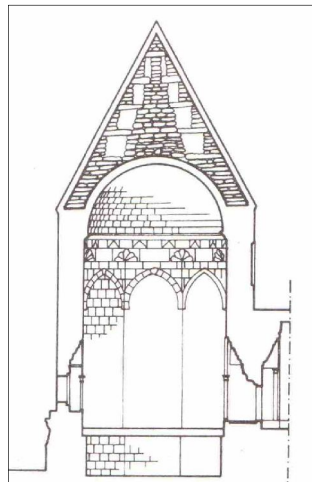


Fig 2.145: Ali Cafer Tomb in Kayseri (Kolay, 1999).

This structure was constructed with the ideal of timber lintels which were placed on the middle of the masonry walls. This type of structure was widely used in residential buildings from the early times of history in Eastern Anatolia and Transcaucasia. For instance; Ulu Mosque in Erzurum, Tuğrul Şah Mosque in Sivas (Kolay, 1999).

The ornamentation was generally done on the surface of the construction materials and knitting patterns of the elements that were used on the closure structures. Ornamentation on the stone structures was done in Eastern and Southeastern Anatolia such as cross and star vaults. Before knitting the patterns of the vault structure, the ornamentation was applied on the stones. The most used example of the ornamentation was the geometrical (star, spiral or wheel) or plant motives which were patterned in a line or star. The Ulu Mosque and hospital in Divriği was the most recent example of this ornamentation (Kolay, 1999).

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In brick knitting, the most extensive ornamentation was patterning the glazed bricks with the geometrical lines and motives of ceramic on the face of the brick. For instance; Ulu mosque dome in Malatya, E refo lu mosque dome in Bey ehir, Sırçalı Madrasa entrance iwan vault in Konya. Other type of ornamentation was using the bricks in a different geometric combinations such as herringbone. For instance; Karatay masjit in Konya, Melik Gazi tomb masjit in Pınarba 1 (Kolay, 1999).

The muqarnas ornamentation on closure structures were not used extensively. The material units of the closure structures were get in process for muqarnas ornamentation. For instance; Ulu Mosque in Van (brick material was used), Ulu mosque in Erzurum, Yakutiye Madrasa in Erzurum, Han Kö k Masjit in shaklı. These examples of muqarnas ornamentation were the elementary trials of the bath structure closure elements which were built in 14th century Turkish seigniories or early Ottoman period (Kolay, 1999).

- Closure structures in seignior period

In seignior buildings; vault and dome structures were used as closure elements. In this period of time, dome structure was become dominant in architecture. The vault structure was always been the closure elements in secondary spaces. In Menteeo ulları seignior in Peçin settlement, this closure structure was used in caravansaries for instance; Kızılhan, Üçgöz Caravensarai, Kara Pa a and Yelli madrasa's as well in Ulu mosque in Manisa (1378). All in those buildings pointed barrel vault were used except main iwan in Kara Pa a Madrasa in Peçin, ground floor closure in Kızılhan and hot area in Tabaklar bath in Bergama. In those buildings curvilinear arch section barrel vault were used. In seignior period of time cross vault, star vault were used rarely (Kolay, 1999).

The dome structure in seignior period was built with the intension of structural care which was the only choice for closure structure of the small volumes such as mosque, tomb and bath. As well dome structure were used as determining the entrance of mihrab in Ulu mosques, for instance Ahmet Gazi mosque in Milas (1378), Ulu mosque in Birgi (1312), Ulu mosque in Manisa (1376) (Kolay, 1999).

The widest span passed with dome structure was Eski Çine Ahmet Gazi mosque with 16.50 m diameter in seignior period of time. The average diameter of the domes in that period of time was 6m (Kolay, 1999).

All the bath buildings, closure elements were built with dome structure in seignior periods of time. Besides the baths, similar domes inside of the structure were started to build and be common application in all other type of buildings with the construction of Firuz Bey Mosque in Milas (1394). This building was the specific building in its typology that all the closure structures were built up with dome (Kolay, 1999).

In this period of time, the flat type of closure structures was used in two buildings; entrance volume in Sultan ah tomb in Birgi (1310) and entrance axis in Firuz Bey mosque (1394) (Kolay, 1999).

For constructing dome and vault, usually brick and stone were used. Except in Menteeo ulları seignior, all the other seigniories the closure material was brick. In Menteeo ulları seignior in Peçin settlement, the lime stone was used for constructing the closure structures. For instance Çanakçı masjit in Tire (1388-1339). In Aydıno ulları seignior, timber material was used for closure structures of the buildings. For instance; Ulu mosque in Birgi (1312), Selçuk sa Bey mosque (1374), the spaces that dome structures was not used, timber construction was used for the closures of those spaces. The remained timber material was not unique; they were existed from the last maintenances (Kolay, 1999).

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The cover material of the closure structures were always guttered roof tile. However in some of the buildings that were belonged for the Mente eo ullaharı and Aydıno ullaharı, the roof cover material was lead. According to Wilhelm von Bodensele and Ludolph von Suchem who visited Ayasoluk in 1335 and bn-I Batuta who visited Ayasoluk in 14th century; they wrote that the closure of Aziz oanesh church was lead. Therefore the lead material in construction for covering the closure structures was used in this period of time. And it could be thought that, cover material of the closure structures of the buildings could be lead which were listed as; Selçuk sa Bey mosque (1374), Ahmet Gazi mosque in Milas (1378), Firuz Bey mosque (1394), Ulu mosque in Birgi (1312), Aydıno lu tomb (1334). The Do an Bey mosque's and Çanakçı masjit's (1338-1339) in Tire; closure structures were covered with stone plaques (Kolay, 1999).

### ➤ Timber roof

The timber roofing was used in two buildings in Aydıno ullaharı seigniory. For instance; Ulu mosque in Birgi (1312) and sa Bey mosque (1374). Furthermore there were few examples of timber roofing in Anatolia. Ulu mosque in Harran and Diyarbakır and Bey ehır were the examples of timber roofing in Anatolia (Kolay, 1999).

### ➤ Vault

The barrel vault structures in Anatolia were constructed with rubble stone masonry. For instance in the entrance iwan of Ahmet Gazi Madrasa (1375-1376), the vault was constructed with cut stone, the cells closures of the same building were constructed with rough cut stone. The brick material was used for constructing the vault structures which were knitting the longitudinal axis of the vaults. These brick materials were not constructed without mold. Therefore on the masonry walls of those structures, there were holes which were opened repetitively on the axis and below on the edge of the vault for the supporting arches of the vault. These supporting arches of the vaults were constructed with rubble stone with same construction technique. The holes of the supporting arches on the masonry walls, the mortar traces of the arches and the span that were passed with vault structure were the evidences for the separate construction of the supporting arches before the construction of the vault. For instance; Kara Pa a madrasa, Kızılhan caravanserai, Üçgöz caravensarai (Kolay, 1999).

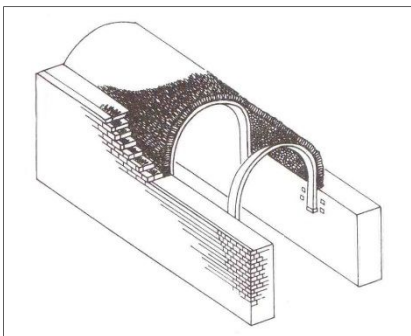


Fig 2.146: Arch support under the vault (Kolay, 1999).

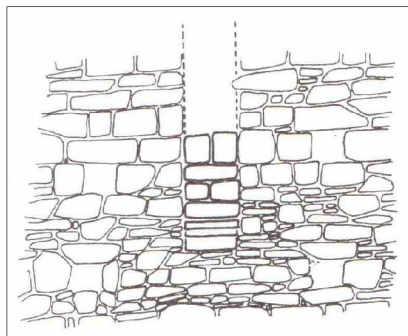


Fig 2.147: Peçin Kızılhan, support arch trace (Kolay, 1999).

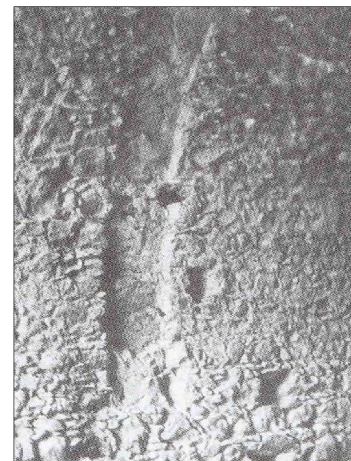


Fig 2.148: Peçin, Üçgöz Caravanserai, support arch trace under the vault (Kolay, 1999).

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The cross vault was used in limited buildings such as Ahmet Gazi Mosque in Milas (1378), Yelli mosque in Peçin settlement, Hüsamettin mosque in Tire and Ulu mosque madrasa in Manisa (1378). In Yelli mosque, two cross vaults and their knitting patterns were shown on below (Kolay, 1999).

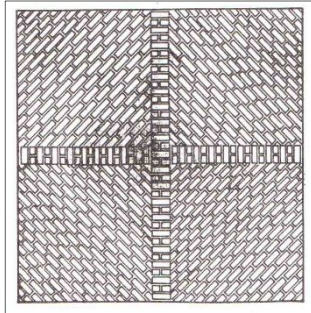


Fig 2.149: Peçin Yelli Mosque, knitting pattern of vault I (Kolay, 1999).

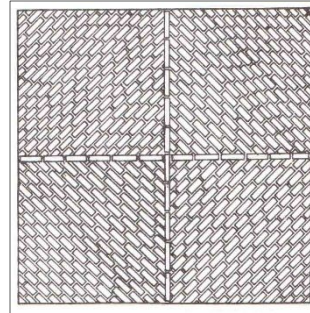


Fig 2.150: Peçin Yelli Mosque, knitting pattern of vault II (Kolay, 1999).

On the below figures, different types of vault structures were used in buildings of Turkish seigniory period (Kolay, 1999).

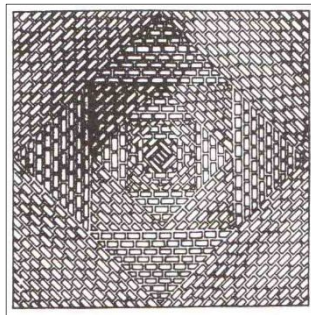


Fig 2.151: Hüdavendigâr Mosque in Behramkale, vault structure (Kolay, 1999).

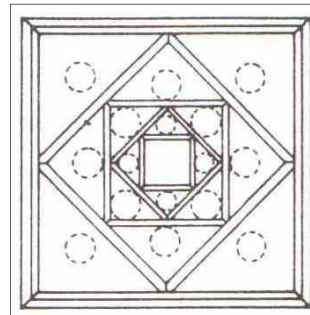


Fig 2.152: Balat bath, vault structure (Kolay, 1999).

Decorative vaults structures were used in Western Anatolian Turkish seigniory period of architecture. In İsa Bey Mosque (1374) was designed by architect who came from Damascus city. In this building courtyard vault structure was under the effect of the essences from Syria, Eastern and Southeastern Anatolian traditions. Therefore the vault structure constructed as star shape which was commonly used in Syria, Eastern and Southeastern Anatolia (Kolay, 1999).

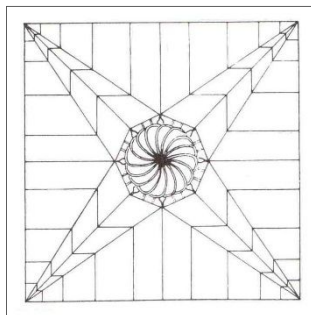


Fig 2.153: İsa Bey Mosque in Selçuk, star vault structure (Kolay, 1999).

### ➤ Dome

The dome structures in Anatolian seigniories period of time, the mortar joints were used in masonry patterns in thin and thick applications. As an example for thin mortar joints; Ahmet Gazi madrasa in Peçin settlement (1375-1376), Yelli mosque, İlyas Bey mosque and madrasa in Balat (1404), Ulu

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mosque in Birgi (1312) and Aydıno lu Tomb (1334). As an example of mortar joints with thick and dent joint applications were; Gucur mosque in Tire, Çukur bath in Manisa. The thick mortar joints were used in whole Turkish seigniories however thin mortar joints were used only in Southwestern Anatolian areas (Kolay, 1999).

The hot areas in Çukur bath; the knitting of the dome perimeter was done with thick mortar joints with imprecise parallel knitting of the bricks. These specifications in small spaces, determined the knitting of the dome without mold structure. Without using the mold for knitting the domes were used in these periods of time and also in Ottoman period of time. In this technique, a timber column with perpendicular arm was placed in the center of the circle which was moveable on it's around. By the help of the timber arm the bricks were placed correctly and the diameter of the circle was precise. In every row the dimension of this timber arm was shortened and the bricks were passed the previous row 2 to 3cm. When the hole of the dome was become smaller the timber column and perpendicular arm was disjointed. And the remained dome construction was completed by the technique of passed the previous rows 2 to 3cm (Kolay, 1999).

In big spaces, thin mortar joints and thick - dent mortar joints were knitting parallel to the perimeter of the circle. The harmony of the knitting of the bricks to the slope of the dome such as every layer brick pattern passed the bricks 2 to 3 cm in a homogeny to all the parts of the dome; determined that the dome structure was built on the mold (Kolay, 1999).

In three buildings which were Ahmet Gazi madrasa in Peçin settlement (1375-1376), tomb C in Peçin settlement, Tabaklar bath in Bergama, brick and stone were used in the same dome structure. In Ahmet Gazi madrasa iwan dome was knitting started with 11 rows of cut stone and after it was continue with brick pattern. As well in tomb C in Peçin settlement, the ruined dome was knitting with cut stone in first two rows and after the dome structured continued with three rows of brick knitting. In Tabaklar bath in Bergama, the cold area dome was knitting with five rows of cut stone in the beginning of the structure and continued with three rows of "alma ık" brick and stone mix and completed with brick pattern. In both Ahmet Gazi madrasa and Tabaklar bath the knitting of the dome structure were not made differentiation on the geometry of the dome (Kolay, 1999).

The thickness of the domes such as bath structure near Selçuk sa Bey Mosque, Çukur bath in Manisa were 1.5 brick thickness in the perimeter of the dome and one brick in the upper parts of the dome structure. In some of the buildings, inside of the tambour of the dome, there was a beam which was constructed with the same material of dome and the brick patterns were started from this beam. For instance; Yelli mosque in Peçin settlement, Ahmet Gazi madrasa iwan (1375-1376), Ulu mosque in Birgi (1312), Aydıno lu tomb (1334), Mehmet Bey mosque in Tire, İlyas Bey masjit in Manisa, Yedi Kızlar tomb (Kolay, 1999).

In all structures, the domes were in half sphere geometrical shape. The exterior of the buildings, dome structures were placed on the end of masonry walls or there was tambour between the dome and the masonry walls. The dome structure which started from the end of masonry walls were not used commonly, however in all the Turkish seigniories this kind of dome structures were existed. For instance; Yelli mosque in Peçin settlement, İlyas Bey madrasa in Balat (1404), Hafsa Hatun tomb in Karacasu, Saruhan Bey tomb in Manisa, Yedi kızlar tomb, Tuzla Hüdavendigâr Mosque (Kolay, 1999).



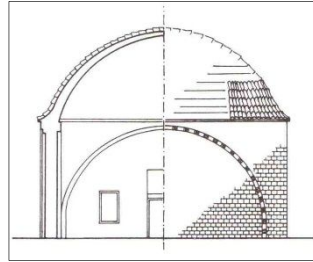


Fig 2.154: Hüdevendigar Mosque in Tuzla, dome structures were placed on the end of masonry walls wall (Kolay, 1999).

Between the masonry walls and the dome, the tambour was used. Single tambour was used for starting the dome base perimeter at the same level with tambour base. The structural system for single tambour which was generally octagonal geometric shape used in all Turkish seigniories. The purpose of using this type of tambour was strengthening the dome structure. For instance; Eski Çine Ahi Bayram tomb, Ahmet Gazi Madrasa iwan in Peçin settlement (1375-1376), Do an Bey Mosque in Tire, Çanakçı masjit (1338-1339), Ulu Mosque in Manisa (1376), Tabaklar bath in Bergama, Hüdevendigar Mosque in Behramkale (Kolay, 1999).

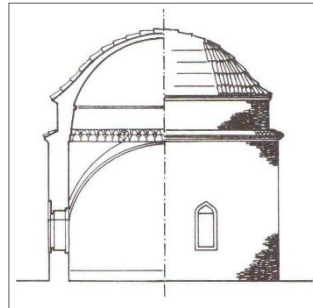


Fig 2.155: Çanakçı Masjit in Tire, dome base perimeter at the same level with tambour base (Kolay, 1999).

The other structural use of tambour was placing below the base of dome. For instance; Selçuk sa Bey Mosque (1374), Hüsamettin Mosque in Tire (octagonal tambour was used in this building), Gucur mosque in Tire (hexagon tambour was used in this building), Üçlallı Mosque in Tire (dodecagon tambour) (Kolay, 1999).

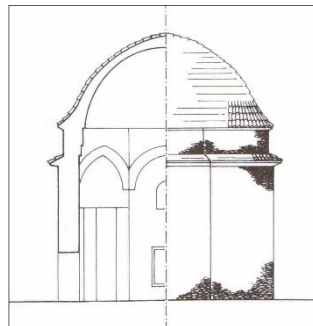


Fig 2.156: Gucur Mosque in Tire, tambour was placing below the base of dome (Kolay, 1999).

Other types of tambour application on the structural systems of the domes were; using double tambour. These types of tambour usage were seen in Mente e and Aydıno ulları seigniories. In this type of tambour applications; the base perimeter of the dome was placed between two tambours. The lower tambour was the base of the dome perimeter and the transitional elements were attached to it, and the upper tambour was an element which was strengthening the base of the dome. For instance; Eski Çine

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

Ahmet Gazi Mosque (dodecagon tambour), İlyas Bey Mosque in Balat (1404), Firuz Bey Mosque in Milas (1394), Tire: Karahasan Mosque and tomb, Mehmet Bey Mosque (octagonal tambour) (Kolay, 1999).

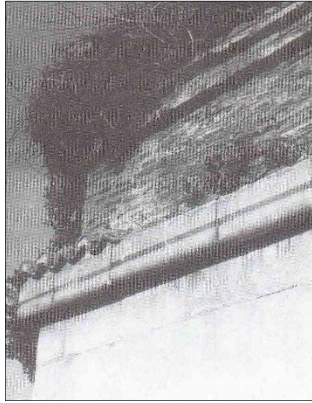


Fig 2.157: İlyas Bey Mosque in Balat, double tambour (Kolay, 1999).

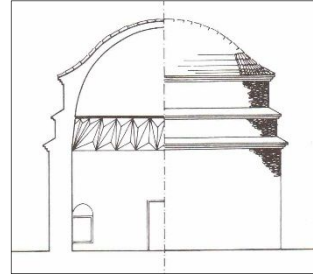


Fig 2.158: Karahasan Mosque in Tire, dome started from the double tambour (Kolay, 1999).

In all of the buildings, the knitting pattern and the construction material of the tambour was the same with masonry wall knitting pattern and construction material. Except; Eski Çine Ahmet Gazi Mosque, Firuz Bey Mosque in Milas (1394), Selçuk sa Bey Mosque (1374) and Aydınolu tomb in Birgi (1334). In these buildings the tambour were constructed with brick material however the masonry wall structure were constructed with rubble stone infilling with marble cladding. In Balat İlyas Bey Mosque (1404), double tambour was used under the dome. The lower tambour was constructed with same knitting technique and material of masonry walls, the upper tambour was constructed with brick material (Kolay, 1999).

In some of the buildings, pyramidal roof was used upper part of the dome structure. For instance; Eski Çine Ahi Bayram tomb and Revak Sultan tomb in Manisa, had octagonal pyramidal roof structures which were knitting with brick and it was perceived from outside. However Kazirzade Mosque, Hüsamettin Mosque and Ahmet Gazi Madrasa iwan in Peçin settlement (1375-1376), the octagonal pyramidal roof was more flat and less inclined than the Eski Çine Ahi Bayram tomb and Revak Sultan tomb in Manisa. Probably the slope of the roof were shaped with mortar and got the pyramidal form (Kolay, 1999).

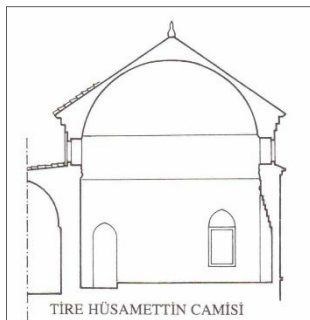


Fig 2.159: Hüsamettin Mosque in Tire (Kolay, 1999).

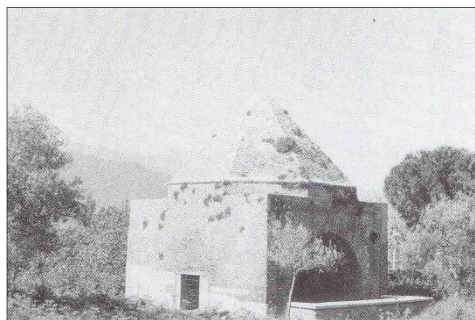


Fig 2.160: Ahi Bayram Tomb in Eski Çine (Kolay, 1999).

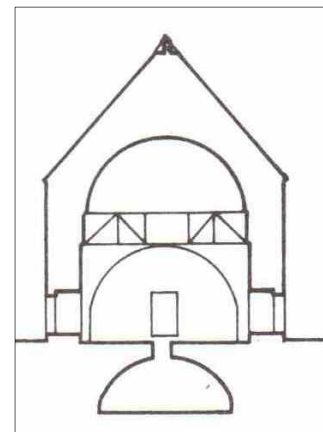


Fig 2.161: Ahi Bayram Tomb in Eski Çine (Kolay, 1999).

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### ➤ Flat type of closure structures

The flat type of closure structures were built in Firuz Bey Mosque in Milas (1394) and Sultan Şah tomb in Birgi (1310). However the material and the construction technique of the closure structure could not be perceived in Firuz Bey Mosque because of the plaster cover on the surfaces (Kolay, 1999).

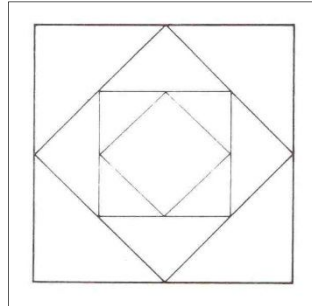


Fig 2.162: Firuz Bey Mosque in Milas, flat type of closure structures (Kolay, 1999).

In Sultan Şah tomb in Birgi, the rectangular plan of the opening was minimized with side cantilevers which were covered with brick planks. As well the residual middle square plan opening was covered with brick planks (Kolay, 1999).

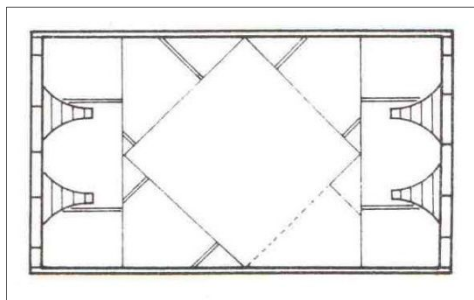


Fig 2.163: Sultan Şah tomb in Birgi, flat type of closure structures (Kolay, 1999).

Guttered roof tiles and stone planks were placed on the mortar or soil which was covered the closure structures. The lead planks were recently used as covering materials in building. For instance; Ahmet Gazi Mosque in Milas (1378), the lead covering materials was not original but applications of these covering materials was very old. In this building, the lead materials were placed on the dome structure without any joint materials (Kolay, 1999).

### ➤ Ornamentation

The covers of the closure structures were generally left without ornamentation. The little ornamentation was seen in dome structures. The dome structure of Aydınoğlu tomb in Birgi (1334) was ornamented with linear red and turquoise colors of glazed brick tiles (Kolay, 1999).

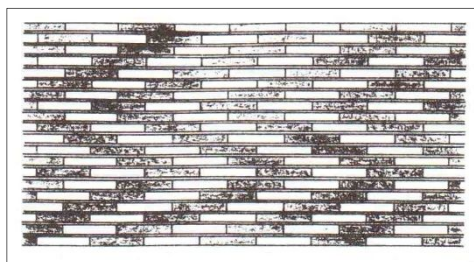


Fig 2.164: Aydınoğlu tomb in Birgi, ornamentation with glazed brick tiles (Kolay, 1999).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

The domes of the baths were ornamented with gypsum decorations. Most of these gypsum decorations were lost, however the remained decorations were composed of muqarnas different types of ribbed decorations. For instance; bath near Delphinion in Balat, bath near Selçuk sa Bey Mosque, Tabaklar bath in Bergama (Kolay, 1999).

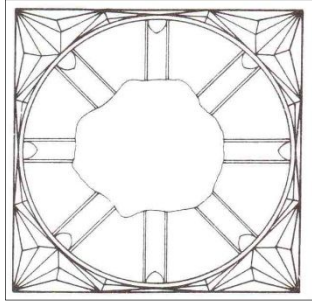


Fig 2.165: Selçuk bath, gypsum ornamentation (Kolay, 1999).

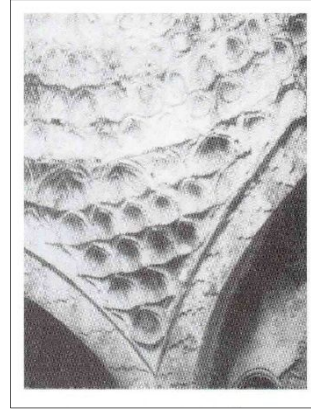


Fig 2.166: Tabaklar bath in Bergama, muqarnas ornamented dome (Kolay, 1999).

Generally ornamentation was placed on inside and outside of the tambour of the dome. Inside of the dome, ornamentation was placed on the base of the dome. For instance; Ahmet Gazi madrasa iwan in Peçin settlement (1375-1376), Yedi Kızlar tomb in Manisa (Kolay, 1999).

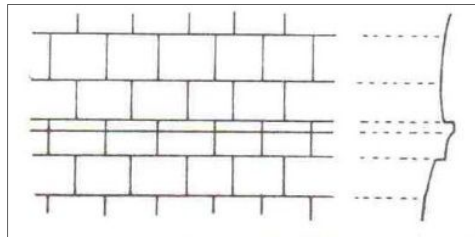


Fig 2.167: Ahmet Gazi Madrasa in Peçin, main iwan dome profile from the base (Kolay, 1999).

Other examples for interior ornamentation for the dome structures were shown on below (Kolay, 1999).

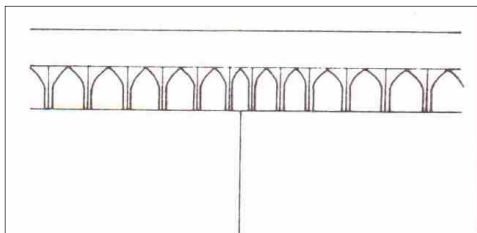


Fig 2.168: Do an Bey Mosque, ornamentation of muqarnas row (Kolay, 1999).

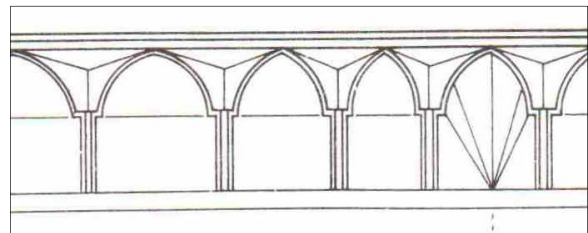


Fig 2.169: Çanakçı Maşjit in Tire, of ornamentation of arch row (Kolay, 1999).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

Exterior of the dome structures, ornamentation were generally placed on tambour of the dome (Kolay, 1999).

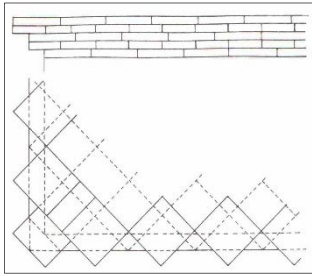


Fig 2.170: Karahasan mosque in Tire, double row of sawtooth (Kolay, 1999).

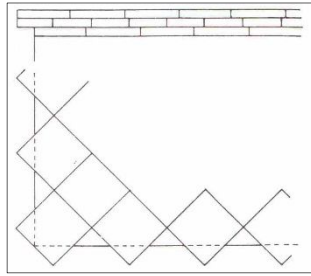


Fig 2.171: Ulu mosque in Manisa, single row of sawtooth (Kolay, 1999).

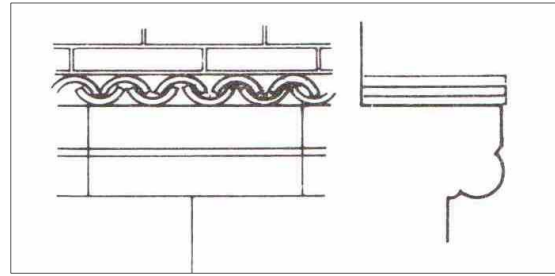


Fig 2.172: Iyas Bey Mosque in Balat, ornated stone eave (Kolay, 1999).

In Üçlallı Mosque in Tire; small brick cantilevers were placed on the tambour of the dome. Similar cantilever motives were used in Firuz Bey Mosque in Milas (1394). In this building, narrow surrounding canopy were supported with four cantilevers which were attached to the tambour of the dome. Ornamentation was used on the surrounding of the canopy. As well cantilever stones and the walls between these cantilevers were ornamented with plant figures. Under the canopy, ornamentation was done with geometric figures of colored stones (Kolay, 1999).

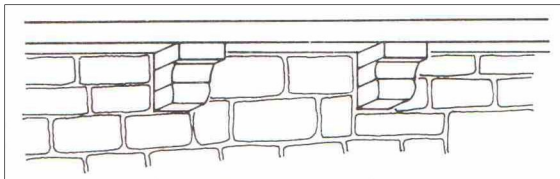


Fig 2.173: Üçlallı Mosque in Tire, brick cantilever under the eaves of the dome (Kolay, 1999).

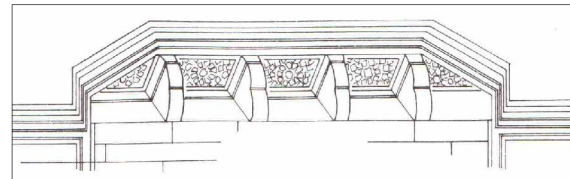


Fig 2.174: Firuz Bey Mosque in Milas, stone cantilever under the eaves of the dome (Kolay, 1999).

### 2.5.2. Early Ottoman period

#### ○ Masonry walls

In the beginning of the Ottoman Empire, the architecture was under the essences of Byzantine Empire construction techniques. The main construction technique that were affected the masons in Anatolia was the “alma ık” technique with stone and brick material. In the first half of the 14th century the “alma ık” technique was firstly transferred than synthesis by the masons and after applied to the buildings in Ottoman. However in the second half of the 14th century this technique was developed with the patterns of Ottoman architecture and the links with other structural elements in the building construction were established. Such as the proportion of the brick and stone, the harmony of the masonry wall with other structural elements, the construction techniques of mortar joints were determined in second half of the century (Ersen 1986).

#### ▪ Ornamentation on masonry walls

In the early period of Ottoman architecture, the ornamentation of the elevations was composed of brick and two colors of stone material. The used of ornamentation on the masonry wall between 1330-1350 and 1350-1400 were shown on the tables (Ersen 1986).

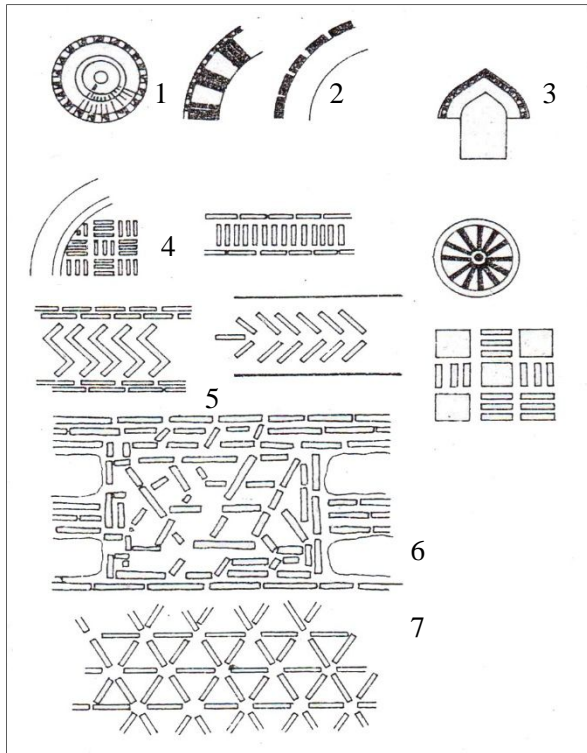


Fig 2.175: Ornametation on masonry walls in early period of Ottoman arch I (Ersen 1986).

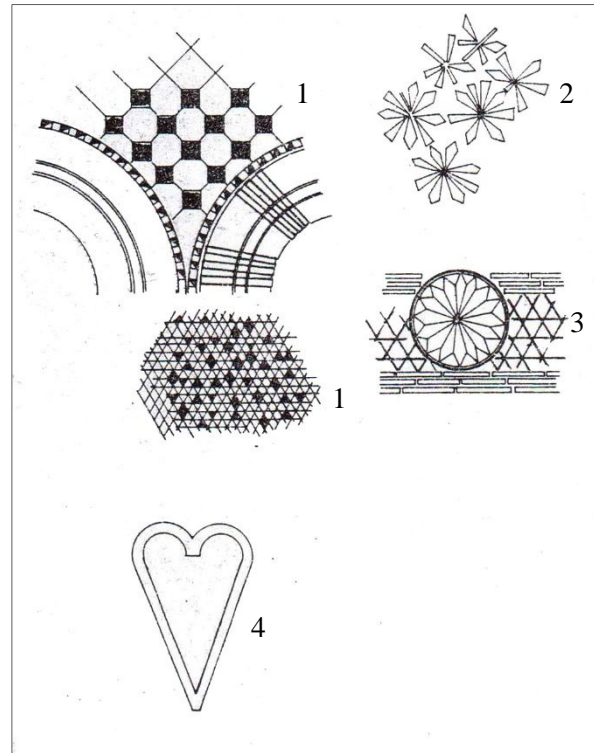


Fig 2.176: Ornametation on masonry walls in early period of Ottoman II (Ersen 1986)

1-Rose, 2-Arch profiles (sawtooth and brick row), 3-Figurative arch, 4-Checkers, 5-Houndstooth, 6-Yıldırım Madrasa's masonry wall ornamented with brick work, 7-Geometric shapes (after 1350's)

1-Checkers, 2-Flowers, 3-Rose, 4-Hearth

○ Transitional elements and the dome

In the early period of Ottoman architecture, the buildings were designed according to the square plan shapes with domed closure structures. This was the important criteria in 14th century building design in Ottoman seigniory differentiated from the other Turkish seigniories (Ersen 1986).

Architectural planning in early period of Ottoman Empire; the modules which were constituted square plan shapes with dome were used efficiently. However there was an intension to develop transitional and dome structures. Strengthening the tambours were always problem for the big openings in dome structures (Ersen 1986).

The perimeter of the dome was under the effect of tension forces. The brick and stone element did not have adequate strength for the tension forces. In the secondary buildings in early Ottoman domes were built without tambour, however they were not succeeded in structurally. The types of tambour and their connection with domes were sought in that period. In 1300 – 1400, the connections with domes and tambours were classified in three sections (Ersen 1986).

- Without tambour, this structure was unstable therefore the only example was existed in Bursa Çobanbey Tomb.
- The edge perimeter of the dome were surrounded by tambour and filled with Horasan mortar and rubble stone. In this type tambour was not a part of dome structure.

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

- Centered tambour, the tambour was built high and partially surrounded the edge of the dome. This structure type was used in experimental period.

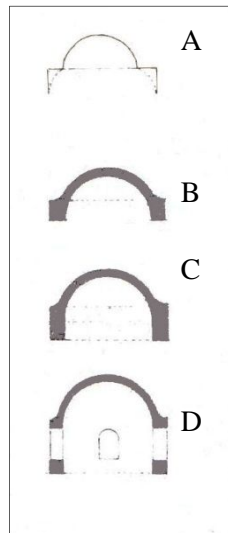


Fig 2.177: Dome and tambour combinations I (Ersen 1986).

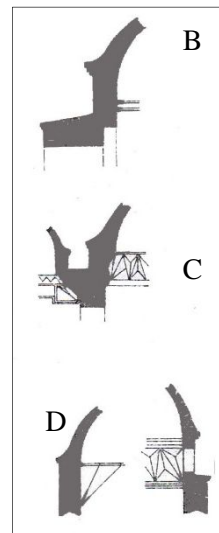


Fig 2.178: Dome and tambour combinations II (Ersen 1986).

A- Without tambour, B-Tambour was under the base of the dome, C-Tambour was in the middle, D-Base of the dome was located on the top of tambour

The transitional structural elements that were used in early Ottoman were; pendentive, flat triangle, two or multilateral flat triangle. Pendentive was a transitional element in Byzantine architecture although it was used in the early period of Ottoman. Ottoman dome structures did not have any formal relation with Byzantine domes (Ersen 1986).

A belt which was composed of triangles could be placed on the edge of the dome, inside of the tambour, under the tambour or middle of tambour and dome. The tambours of the domes were classified according to the plan typologies which were shown on the below steps:

- Without tambour,
- Square tambour,
- Octagonal tambour,
- Outside was dodecagon, inside was circular,
- Outside was dodecagon, inside was octagonal,
- Compatible with division hexadecimal of triangular belt or higher than dodecagon.

The window openings of the tambour was narrow and small scale with curvilinear arched. In the first half of 14th century the dome structures were built without tambour or tambour with square, dodecagon or hexadecimal plan layout with massive form. The tambours were built with the specifications of blind wall, lamination lantern and three or four window opening on the main axis (Ersen 1986).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

The construction materials of dome was always brick as well the transitional elements were built up of brick except the Süleymanpa a madrasa in znik. This building pendentives were built up of brick materials (*Ersen 1986*).

The form of the eave profiles of early Ottoman architecture, sawtooth was frequently used.

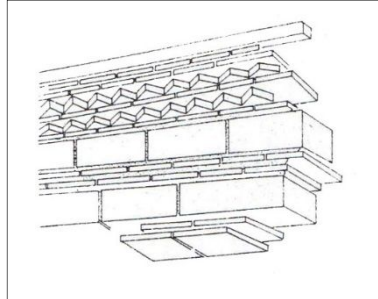


Fig 2.179: Sawtooth eave profile (*Ersen 1986*).

### 2.5.3. Classical period of Ottoman

Classical Ottoman Period was started from 1505 and ended in 1718. Architect Sinan buildings were part of Classical Ottoman Period which were continued until the beginning of XVIII century. In this period of time in mosques, the aim of the unity between spaces was reached. The first example for the unity between the spaces was Edirne Selimiye mosque. In this mosque other important issue was its proportional pyramidal form which was occurred by different size of dome structures. Pendentives, squinchies were used in Selimiye Mosque as transitional elements (*Tayla, 2007*).

Architect Sinan was an important figure in this period for establishing these design disciplines and orders. This period were pulled away to top and differed from other Turkish periods by the designs of architect Sinan (*Tayla, 2007*).

The typologies of the buildings and different structural use of elements were rise in this period of time. However, the character of architecture was established in plan, elevation arrangements although different structural use of elements and typologies of buildings in this period of time (Fig 2.180, 2.181) (*Tayla, 2007*).

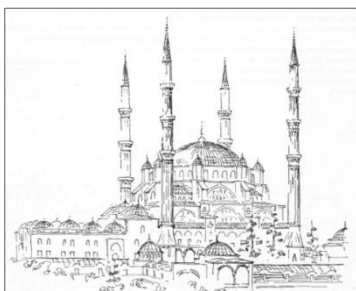


Fig 2.180: 'Edirne Selimiye Camii', drawing (1569-1575) (*Tayla, 2007*).



Fig 2.181: 'Edirne Selimiye Camii' (1569-1575) (*Tayla, 2007*).



## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

### ○ Foundations

In Classical Ottoman Period the foundation were designed in two conditions which named weak and strong earth types. In strong earth types the foundations were designed and constructed like stepped form. In 1957, a pit was opened in Süleymaniye Mosque foundations and they were examined. According to these examinations under the foundations there were 20cm thick 'horasan' mortar and it was strength with timber grid. Under the 'mihrap' wall foundations constructed stepped formed. The depth of the foundations was 5.90m. Big stones connected with 'horasan' mortar and they were constructed thick lap joints. The same construction types of foundation were used in other types of the masonry walls (Aksoy, 1976).

In fig 2.182: Edirne Mihrimah Sultan Mosque foundations details are seen (Tanyeli, 1990).



Fig 2.182: Edirne Mihrimah Sultan Mosque foundations details (Tanyeli, 1990).

Fatih complex buildings, in Ba kur unlu (1462-71) foundations were seen after the code of the road was changed. And the sketch of the foundations was seen in fig 2.183.

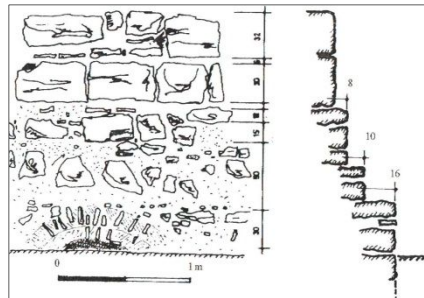


Fig 2.183: Fatih madrasa, complex buildings, Akdeniz Ba kur unlu (1462-71) foundations (Akinci, 1994).

The madrasa, complex building of Akdeniz Ba kur unlu's foundation step dimensions were seen in fig. These steps were designed in big stones which dimensions were 25x60 – 40x32x30x52. The kinds of these stones were 'od' and 'küfeki'. They used both types in a mixture. After the big stones the smaller ones were laid after. 'Horasan' mortar was seen in these foundations. Under the foundations vault structures were seen. It was thought that these vaults were used as channels. However under the vaults there was no clue about the stone settings (Akinci, 1994).

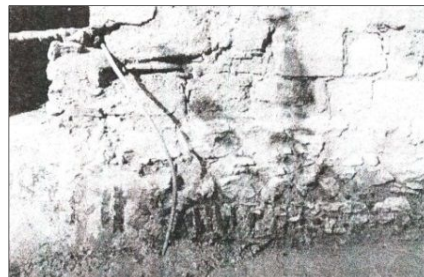


Fig 2.184: Fatih madrasa, complex buildings, Akdeniz Ba kur unlu (1462-71) foundations (Akinci, 1994).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

In weak earth types the foundations; backfilling were done. Earth was pressed with the additions of stones, old building elements on the surface of the foundations. In foundations of weak earth type, foundation walls were built with big stones on the surface of the foundation wall. Inside of the wall small stones, brick pieces and 'horosan' mortar were placed. In every 50 to 70 cm timber beam was placed. According the clues from the foundations there were resin that showed pine timber beams were used inside of these foundations for stabilized them. In fig 2.185, Tahtakale Bath, wall section through foundation could be seen (Aktu , Ersen, 1991).

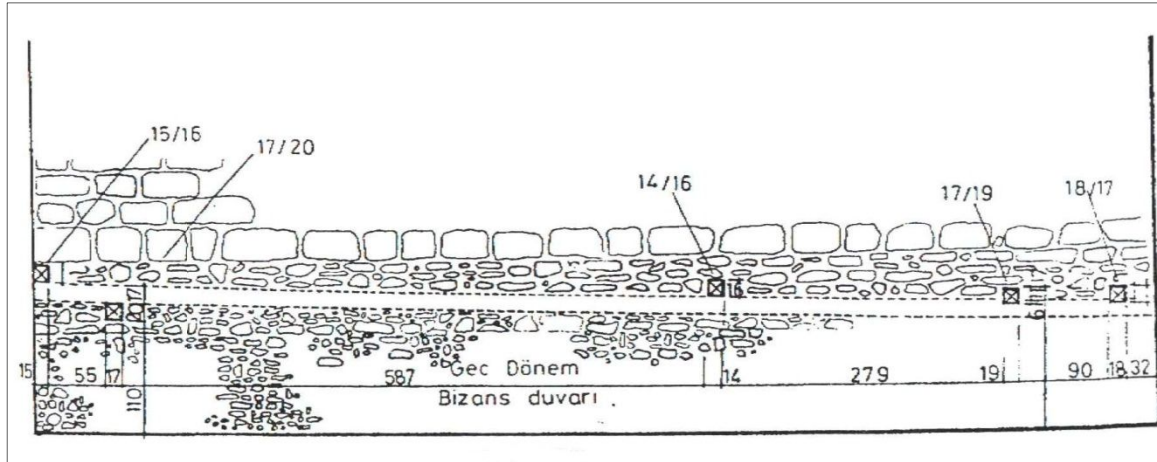


Fig 2.185: Tahtakale Bath, wall section through foundation could be seen (Aktu , Ersen, 1991).

In weak earth surface types, Ottoman's used timber piles for stabilizing the building. For instance in Nur-u Osmaniye Mosque timber pile foundation system was used. That information was taken out from the Ottoman inventory from the source of 'Ahmet Efendi'. Also it was summarized by Do an Kuban who was a well-known architect academician (Ahmet Efendi, 1916-1918).

### o Walls and wall pattern techniques

In Classical Period of Ottoman Empire, there were two types of wall pattern.

1. Plain stone wall construction.
2. Stone + brick 'Alma ık' wall construction.

In Early period of Ottoman Empire the walls were built in different construction pattern techniques. This technique called "alma ık" which is made up of stone and brick to gather.

Plain brick was not characteristics in Ottoman Empire. In stone + brick technique was used according to the statue of the building. For instance in important facades which faced to the main road axis cut stone were used. Secondary facades stone + brick technique were used. Or rowed stone or rubble material pattern were used. The workmanship and the material quality were changed. For instance in big complex buildings; all the buildings were not constructed in the same quality of material. However in Süleymaniye complex building all the wall construction materials was cut stone. It was the important building complex in Ottoman (Arseven, 1994). Stone wall construction was more expensive than the other construction techniques. That is the main reason for this difference. Also there are some small structures constructed of ashlar masonry built by rich people.

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

- Cut stone wall construction techniques

In Ottoman architecture most important and monumental buildings were constructed cut stone material. In this construction technique there was a rubble stone material. The connective element was ‘horosan’ mortar.

In cut stone wall, the connections of each stone were achieved by iron rods. These iron rods were used for increasing the horizontal strength of stone wall. Higher strength of the stone wall was changed the behavior of the wall for the earthquake forces and also these iron rods was made the wall homogeneous (Barkan, 1972). In fig 2.186 and 2.187, iron rods and iron mortice were seen.

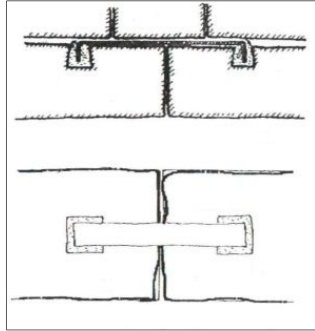


Fig 2.186: Iron rods connected the stones horizontal (Tayla, 2007).

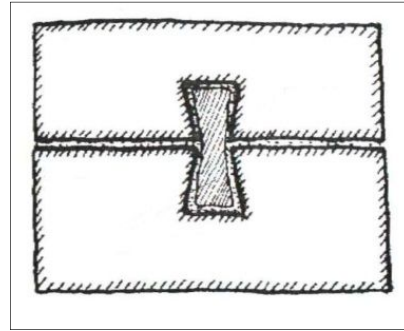


Fig 2.187: Iron mortice connected the stones vertical (Tayla, 2007).

In the construction inventory of Süleymaniye, there were four types of iron rods. The original names of these iron rods were “büyük, büyük vasat, vasat and küçük” dir (Barkan, 1972).

In ehzade Mosque the length of the iron rods were differenced between 25-30-35-46-54cm, width of the iron rods were 4cm - 5.5cm and the thickness of the iron rods were between 5cm - 8cm. These iron rods were placed close to ground level of the wall. In general these iron rods were located beginning of the wall and they were strengthen will lead. However in ehzade Mosque example the iron rod were placed inside the stone with their own cavity. The molten lead were poured onto the iron rod for preventing the iron from the corrosion.

There were some examples for cut stone details in different building in early period of Ottoman Empire.

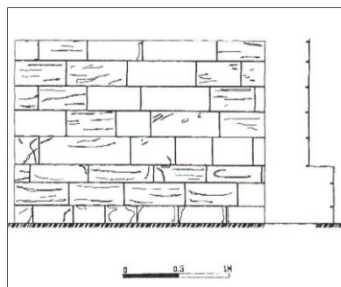


Fig 2.188: Cut Stone Wall Detail (Sultan I. Mehmet Mosque 1463-1470) (Akinci, 1994).

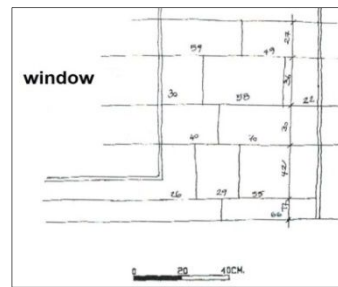


Fig 2.189: Cut Stone Wall Detail (Mahmut Pa a Mosque 1464) (Kuban, 1996).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

In fig 2.190 and 2.191; the dimensions of the cut stones are; 46/4-29cm and 30/23cm.

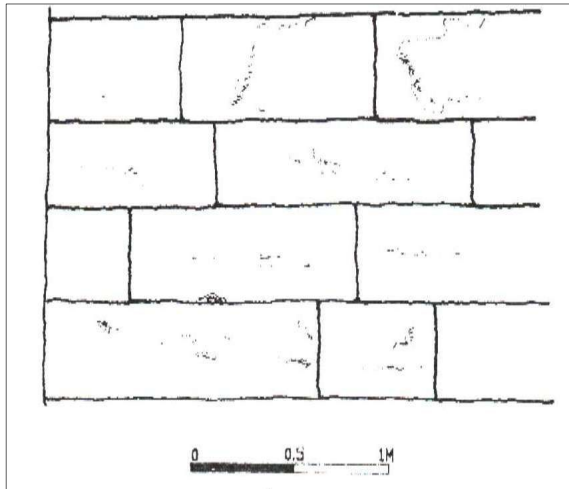


Fig 2.190: Cut Stone Wall Detail (Murat Pa a Mosque 1471-1478) (Akıncı, 1994).

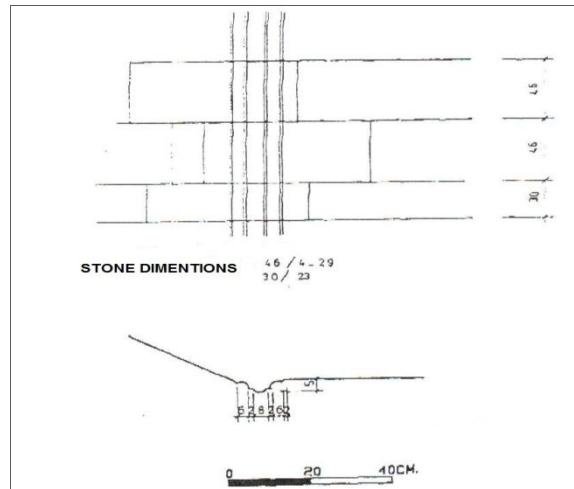


Fig 2.191: Cut Stone Wall Detail (Murat Pa a Tomb 1473) (Akıncı, 1994).

In fig 2.192 and 2.193; the dimensions of the cut stones are; 26/8-92-43-52cm, 28/130-34cm and 30/100-95-145. In fig, dimensions of the cut stones are; 20/21-40-47-60-69-73-80cm, 17/26-31-76cm and 18/20-40-55-59-76cm.

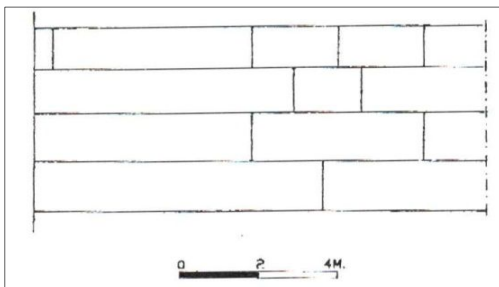


Fig 2.192: Cut Stone Wall Detail (Sultan Selim Mosque 1522) (Akıncı, 1994).

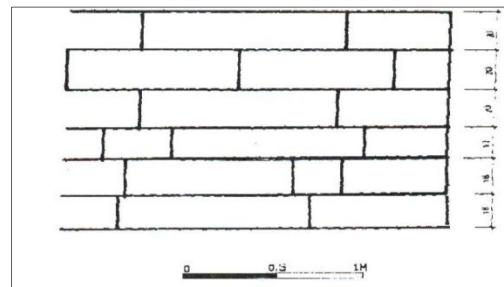


Fig 2.193: Cut Stone Wall Detail (Kepenkçi Sinan Mosque 1539) (Akıncı, 1994).

In fig 2.194 and 2.195; the dimensions of the cut stones are; 17/44-55-62 and 19/24-35-43-54-62cm. In fig, the dimensions of cut stones are; 22/41-109-89, 47/131-88-20 and 71/126-65-149cm.

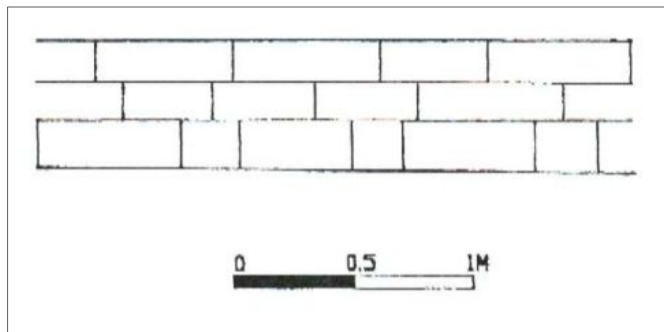


Fig 2.194: Cut Stone Wall Detail ( ehzade Mosque 1548) (Akıncı, 1994).



Fig 2.195: Cut Stone Wall Detail (Süleymaniye Sani Madrasa 1550-57) (Akıncı, 1994).

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In fig 2.196 and 2.197; the dimensions of the cut stones are; 40/57-58 and 54/20-80cm.

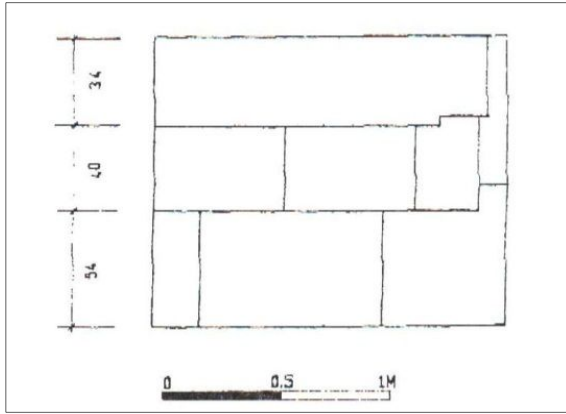


Fig 2.196: Cut Stone Wall Detail (Sinan Pa a Tomb 1555) (Akinci, 1994).

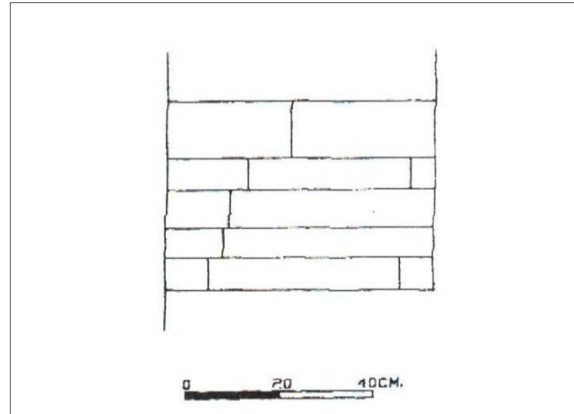


Fig 2.197: Cut Stone Wall Detail (Edirne Mihrimah Sultan Mosque 1556) (Akinci, 1994).

In fig 2.198 and 2.199; the dimensions of the cut stones are; 46/24-31-68-94-183cm, 52/42-76-209cm and 42/34-84-100cm.

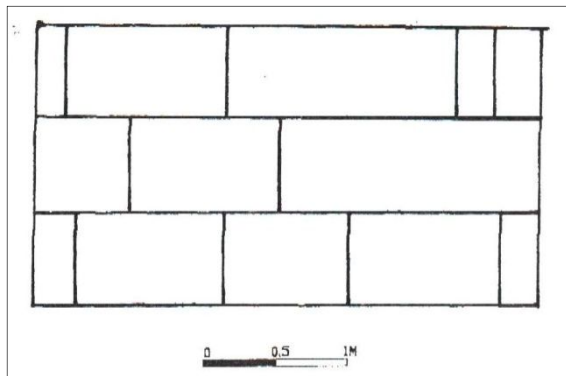


Fig 2.198: Cut Stone Wall Detail (Kılıç Ali Pa a Mosque 1580) (Akinci, 1994).

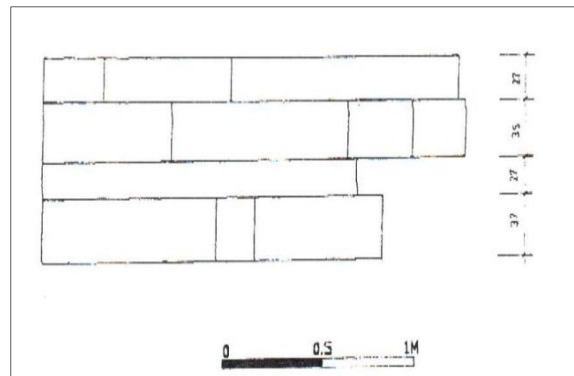


Fig 2.199: Cut Stone Wall Detail (Mesih Ali Pa a Mosque 1585) (Akinci, 1994).

### ▪ Rough stone construction technique

In this kind of wall construction technique, the surfaces of the stones are not passing through a very fine procedure. The surfaces of the stones were left rough. The dimensions of the stones were between 15-18-20-15-30-35cm wide and 12-30cm height. This type of wall construction was constructed in secondary important places outside elevations. In addition, this type of construction was used interior spaces in which wall surfaces would be plastered later. In fig 2.200 and 2.201, are early period of Ottoman Empire and fig 2.202 is classical period of Ottoman Empire rough cut stone wall details (Akinci, 1994).

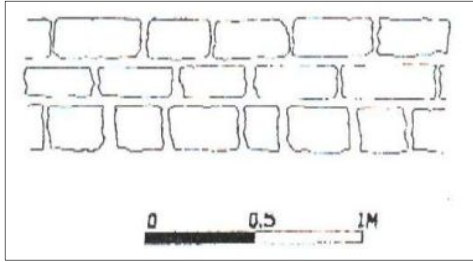


Fig 2.200: Rough Cut Stone Wall Detail (Fatih Akdeniz Madrasa 1463-1470) (Akıncı, 1994).

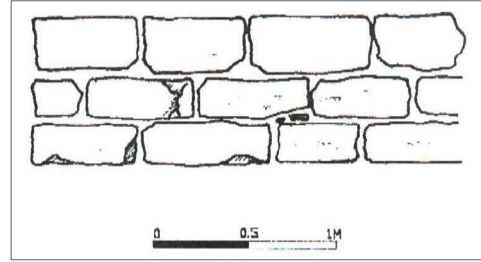


Fig 2.201: Rough Cut Stone Wall Detail (Çardaklı Bath 1503-1504) (Akıncı, 1994).

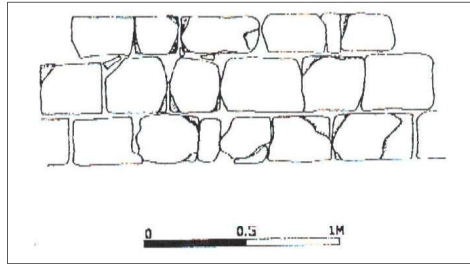


Fig 2.202: Rough Cut Stone Wall Detail (Rüstem Paşa Madrasa 1550) (Akıncı, 1994).

- Rubble stone wall construction techniques

In this construction technique different size of rubble stone and mortar were used. For the small wall openings, tiny rubble stone were used. In the corner of the rubble stone wall construction, cut stone pieces were used for providing extra strength to the rubble stone wall. In Süleymaniye Madrasa service buildings this wall construction technique was used. In fig 2.203 and 2.204, there were two examples of rubble stone wall construction.

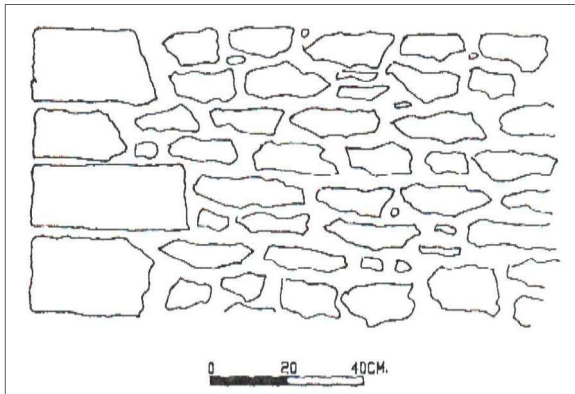


Fig 2.203: Rubble Stone Wall Detail (Süleymaniye Madrasa 1550-1557) (Akıncı, 1994).

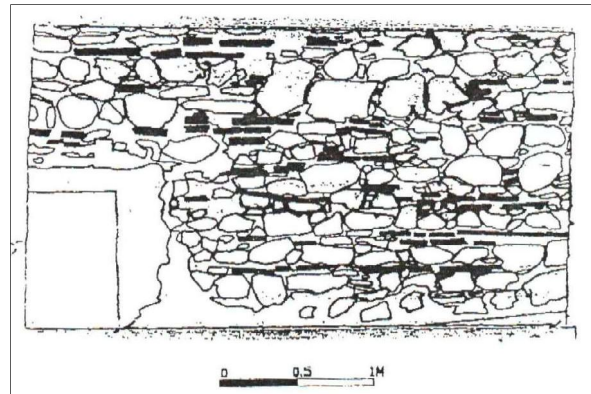


Fig 2.204: Rubble Stone Wall Detail (Anadolu Hisarı 1394-1395) (Akıncı, 1994).

- Brick and stone 'alma ık' wall construction technique

In Istanbul region the technique in 'alma ık' wall was done with cut stone and brick or rough stone and brick. In cut stone and brick most used pattern were; one row stone and two row brick or one row stone and three row brick. Architect Sinan was rarely used 'alma ık' wall construction technique. In some of the wall constructions outer wall was constructed by brick and stone however inside of the wall constructed only in stone. However it could not be generalized because most of the building's interior were plastered. However in Byzantine period buildings, bricks were followed through the wall to the all

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surrounding. The brick continuity depended upon economic reasons rather than esthetical reason in Ottoman Empire. In Ottoman Empire, the usage of the brick was very limited. However in later centuries the usages of the brick was increased and parallel to this the usage and the size of the stone was degreased. The sizes of the brick were changed between 24x24cm, 28x28cm and 30x30cm. Also the depth of the brick was changed between 3 - 3,5 - 4 - 4,5 - 5cm. The dimensions of these bricks were not standard like in contemporary bricks, the sizes of these bricks were changed according to the workshops. In fig 2.205, 2.206, 2.207 and 2.208; brick and stone 'alma ık' wall construction technique was seen. In fig 2.205, the size of the stone; 13/47 - 15 - 25 - 16 - 18cm and the size of the brick was; 4/21 - 10 - 27 - 14 - 27 - 25 - 13 - 52 - 37 - 30 - 27cm. In fig 62, the size of the stone; 22/25 - 60 - 40cm and the size of the brick was; 2/30 - 29cm.

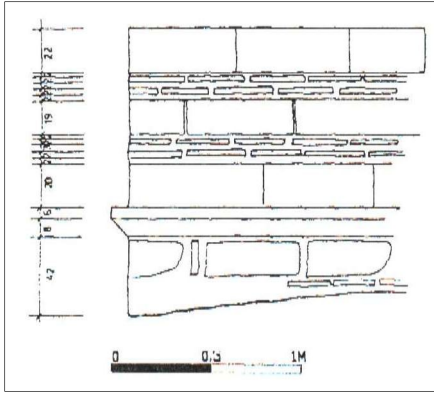


Fig 2.205: Brick and stone 'alma ık' wall detail (Bostani Ali Mosque 1547) (Akıncı, 1994).

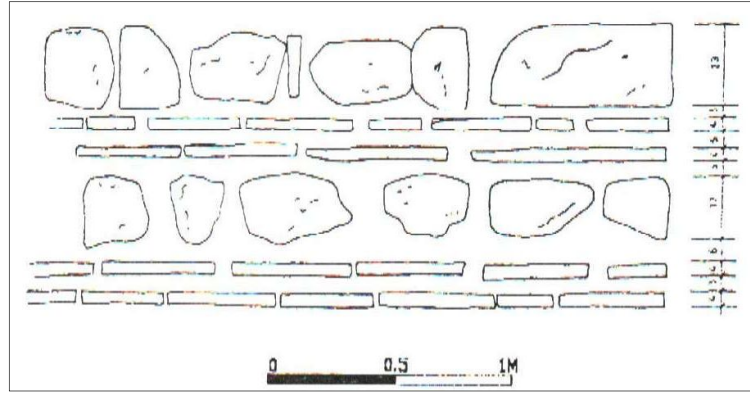


Fig 2.206: Brick and stone 'alma ık' wall detail (Süleymaniye Madrasa 1550-1557) (Akıncı, 1994).

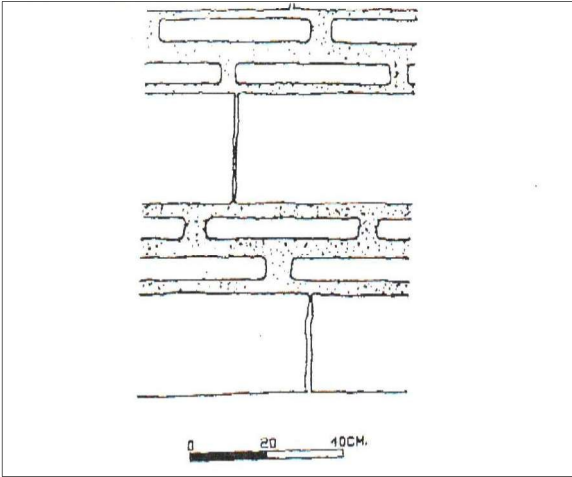


Fig 2.207: Brick and stone 'alma ık' wall detail (Hadım İbrahim Paşa Mosque, 1551) (Akıncı, 1994).

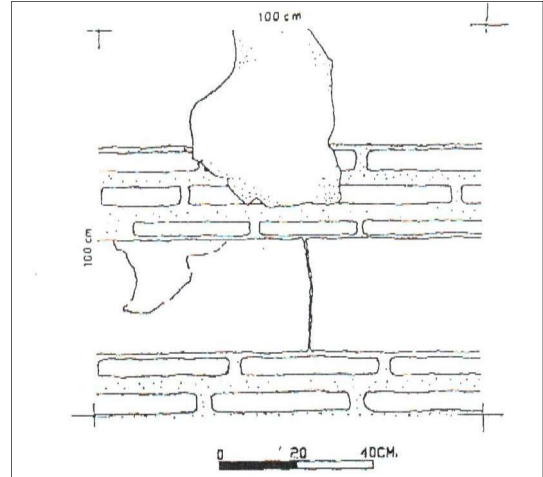


Fig 2.208: Brick and stone 'alma ık' wall detail (Ahi Çelebi Mosque, 1553-1555) (Akıncı, 1994).

### ▪ Decorative brick technique in stone wall construction

In this technique, the stone wall decorated with the patterns of the bricks which were common in Early Ottoman period. These patterns formed with linear brick rows sometimes with decorative panels. The early examples of these patterns were used in Anadoluhisarı and Rumelihisarı in İstanbul. In fig 2.209, the brick decorative patterns in Anadoluhisarı are shown. In fig 2.210, different decorative patterns in Rumelihisarı are shown.

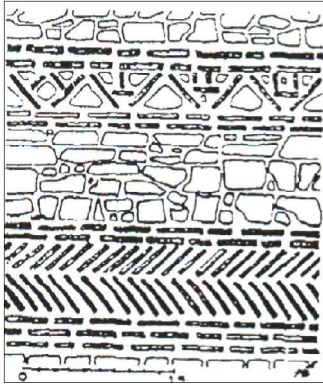


Fig 2.209: Decorative brick technique in stone wall construction detail (Anadolu Hisari, 1394-95) (Akinci, 1998).

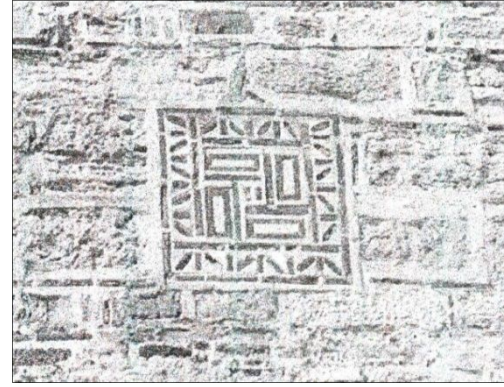


Fig 2.210: Decorative brick panel in stone wall construction detail (Rumeli Hisari Halil Pa a Tower, 1452) (Akinci, 1998).

- Picking material use from ancient structures

In Selcuk's period as well in Ottoman's period, picking materials used in construction from ancient structures especially from Byzantine. In Beyazit Bath foundations, it could be seen that picking stone was used (fig 2.211). In Ottoman's most common materials were picked from ancient structures were the columns. In Istanbul many of the Ottomans building constructions these columns were used (Akinci, 1998).



Fig 2.211: Picking material use from ancient structures, detail (Beyazit Hamami, 1506-1507) (Akinci, 1998).

- Lap joints of wall pattern

In cut stone wall, lap joints were close to each other. The lap distance between the lap joints are 1 to 5mm. In rough and rubble stone walls the lap distance are increased to 3 to 8cm. In some of the buildings these lap joints are distanced more than that therefore they used brick pieces on these lap joints. In brick and stone 'alma ik' wall construction the lap joints between the bricks were thinner than the joints between stone and brick. In fig 2.212, the lap joints were seen. On the upper left 'Anadolu Hisari (1394-95)', rough wall construction is seen. On the upper right 'Esekapı Madrasa (1560)', alma ik wall construction is seen. On the lower left 'Cedid Ali Pa a Madrasa (1548)', cut stone wall construction is seen. On the lower right 'Sultan Ahmet Mosque (1609-1617)', cut stone wall construction is seen.



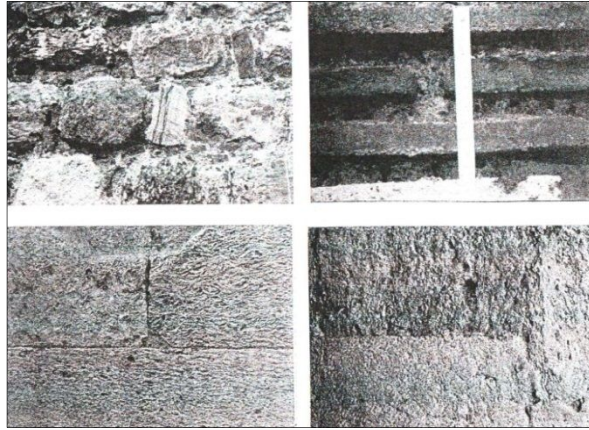


Fig 2.212: Lap joints were seen (Akinci, 1998).

- Timber post and beams

In classical period of the Ottoman Empire, the elements of stone wall construction were; stone, brick, timber and for binding material ‘horosan’ mortar. In that period timber beams which placed horizontal and vertical were used inside of the stone wall. Using timber beams inside of the stone wall was a characteristic of Anatolian architecture. However that kind of stone wall construction was seen in late of Byzantine Empire. In fig 2.213, was timber construction technique which called ‘Beyce Sultan wall construction technique’ which was used in Anatolia before Ottomans (Akinci, 1994) (Nauman, 1985).

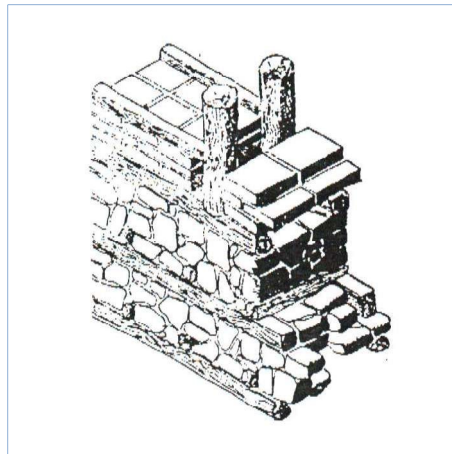


Fig 2.213: Timber construction technique, ‘Beyce Sultan wall construction technique’ (Nauman, 1985).

Inside of the stone wall timber beam application were seen in architect Sinan’s one of last buildings which name is ‘Atik Valide Madrasa’. 8x14cm timber beams were surrounded the building. There were five parallel timber beam lines under the dome. Between each timber beam parallel line 96-102cm distance were left. Also these parallel beams were connected each other with timber vertical timer posts. The distance between vertical timber posts were 72-98cm. In fig 2.214, ‘‘Atik Valide Madrasa’ and the timber beam in stone wall construction were seen (Akinci, 1994).

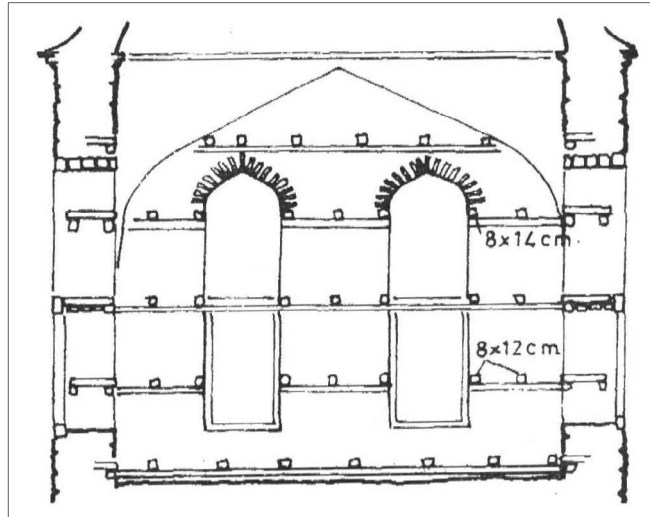


Fig 2.214: ‘‘Atik Valide Madrasa’ and the timber beam in stone wall construction (Akinci, 1994).

## 2.6. Categorization of types of building materials in Ottoman architecture

In Ottoman Empire all the materials used in construction of the buildings were documented. In these documents the origin of the materials were written. Main materials were stone, brick, timber, lead, ‘horasan’ mortar, lime and gypsum. All these materials were described in following paragraphs. In this chapter, the examples were chosen from different periods of Ottoman Empire. As well early period Ottoman Empire buildings were included in this chapter.

### 2.6.1. Stone

Natural stone was the important material in building design in Ottoman Empire. Big projects like Süleymaniye mosque, the need for stone material was great. Most of these stones were brought from rock pit. However some stones with large dimensions brought from ancient cities that were colored decorative stones such as marmor Thessalicum (serpantin), monophyrites, lapis syenites etc. For instance some of the big stones in Süleymaniye construction were brought from Alexandria with ship. In Ottoman constructions picking stones from different structures were not very accustomed because of their shipping difficulties (Ahmet Efendi, 1916-1918).

In traditional Ottoman architecture stones were divided into three main areas which were listed as sedimentary stones, magmatic stones and marbles. These materials were investigated according to their specifications, used areas and locations.

#### ○ Sedimentary Stones

Sedimentary stones were important group in building construction in Ottoman. Lime stones, ‘Marnlı’ lime stones, travertine, alabaster, ‘Terme’ stone, serpentine stone, sand stone, conglomerate and breccia were part of lime stones. In this of research paper these materials were summarized (Tayla, 2007).

#### ▪ Limestone (Kalker)

As a building material these stones were constituted the important group of in building construction in Ottoman. These stones were the compositions of calcium carbonate. Types of limestone’s which were founded in Turkey were listed on the following steps (Tayla, 2007).

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### ➤ Bakırköy lime stone

This type of limestone was extract from mine in Bakırköy, Davutpa a and Sefaköy in stanbul district. This stone was used in different mosques and complex buildings in stanbul. And the name of this stone was ‘küfeki’ stone or ‘maktralı kalker’ in Turkey.

In 1950-60 restoration movement most of the used qualified ‘küfeki’ stone extract from Bakırköy mine. In Ottoman Empire most of the buildings were constructed by ‘Küfeki’ stone which was used from Roman Empire.

Bakırköy ‘maktaralı kalker’ was the most used material in Ottoman. Bakırköy mine was under the city after 1950’s and from that period of time these mines were not used any more (Tayla, 2007).

### ➤ stanbul, amlar – Kayaba ı Lime Stone

The color of this stone was white and yellow. Some of these stones were used on the floor tiles of Ta kı la building in stanbul (Tayla, 2007).

### ➤ Ankara Lime Stone

There were some mines around the Ankara. The most important one is ‘Trias’ which has light and dark grey color. This stone was used in Roman Bath buildings in Turkey (Tayla, 2007).



Fig 2.215: ‘Roman Bath’, Ankara (Wikipedia.org., 2012)

### ➤ Kastamonu Lime Stone

These stones were used from Selcuk’s mosque, bridge and the other buildings until today. These stones were extracted from mine in big mass pieces. These stones were suitable for processing and building construction (Tayla, 2007).

### ➤ Çorum Lime Stones

These stones were dark yellow and many organic materials were attached to them. Çorum watch tower and mosques walls and minarets were built by this stone (Tayla, 2007).

### ➤ Ergani Lime Stones

These stones were white and yellow color with many organic materials to them. Some voids inside of these stones. In Diyarbakır’s monumental buildings these materials were used in ‘alma ık’ style (Tayla, 2007).

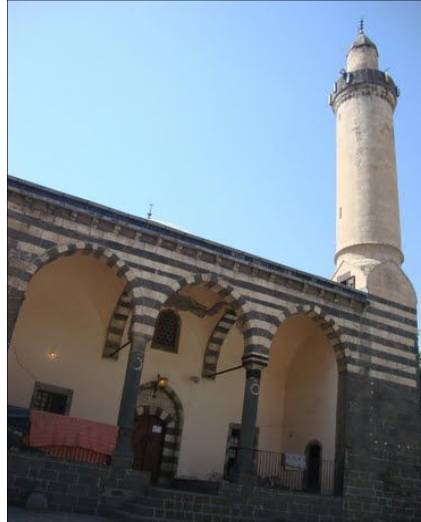


Fig 2.216: 'Diyarbakır Lala Bey Mosque', XV-XVI cent, Diyarbakır (Panoramia.com, 2012).

- Marnlı Lime Stones

The components of this stone were calcium carbonate and clay. The percentage of the clay was %10 to %20. The amount of the clay determines the lightness of the color and the density of the material. This lime stone were extracted from different mines and the stones get the names of these mines (Tayla, 2007).

- Gebze Marnlı Lime Stones

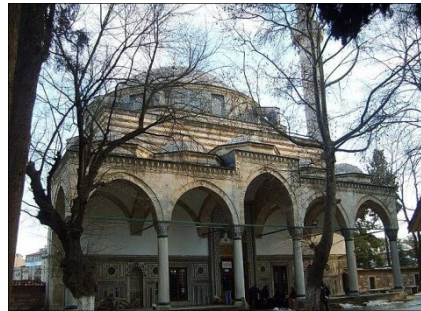


Fig 2.217: 'Gebze Çoban Mustafa Paşa Mosque', 1523, Kocaeli (Gokyuzuedebiyati.org, 2012).

- Appollon Lake Marnlı Lime Stones

- Urfa Marnlı Lime Stones

- Travertine

Travertine's were formed in calcium bicarbonate water drips. If these stones were formed in many holes and plant remnant called lime stone tuff. However limited holes and high density stone called travertine. Travertine was used as cladding materials in Ottoman. However in some parts of the Turkey the usage of travertine was changed. For instance in Ulucamii (Mosque) in Bursa, this material used as structural stone in the mosque (Tayla, 2007).

Like other materials travertines have different kinds. These kinds are written below:

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### ➤ Denizli travertine

These travertine's were used for building the Hieropolis cities theater. Important Roman buildings were built with these materials. The big bath was built with that material. The north of the Denizli there were a big theater belong to the Romans which made up of that kind of travertine (Tayla, 2007).

### ➤ Çankırı travertine

In Çankırı there was too many travertine mines around the city. The travertine's color was light and dark yellow or yellow color close to honey which were excavated from here.

These materials could be seen 20km bellow to the Eskipazar which color was close to white color. These stones were used by Roman's for the construction of Hadrianopolis Poythmice city buildings (Tayla, 2007).

### ➤ Ankara Malıköy taravertine

These travertines were the highest quality ones around the area. The density of that material is very high. The color of that material is close to white tones. And the strength of the material is higher than the other similar materials (Tayla, 2007).

### ➤ Antalya travertine

These travertines were used in Antalya fortress walls, port and to many historical buildings (Tayla, 2007).

### ➤ Bolu travertine

These travertines called 'küfeki' stone. This travertine has less holes inside the stone and the density of that material is high. These materials were used in Eskicamii mosque and Büyük camii mosque which were built under the patronage of Sultan Yıldırım Bayezid (Tayla, 2007).



Fig 2.218: 'Büyük Camii', 1899, Bolu (Bolunet.com, 2012).

Original "Büyük Camii" in Bolu was built in 1382. After the building was demolished because of the fire the new building was constructed in 1899. The style of this mosque is Late Ottoman.

### ➤ Bursa travertine

These travertine's were excavated form Pınarba 1 and Kale. These materials have low density and rotten. The holes inside of the material were composed by the rotten of the plant materials inside the holes. These materials could be allocated in the section of tuff lime stone.

However these stones were used in early Ottoman period buildings in Bursa. The lack of material source in Bursa was directed architects to use this material in very important buildings in Bursa. Ulucami

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(mosque), Ye ilcami (mosque), Emir Sultan Camii (mosque) are the first examples which were built this stone (Tayla, 2007).

### ➤ Konya travertine

These travertine's are high density and strength materials that were excavated around the Konya. Many of the Selcuk's and Ottomans buildings were built with these building materials (Tayla, 2007).

### ➤ Ni de travertine

These materials were excavated around the Ni de. Main specifications of these materials were high density and dark color. These materials were used in Pa a Camii (mosque), madrasa and military buildings (Tayla, 2007).

### ▪ Alabaster

Alabasters were generally formed by hydro formal type with addition calcium bicarbonate suspensions. The mines generally located near Kır ehir and Kayseri thermal water districts. These stones were different colors and mostly these stones were used for ornamentation (Tayla, 2007).

### ▪ “Terme” stone

The mines were located 1 to 1.5km to the south of Kır ehir city. These stones which were excavated from here were used in mosques, baths and many buildings. In Kır ehir Caca Bey Madrasa these materials were used in (alma ık) technique with the mixture of dark yellow travertine's with marbles (Tayla, 2007).



Fig 2.219: 'Kır ehir Caca Bey Madrasa', 1271, Kır ehir (Wikipedia.org, 2012).

### ▪ Serpentine Stone

Composition of these stones was magnesium silicate with speckled order light and dark green color. These stones volumes were increased and cracks were formed by getting water inside of their fabric. Sometimes these cracks were filled out mineral waters then marbled view formed. These types of materials called marbled serpentine stones (Tayla, 2007).

Most of the historical buildings in Turkey these stones were one part of the construction. Green stones that were used in columns in big mosques in İstanbul made up of serpentine stone. However there was not a certain clue about the origin of excavation of these stones in those buildings. One uncertain clue was; these stones were brought Midilli and Milos islands in the Aegean sea before 2000 to 3000 years ago. Serpentine stones used for constructing the buildings in Anatolia by different civilizations in that period of time. Ottoman's used these stones for constructing all type of buildings; mosques, tomb, madrasa's, baths and schools throughout their region (Tayla, 2007).

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### ➤ Bilecik Serpentine

To many years ago these stones were excavated around the Bilecik mines. These stones were colorful and they had different textures.

#### ▪ Sandstone

These stones are formed by very small sand grains. According to their connections, these stones called sand stone or gre. Bonding elements in these stones are silisium, lime stone or clay. Some organic materials could be inside of the stone.

According to the conjunction element, these stones could be divided into the sections. When the silisium found inside small sand grains these stones were very durable. However when the lime found inside of inside of sand grains these stones were not durable as silisium but their durability depends upon the density of the stones.

In Ottoman, especially lime based sand stones were used in building constructions. Haydarpa a train station was one of these buildings (Tayla, 2007).

### ➤ Lefke Osmaneli Gre

These stones were excavated from Bilecik Osmaneli district. The color of this stones was green with white grains. These stones were convenient for process and whittle. Haydarpa a train station elevation claddings were made up of these materials (Tayla, 2007).

### ➤ ile Stone

Grey and white color ile stones were used in Dolmabahçe, Beylerbeyi and the other important palaces in stanbul. On the other hand these materials were used in Mosques in Anatolia (Tayla, 2007).



Fig 2.220: 'Dolmabahçe Palace', 1856, stanbul (Wikipedia.org, 2012).

### ➤ Tekirda Ke an Stone

These stones were excavated from south side of the Çatalca which had dark mixed with green and grey color. These stones were used in historical buildings around Tekirda , Ke an and Malkara. Tekirda stone which were excavated from 22km west of Tekirda , were used in Rüstem Pa a and Orta Mosques and baths (Tayla, 2007).

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### ▪ Conglomerate and Breccia

Sand grains which were bigger than 2mm. and the combination of these bigger grains than the sand stone were done with natural bonding material. These bonding materials are the same with sand stone. Bonding elements in these stones are silisium, lime stone or clay. If the sand grains are angular it called 'Bre '. However if the sand grains are round these are called conglomerate (Tayla, 2007).

#### ➤ Hereke conglomerate

These materials were excavated around Hereke that were founded different spectrums of grey color. The red color was inside of the material which was formed by iron oxide bonding.

These stones were used in Byzantine period of time. Nevertheless in Bayezit Mosque courtyard arches, this material was used for constructing them. In ehzade, Süleymaniye, Cerrahpa a, Sultan Mehmet and Yenicami this material was used for constructing the arches as small pieces. The main importance of this material was the harmony of its color with white marbles. This was the reason for using it very frequently (Tayla, 2007).



Fig 2.221: 'Süleymaniye Mosque arches and columns', 1856, Istanbul (Wikipedia.org, 2012).

#### ➤ Bilecik Breccia

These stones excavated from north of Bilecik district mines. Bilecik district breccia's were named according to villages which stone mines were located. Vezirhan, Ta kesen, Gülümbe and Hitırlar were villages in Bilecik district which names were given the stones (Tayla, 2007).

Bilecik Breccia was high density stone. Some of the Bilecik Breccia's were excavated form the tectonic areas and therefore stone pieces were broke off different direction of tectonic movements. And the end of this process this stone took the shape of tectonic breccia (Tayla, 2007).

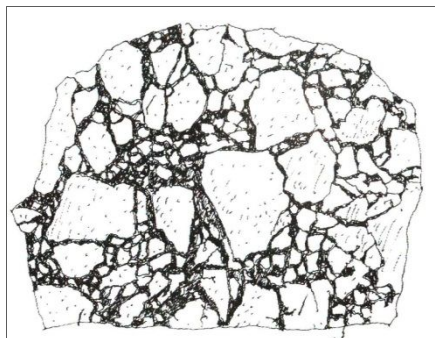


Fig 2.222: 'Tectonic breccia near Vezirhan' (Tayla, 2007)



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The grains were filled with in red color lime stone. In addition to that on these stones there were white calcite grains. These grains could be cracked and eventually these stones could be break down. Bilecik breccia had a different and beautiful texture however these stones were just used in cladding. Massive use in building construction was not purposed (Tayla, 2007).

In Bilecik district, Roman sarcophagus which Bilecik breccia stone was used was ruin right now. In addition to that, this stone material was used in some tombs of Ottoman Empire. In stanbul mosques, demand of this material was very low because of Hereke conglomerate colors were much softer than that one (Tayla, 2007).

### ○ Magmatic stones

Magmatic stones were grouped in five type of stones. Granite, Trachyte, Andesite and Dacite, Basalt, Pozzuolana, Tuff, Anglomera were the parts of this group.

#### ▪ Granite

Granites were formed by magmatic minerals which were quarts, feldspar and mica. In various types of granite, compositions of minerals percentage, textures were different. Granite was very hard to process on it. However this material was good at polishing. Therefore columns, obelisks, arches and slab structures were made up of this element. In Ottomans and previous civilizations some part of this material was brought from Egypt and the big part brought from mines in Anatolia.

Granite mines were differentiated with their mine origin (Tayla, 2007).

#### ➤ Kapıda Granite

The biggest granite mine in Anatolia. These granites were grey color with small grains (Tayla, 2007).

#### ➤ Armutlu Granite

These granites were in pink and white color because of felspar (Tayla, 2007).

#### ➤ Ezine Kestanbolu Granite

These garanites were excavated from Çanakkale Kestanbolu which color was grey. This granite was used for constructing columns from the ancient times. Near the Kocaali village, ancient columns which were constructed in the past could be seen. The diameters of these columns were 1.7m and the lengths of these columns were 12.5m.

Some of these columns were constructed 0.5m diameter and 2 to 3m length. These were used in many parts of stanbul in the Ottoman period. Approximately there were 40 big and 1000 small size columns could be seen around the mines. And also there is no doubt that these columns were used stanbul mosques which were grey color and massy (Tayla, 2007).

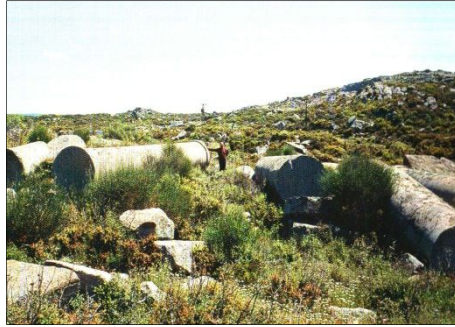


Fig 2.223: 'Granite columns in Çanakkale Kestanbolu' (Tayla, 2007)

### ▪ Trachyte

Trachyte's were one of the magmatic stones 'siyenitin' volcanic type. The constitutions of the minerals were felspar, quarts, 'liyotit' and silisium in %62 to 64 percent (Tayla, 2007).

These stones were cut and dimensioned as construction elements in the buildings. The more rigid ones could be used on the pavements of the buildings.

#### ➤ Afyon Trachyte

Afyon trachytes were especially found light to dark grey colors however sometimes the colors changed to pinky. These stones were excavated form Afyon city (Tayla, 2007).

#### ❖ Topuzlu Stone

Topuzlu stone found in pink and violet and were excavated from Topuzlu settlement (Tayla, 2007).

### ▪ Andesite and Dacite

Andesites were the type of diorite volcanic stone. The color of this material depends up on minerals of stone. The color of that material was grey, light or dark green, pinky and black. Generally these materials were high density. In these stones the percentage of sillisium was %60 (Tayla, 2007).

#### ➤ Ankara Stones

Ankara stones were excavated form the east part of the city center which were formed by 'doasit', tuff and pozzuolana. There were two main mines in Ankara that were Mamak and Araplar village mines. Mamak mines were located on the east side of the city. These stones were durable. Araplar village mines were located between Araplar villaga and Hüseyingazi Mountain. The Araplar village stones were looked like basalt plates and black color (Tayla, 2007).

#### ➤ Balıkesir Andesite

These stones were excavated near Balıkesir from Kızpınarı location. The color of these stones were pink, violet. These stones were used in Za anos Pa a Mosque (Tayla, 2007).

#### ➤ Erzurum Trachyte and Basalt

In Erzurum most of the old buildings, this stone were used as massive building element or cladding material (Tayla, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

### ❖ “Kamber” stone

The color of this stone was pinky and red. The manipulation process was very easy to apply to this stone. This stone excavated from Dumlu settlement- Kamber Village. This stone was used on the elevation claddings of some buildings and window jambs (Tayla, 2007).

### ❖ “Müdürge” Stone

This stone was light grey color which was excavated from 9km away from Müdürge Village. This stone was used on the elevation of ‘Çifte Minareli Madrasa’, Murat Pa a Mosque, Narmanlı Mosque, Kur unlu Mosque (Fig 25) (Tayla, 2007).

### ❖ “Sivi li” Stone

These stone was grey and green volcanic type tuff. In generally inside of this stone there were black pozzolana pieces could be seen. This stone were excavated from east part of the Erzurum city. Many of the historical buildings made up of this stone which were ‘Çifte Minareli Madrasa’, ‘Üç Kümbetler’, ‘Yakubiye Madrasa’, ‘Ulucamii’ and Castle were some of the parts of examples (Tayla, 2007).

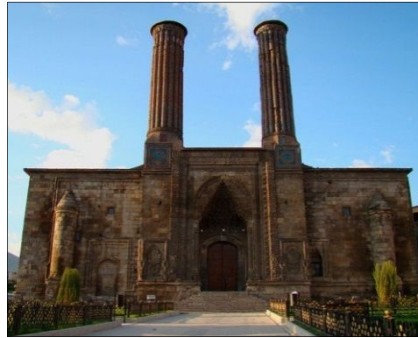


Fig 2.224: ‘Çifte Minareli Madrasa’, Erzurum (Wikipedia.org, 2012).

### ❖ “Topalak” Stone

These stone were excavated form the south-east side of the city. This stone were used in Muradpa a, Bakırlı and Dervi a a Mosques (Tayla, 2007).

#### ➤ Bolu Andesite

The mines were located 5km south of the city which were pinky and grey color. Inside of the stone felspar particles could be seen. In Bolu city this stone was used in many parts of the buildings (Tayla, 2007).

#### ➤ Isparta Trachyte

These mines were excavated from south west of the city from Derebo azı settlement (Tayla, 2007).

#### ➤ zmir Andesite

In zmir settlement, these stones were excavated from two locations that were ‘Kızılçullu’ and ‘Söve Ta ı’ from Foça (Tayla, 2007).

### ❖ “Kızılçullu” Andesite

These stones were excavated from south east of zmir which were green color (Tayla, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

### ➤ Kars Trachyte

The mines were located on the south side of Sarıkamı settlement. These stones were pinky trachyte's (Tayla, 2007).

#### ▪ Basalt

These stones were the part of gabbro group of magmatic stones. These stones were semi crystal, glassy texture with black and homogeneous and also they were very heavy. Many of the basalts texture were not smooth. These types of Basalts called basalt pozzuolana. This material has got high density with high strength and very durable. Therefore these materials were used in building construction, floor tiles, bridge and many building construction parts (Tayla, 2007).

### ➤ Diyarbakır Basalt

This stone was the main material in building construction in Diyarbakır city. In building construction there were two types of building elements that were used. One of these stones called 'di ita ' which was light easy formation process and easy excavated from mine. Therefore this material was preferred in the city. In Diyarbakır houses the courtyard floor tiles were built up on basalt (Tayla, 2007).

The other type of stone called 'erkekta ' which had high density. This stone were not used in residential settlements. In contrary this material was used on the wall of the Diyarbakır fortress, many of the mosques for instance Ulucamii, Fatih Camii, Safa Camii, Berham Pa a Camii, Melek Ahmet Pa a Camii were some of the buildings that 'erkekta ' was used (Tayla, 2007).



Fig 2.225: 'Berham Pa a Mosque', (1572) Diyarbakır (Wikipedia.org, 2012).

### ➤ Urfa Basalt

This types of stones were excavated from north of the Urfa city. Especially these stones were spongy and zeolite. If these stone had a very spongy texture they were called 'di ita '. This stones were resisted to the fire therefore these stones were used inside the ovens. High density Urfa basalt called 'erkekta '. This stones used on windows doors jambs and pedestrian bordures (Tayla, 2007).

### ➤ Manisa Basalt

These stones were excavated form Kula settlement and surroundings. Also these stones were spongy, light weight and volcanic. They were used for constructing the masonry walls of the houses in addition to that these stones were used in the second floor walls for filling element for the timber beams. Same stones were used for constructing the chimneys too (Tayla, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

- Pozzuolana, Tuff and ‘anglomera’

### Pozzuolana:

These stones were formatted according to specifications of magmatic stone. Trachyte pozzuolana, andesite pozzuolana, basalt pozzuolana were some examples of magmatic stones.

While ejection the pozzuolana from the crater, these materials were accumulate in the rivers, lakes and in the sea. These accumulations called volcanic tuff (Tayla, 2007).

### Tuff and anglomera:

These stones were ejected from the crater and formatted with the volcano ashes which called anglomera. In Turkey these stones and tuffs could be found in many volcanic areas. In mines, these stones were easily processed and excavated. In the open air these stones were hardened and lose their softness (Tayla, 2007).

In Turkey these materials were found to gather. Theses stones were used in buildings. On these materials shaped were given easily and they had different beautiful colors. Also these materials were very light. Therefore they used in mosques, landmarks and different building purposes (Tayla, 2007).

#### ➤ “Afyon” Stone

The types of Afyon stone were collected in two kinds. First one was Afyon Ayazin Stone, second one was Afyon Köprülü Stone (Tayla, 2007).

#### ❖ Afyon Ayazin Stone

These stone were excavated from 30km north of Ayazin village which was easily processed and white color volcanic tuff. It looked like Kayseri Yonu Stone, used form the ancient times. In the period of the Roman Empire this stone used in many monuments and also this material used for on the graves. In addition it used in Afyon city for building mosques and minarets in the period of Ottoman (Tayla, 2007).

#### ❖ Afyon Köprülü Stone

This stone were excavated from 10km’s from west of Afyon city which were dark and purple. The other specification of this stone was a high resistant to atmospheric conditions and water. This material often was used for building construction. The dark red types were used on building corners, window jambs, stairs and on the slabs. Stiff and black one was used in Afyon city ‘abide kaide’ and many building construction (Tayla, 2007).

#### ➤ “Od” Stone

This stone were excavated from Karamürsel between Gönceli. The material was green and volcanic tuff. It was a resistant to fire it known as ‘Od’ stone. In 18<sup>th</sup> century, this material was used for building ovens (Tayla, 2007).

‘Od’ stone which had a specification like tuff and agglomerate. This stone was brought from Karamürsel and stanbul district (Erguvanli, Sayar). In fig 2.226, the ‘Od’ stone was used as a construction material of window sills and posts.

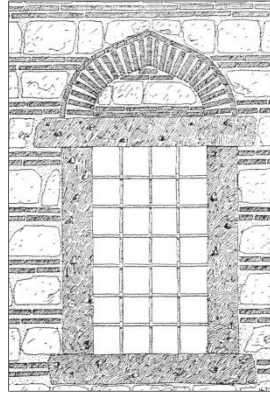


Fig 2.226: 'Od' stone was used as windows sills and posts (Tayla, 2007)

'Od' stone was very common use in Byzantine times. For instance 'Od' stone were used in Hagia Sophia and Aya Irini in Byzantine. In Ottoman these the usage of 'Od' stone were seen from 15<sup>th</sup> century. In Rumeli fortress entrance door walls (1452), Çandarlı Halil Pa a Towers outside walls and Fatih complex buildings (1463) foundations 'Od' stone were used. However the some historians evaluations described that these stones were brought form Byzantine buildings. The main clue for this thought was the size of these stones. In that period big size of the 'od' stones were found only in historical buildings (Barkan, 1972).



Fig 2.227: 'Fatih Complex Buildings', (1463-1470) stanbul (Ibb.gov.tr, 2012).

### ➤ Konya Sille Stone

This stone were excavated mines from Konya city Sille district away from 10km. These stones were trachyte and andesite. The formation of this stone was composed from sanidine and andesine crystals. And also the color was pinky. This was the important building material in Konya district. This material was used in early republic period and in Selçuk period of time (Tayla, 2007).

### ➤ Küthaya Tuff

These stones were white and grey color trachyte tuff which were excavated from 20km form the southwest of the Küthaya city. The local name of the stone was 'Köhke'. The Küthaya castle, baths, mosques and some of the official buildings were build up with that stone (Tayla, 2007).

### ➤ Ladik Stone (Andesite)

This material was pink, purple and reddish which look liked Ankara stone. This stone was used in the buildings of Samsun and surroundings (Tayla, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

### ❖ Terme Basalt

These stones were excavated 12km away from Terme settlement near Kocaman village. These basalts were used for building construction (Tayla, 2007).

#### ➤ stanbul Kavak Stone

These stones were located on the wide areas of two sides of the Bosphorus. This material was formatted from tuff and oglemera and excavated from Rumeli kava 1 stone mines. Light and dark green color tuff was seen more than oglemera. These stones were used in stanbul in different building types as cladding material or cut stone (Tayla, 2007).

#### ➤ Kayseri Yonu Stone

These stones were different colors of volcanic stones. Most of them were trachyte. These stones called 'yonu' by the localized people. White, cream, grey, yellow, pink, red and purple were the color of that stone which used from the ancient times (Tayla, 2007).

### ❖ Kayseri Yonuları (Tuff)

These stones names were called according the mine location. The most used one was excavated form 22km south of the Kayseri. From the Selçuk's there were fabulous buildings were built up on with this material. Kayseri fortress walls, Ulucamii, Hacı Kılıç Madrasa, Çifte Kümbet Madrasa and most of the traditional houses were built up with this volcanic tuff stone (Tayla, 2007).

#### ○ Marbles

Marbles were composed by the calcite crystals. These materials were formed by the limestone and dolomite with the formation of heat and pressure changes on that stone. In general the colors of marbles were white and grey. However with effect of other materials, the colors of the marbles changed to pink, red, yellow, black and brown (Tayla, 2007).

Homogeneity of marble enlarges the used areas of this stone from the ornamentation to building.

#### ▪ Marmara Marbles

From the beginning of Anatolian ancient civilizations in most important buildings these material was used. This material was excavated form Marmara Island in Marmara see which had white and grey color (Tayla, 2007).



Fig 2.228: Emirgan Fountain (1783), Marmara marble was used (Degisti.com, 2012).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

Marble had an important and dense use in Ottoman architecture. Most of the marble materials were provided from Marmara Island marble pit. These pits were operated from Ottoman Empire till today. For instance in Haseki Hürrem Sultan Bath, tomb of 3th Mehmet and Sultan Ahmet Mosque the marmara marble was used (Fig 2.229) (Refik, 1931). In fig 2.230, Firuz A a Mosque and its coloum cap was built by Marmara marble was shown. In fig 2.231, Firuz a a Mosque and its column base was built by Marmara marble was shown.

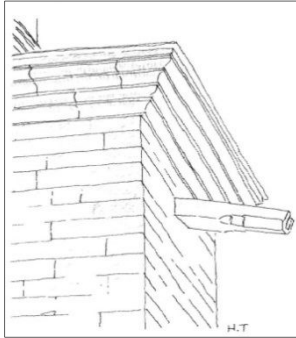


Fig 2.229: In Sutan Ahmet Mosque Marmara marble was used (Tayla, 2007).

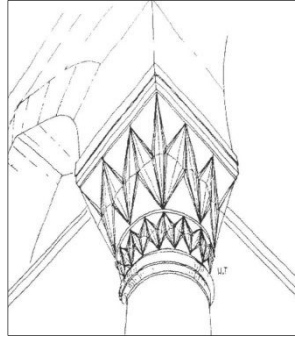


Fig 2.230: Firuz A a Mosque and its head Marmara marble was used (Tayla, 2007).

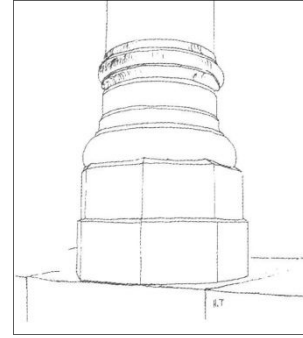


Fig 2.231: Firuz A a Mosque and its base Marmara marble was used (Tayla, 2007).

- Afyon Marble

Afyon marble mines were located in the north of Afyon near see Karahisar. The marbles which were excavated from these mines were very high quality. These marble mines were used in Greek, Roman, Byzantine and Ottoman buildings (Tayla, 2007).

- Aya Marbles

From these mines, white, yellow granule and grainy marbles were excavated (Tayla, 2007).

- Mu la Marbles (Hamursuz Stone)

These marbles image were grey color with crystalized lime stone which were excavated form Mu la (Tayla, 2007).

- Bandırma Marbles

These marbles excavated from Kayacık village which were located 3km southeast side of Bandırma. These were light and dark white color grainy crystalized limestone. These were used in Süleymaniye mosque and the other mosques marbles (Tayla, 2007).

- Yalova Marbles

These marbles were excavated between the Yalova and Orhangazi which were light blue color with tinny crystals (Tayla, 2007).

- Manisa Akhisar Marbles

These marbles were excavated from Mu tular Village which was white and grey color (Tayla, 2007).

- Kütahya Marbles

These marbles were excavated form 30km southwest of Kütahya city which had tinny crystals and white color. These marbles were used in historical buildings in ancient times (Tayla, 2007).



## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

- zmit Marbles

These marbles had tiny pieces with white color (Tayla, 2007).

- Çamlık Marbles

These marbles were excavated from Denizli, Çamlık settlement which were grey-white color and rarely yellow spot. These marbles were used in ancient buildings around the settlement (Tayla, 2007).

- Selçuk Marbles

These marbles were used in Efes antique city which were excavated from Bülbül Mountain and Maden Mountain (Tayla, 2007).

- Araç-Tosya Marbles

These marbles were located 32km away from Kastamonu city. In these mines, white and sometimes yellow grainy marbles were excavated. In Kastamonu mosques these marbles were used for constructing the columns, slabs and the other building materials (Tayla, 2007).

- Kır ehir Marbles

These marbles were excavated from between Kır ehir and Kayseri road near Çallıgedik – Kemeta 1 location which were purple color composed of breccia formation marbles (Tayla, 2007).

### 2.6.2. Brick and tiles

Started with the new political establishment of the Ottoman Period in Anatolia, in architecture; in building and in material usage the new period was begin. Early Ottoman architecture was developed parallel with building construction technology. New building construction technique was used in walls which called ‘alma ık’. ‘Alma ık’ wall construction technique was aligning the bricks and stones on following layers (Tayla, 2007).

In Ottoman period production of brick was done by private and government workshops. For instance in Süleymaniye mosque the arches and the domes were constructed by bricks which provided from private and the government workshops. Similar supply chains were used in other constructions. Therefore in that period of time it can be said that brick material were manufactured in an organized group (Barkan, 1972).

The bricks which were used in classical Ottoman structures were formed in different dimensions for different usages. In the Ottoman literature ‘tu la-i çar u’, ‘tu la-I miri çar u’, ‘tu la-I harci çar u’, which were the different names of brick was used in arches and walls. And they dimensioned with finger size and they measured 9 finger length flat bricks. For the dome construction ‘tu la-I kubbe’ special brick tiles for the dome was used. Their productions were done in very detailed way (Barkan, 1972).

Another special type of brick was ‘Çar ı’ which fabricated according to their sizes in three types. These brick tile was used in wall, arches and vault constructions. From the documents from classical Ottoman architecture, it was understood that there were other types of bricks which were used in different constructions (Barkan, 1972).

From that period of time Byzantine Empire was used brick in different dimensions. As well as in Selcuk’s, bricks size and usage were in different that Byzantine Empire. In Selcuk’s bricks were differentiated in to two groups. One of them is main brick (ana) and the other one is secondary brick

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

(kuzu). In Ottoman the horizontal dimensions of the bricks were bigger than vertical dimensions. In Bursa first buildings were built up with bricks elements of Byzantine buildings. The dimensions of these bricks were 39 - 40 / 39 - 40 / 4cm. These dimensions were taken from Yıldırım İfahane (hospital). In later periods of time these dimensions were getting smaller and formed to 28 - 30 / 28 - 30 / 3.5 – 4cm. These dimensions were used in longer period of times. However in some of the buildings after the dimensioning the tiles on the walls it realized that different types of bricks were used. And this could be the reason of using remnant brick materials from the other buildings especially from Byzantine buildings (Tayla, 2007).

On the following paragraph, the dimensions of the bricks in Ottoman period of time were listed.

- Hüdevendigar mosque – 1366 – Brick dimensions (39 / 39 / 3.5)
- znik Nilüfer Hatun maretı – 1386 – Brick dimensions (27 / 27 / 5)
- Bursa Yıldırım İfehane – XIV century – Brick dimensions (43 -44 / 44 / 4)
- znik Mahmud Çelebi Mosque – 1443 – Brick dimensions (36 / 36 / 4)
- stanbul Samanveren Mescidi – Fatih Period - Brick dimensions (30 – 35 / 30 – 35 / 4 – 4.5)
- Bursa Selçuk Hatun Mosque – XV century – Brick dimensions (39 / 39 / 3.3)
- Bursa Yi it Köhne Mosque – XV century – Brick dimensions (39 /39 /3.5)
- stanbul Hadım brahim Pa a Mosque – 1551 – Brick dimensions (29 – 30 / 29 – 30 / 3.5 – 4)
- stanbul Zal Mahmut Pa a Mosque – 1551 – Brick dimensions (28 – 30 / 28 – 30 / 4)
- stanbul Sinan Pa a Mosque – 1555 – Brick dimensions (30 / 30 / 5)
- stanbul Süleymaniye Bath – Architect Sinan Period – Brick dimensions (35 / 35 / 4)
- stanbul Ferruh Kethüda Mosque – 1562 – Brick dimensions (28 – 30 / 28 -30 / 3)
- stanbul Mihrimah Sultan Mosque – 1562- 5 – Brick dimensions (27 - 29 / 27 – 29 / 3)
- stanbul Azapkapı Sokullu Mosque – 1572 – Brick dimensions (29 – 30 / 29 – 30 / 4 – 5)
- stanbul Kılıç Ali Pa a Madrasa – 1580 – Brick dimensions (24 – 24 – 4)
- stanbul Kılıç Ali Pa a Bath – 1580 – Brick dimensions (34 / 34 / 4)
- stanbul vaz Efendi Mosque – 1585 – Brick dimensions (30 / 30 / 4.5)
- stanbul Mısır Market – 1660 – Brick dimensions (21 / 21 / 3)
- stanbul B. Hasan Pa a Hanı (Commercial building) – XVII century – Brick dimensions (28 / 28 / 3)
- stanbul Damat brahim Pa a Külliyesi (Complex buildngs) – 1720 – Brick dimensions (20 / 20 / 3)
- stanbul Laleli maret (kitchen for the poor) – 1763 – Brick dimensions (27 / 27 / 3)
- stanbul Zeynep Sultan Mosque – 1769 – Brick dimensions (23 – 24 / 23 – 24 / 2.5 – 3)
- stanbul Mustafa Pa a Tekkesi – 1769 – Brick dimensions (27 / 27 / 3) (Tayla, 2007).

In Ottoman period the dimensions of the bricks were generally 39cm-40cm-4cm. However in Architect Sinan period of time the dimensions of these bricks were 30cm-30cm-4cm. In XVII and in XVIII century the dimensions of the bricks were smaller to 25cm-25cm-3cm. In (kuzu) bricks these dimensions were half of it (Tayla, 2007).

In Ottomans unglazed bricks order on the wall were different than the Selcuk's. In this period of time minarets and 'Ye il Türbe' were the good examples of brick pattern ornamentation. Unglazed brick was used in many types of buildings in that period time. However glazed brick patterns on the walls were limited application than Selcuk's period of time (Tayla, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

In minarets especially special type of brick was used. Also on the minarets walls there were different kinds of ornamentations. But they were different than the Selçuk's motives (Tayla, 2007).

Ottoman architecture brought new pattern styles in brick wall construction but it had a strong connection to its past. Erzurum Çifte Minareli Medrese was a good example from Selçuk's (Tayla, 2007).



Fig 2.232: 'Çifte Minareli Maedrese', Erzurum (Yapı.com.tr, 2012).

In Ottoman Empire, the designs of the brick from Selçuk's were developed and Ottomans designed different brick patterns. In fig 2.233, minaret brick patterns in Ottoman Empire are shown.

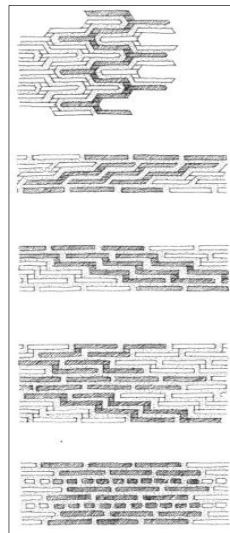


Fig 2.233: Minaret brick patterns in Ottoman Empire (Tayla, 2007).

### 2.6.3. Timber

In this chapter, the use of timber material in Ottoman architecture, the types of timber materials that used in building construction and the process of timber material production were semitized.

In the inventory of Süleymaniye construction, it was noticed that the ratio of timber purchase were very high. Therefore it could understand that timbers were used in the scaffoldings, foundations and moldings. As well in these inventories, it could be understood that these timber pieces were used in post and beams, floor coverings, roof construction. Instead of these timber pieces usages in construction, their quality were mentioned about in these inventories (Barkan, 1979).

In one of the inventory of construction which named was 'Narh Defteri (1640)', it was written that; for the posts the sections were dimensioned between 7x7 finger size (21.7cm x 21.7cm<sup>2</sup>) and 10x10 finger

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

size (31cm x 31 cm<sup>2</sup>) and the posts lengths were dimensioned between 3 ‘zira’ (2.27 m) and 15 ‘zira’ (11.37 m) (Refik, 1931).

Also in these inventories, it was mentioned about the origins of the timbers. For the construction sites in Istanbul region timber were brought generally from the black see and the Marmara regions (Refik, 1931).

In general timber material was used in wide perspective in different building typologies. These were religious, social, commercial, residential and prestigious building typologies. In residential buildings some of the buildings were constructed totally timber and some of them constructed half-timber and half masonry. Wealthy people in the community were chose expensive timber for their residential construction for instance oak, walnut and linden.

In north-east part of the Anatolia chestnut timber, in Mediterranean and middle part of the Anatolia cedar tree is wildy used.

In prestigious buildings in the Ottoman, the buildings were built in masonry in case in some of the mosque buildings timber posts, timber cladding were used. In these timber mosques, the oval beams were made up of poplar timber, the other were built up of much resistant timber like pine and cedar tree. In these buildings especially mosques pulpit, sermon bench, window shutter and doors were built up on oak, chestnut and ebony. Infrequent timber walnut was used for to constructed ‘mimber’ pulpit, “‘künderkari’ geometrical figures of timber pieces and connected together for forming different ornamentation”. ‘Künderkari’ was used in doors. In fig 2.234, ‘künderkari’ door ornamentation was used in ehzade Mosque’s main entrance door (Tayla, 2007).

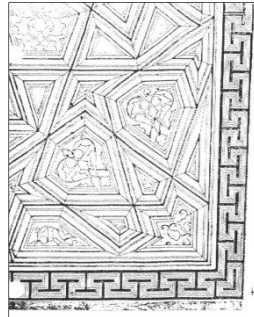


Fig 2.234: ‘künderkari’ door ornamentation was used in ehzade Mosque’s main entrance door (Tayla, 2007).

In Ottoman Empire residential units were assemble in tree units which were masonry, masonry and timber or timber construction. In timber buildings different kinds of timber elements were used. These kinds were listed on the following paragraph (Tayla, 2007).

- Hard Trees: Oak, chestnut, beech, elm, ash tree, beech
  - White Trees: Different kinds of pines, poplar, basswood, plane tree, oriental beech
  - Resinous Trees: Resinous tree, cupressus, torchpine
  - Valuable Trees: Walnut, ebony, citrus, apple tree, pear tree, cranberry, boxwood, cashew
- Oak

This timber was very stiff and high strength. The quality ones of this timber were used for window and door construction. The second qualities were used for beams, posts and for floor claddings (Tayla, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

- Chestnut

This timber was not stiff and high strength like oak tree. Therefore this tree was not appraisable like oak tree. However the prize value of this tree was less than oak and it was easier to process this timber. For those reason this timber was used for window and door frames (Tayla, 2007).

- Beech Tree

The manipulation and working process on that timber was easier therefore this material was used in carpentry and engraving (Tayla, 2007).

- Ash Tree

This timber was stiff and it was very hard to manipulate and work on it. This material used for garden and exterior doors because the type of timber generates cracks on that furniture (Tayla, 2007).

- Elm Tree

The specifications of that tree were similar with ash tree. And also this timber was used for the same purposes with ash timber (Tayla, 2007).

- Poplar Tree

In construction, this material was the lowest quality material. This timber was soft and also easy to work however because of its softness there would be cracks on the surface of that timber. Some of the types of poplar timber were high quality and it could be used in slab, ceiling and wall frames in timber construction houses (Tayla, 2007).

- Linden Tree

This timber was light and it was easy to process and manipulate it. Therefore it was used in engraving, cupboard manufacturing, fence of stair cases and sometimes used in window frames (Tayla, 2007).

- Beech Tree

This tree was soft and the quality was better than poplar. However this tree is not convenient for construction (Tayla, 2007).

- Non - Resinous Pine Tree

This timbers were flexible and they used in ceilings and slabs. And also this type of timber was in posts, beams and foundation piles when the timber pieces were combined to gather (Tayla, 2007).

- Resinous Pine Tree

These timbers were flexible as non- resinous pines however resinous were adding extra strength to this material and it was higher quality than non-resinous pines. Therefore this material was used in cladding, outdoor frames, window frames (Tayla, 2007).

Torch pine tree plates were used for on the top of the masonry wall for conserve the wall from the environmental effects (Fig 2.235). This type of construction used in traditional Turkish timber houses in Black sea region of Turkey.

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

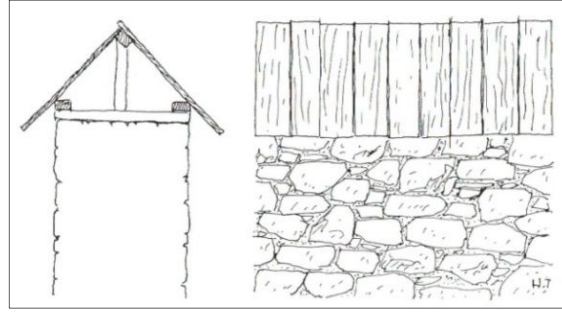


Fig 2.235: 'Torch pine tree plates were used for on the top of the masonry wall' (Tayla, 2007).

### ○ Walnut Tree

This tree was valuable and it was high strength. It could be used in different directions to its grains. It used in modeling, engraving, floor parquet and slab construction in timber buildings (Tayla, 2007).

### ○ Ceshew Tree

This tree was not the original tree in Anatolia. Therefore it was valuable and used in table, cupboard and floor parquet construction (Tayla, 2007).

### Timber manipulating processes in construction

There were four groups of process in construction.

- First one was the logs.
- Second one was the piled logs but they are not leveled.
- Third one was dimensioned logs with ax.
- Fourth one was dimensioned and leveled logs with saw. These timber pieces were used as post, beam, slab and timber pieces.
- Fifth one was the tiny dimensioned pieces for covering the surfaces. These pieces were panels and they were used for covering the ceilings and floors (Tayla, 2007).

### 2.6.4. Iron, lead and bronze

From 16<sup>th</sup> century in Ottoman Empire buildings, iron was used in widespread. Therefore it could be said that iron material got its importance in a time manner. In Süleymaniye complex buildings, big amount of iron were used in the construction. It could be seen from the inventories of Süleymaniye complex buildings. In walls the materials were attached to each other by iron roads. The edges of these iron roads were put inside of the stone and they bunch together with molten lead poured in to these holes. Therefore in this type of construction the amount of iron roads and lead were higher than the other usages in the building constructions (Tanyeli, 1990). In fig 2.236, iron roads were seen (Tayla, 2007).

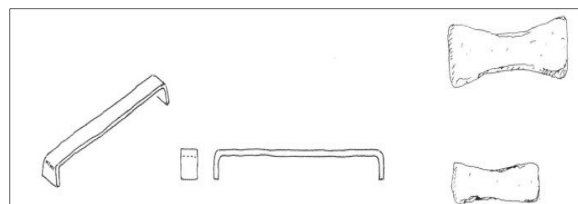


Fig 2.236: Iron roads (Tayla, 2007).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

Iron material was used in wide areas in building construction not only the connection rods of walls. It was used as tension rod between the arches. For instance in II Sultan Selim Tomb (1576), outside walls and the resting line of the inside of the dome were attached to gather with iron tension rod (Tanyeli, 1990).

The iron rods were used as different purposes rather than building construction. They were the main material of nails, window fence, door and window hinge etc. in Ottoman building construction. The usage of lead material was increased parallel with iron especially for the dome cladding (Tanyeli, 1990).

Lead material did not have a common use in early period of Ottoman Empire. The usage of lead material was increased after 16<sup>th</sup> century. For the cladding purposes in 15<sup>th</sup> century roof tile material were used. However in rare application lead material was used as a cladding in some of the mosques in Anatolia. Istanbul region was out of these scales. Lead material was used in many of the constructions in Istanbul (Tanyeli, 1990).

Bronze material was used for covering the fence of the windows, doors shutters badge and belt, hinge, hook, these kinds of toolkits. In iron fence of the windows, bronze material was get through these iron fences. In fig 2.237, the iron fences with bronze cover in Üsküdar Atik Valide Mosque could be seen (Tanyeli, 1990).

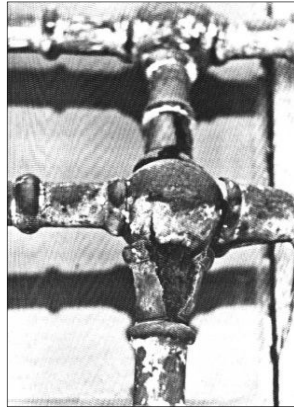


Fig 2.237: Iron fences with bronze cover in Üsküdar Atik Valide (Tanyeli, 1990).

### 2.6.5. Lime and ‘Horosan’ mortar

Lime mortar used for the wall plaster and mortar. The size of the sand determined the type of lime mortar, used for constructing wall material or used for wall plastering the wall (Tanyeli, 1990).

According to the Ottoman inventories, they were brought lime from Gebze and Damra and Hereke. Also the good quality lime was brought from Rumelian (Barkan, 1979).

‘Horosan’ mortar was formed by baked clay mixed with oily lime and brick pieces and brick dust. This technique is well known from east and west nations. Romans used this type of mortar with ‘pozzolana’. However this type of mortar was used in Egypt and it is called ‘homra’ and same mortar was used in India and it is called ‘surkhi’ (Tanyeli, 1990).

Ottoman mortar and plaster get its name from “Horosan”. The brick and tile pieces are hammered and formed to be ready to use in the mixture of “horosan”. This mixture combines with lime and other materials in the construction site. There are three types of “horosan” mixtures; first type is brick granules, second one is tile granules and the third one is the powder (Kolay, 2001).

## CHAPTER 2: HISTORICAL REFERENCE OUTLINE

### 2.6.6. Used building materials in Turkish seigniory period in Western Anatolia

For the masonry wall construction; stone, brick, timber and for the binding material mortar was used in Turkish seigniory period. Stone material was used frequently in south seigniories Menteşoğulları and Aydınsoğulları. In these locations stone materials which were excavated and also similar materials were taken from the existing buildings. These stones were randomly used on the walls. The most used type of stones were limestone, marble, calcareous, limestone, types of andesites. However in the building calcareous type of stone were used frequently as a rubble stone. For exception in “Eski Çine Ahmet Gazi Mosque”, lime stone used as a cut stone (Kolay, 1999).

### 2.6.7. Used building materials in early period of Ottoman

The building elevations texture in the early period of Ottoman architecture was formed with stone and brick “alma ık” with alternative strips of the surface layers on masonry walls. In addition plasters, blind arch, big opening arches, brick ornamentations were come forward according to the importance of the elevations or buildings. The masonry wall was built up with siliceous stream stones (rubble stones) with “alma ık” brick and stone patterns between the years of 1300 and 1350. In the second half of the same century, there was a continuity of using rubble stone however in the monumental buildings or elevations of these buildings “küfeki” type cut stone were used (Ersen 1986).

In the first half of the 14th century, without “söve - jamb”, with timber lintel window opening were used. In the second half of the same century, “söve – jamb” was constructed with marble and “küfeki” stone. Construction with collecting materials from the ruin buildings were widely used between 1300 and 1350. However in 1350 and 1400, the usage of collecting materials from the ruin buildings were became decay because of the number of these buildings was decreased and the masons were produced their own construction materials in their workshops (Ersen 1986).

The construction materials which were produced in the workshops of the masons were shaped and took their forms from essences of the collecting materials form the ruin buildings such as riwaq columns, window and door jambs (Ersen 1986).

The stone and brick “alma ık” wall were constructed with the design of repetition, scale and the mortar joint principles with eclecticist and unstable state in the first half of the 14th century. However in the second half of the century the principles of masonry wall construction were determined and applied. The joint material was “horasan” mortar which composed with sand, lime, brick dust and pieces. The color of this mortar was lighter than the buildings which were remained from Byzantine. The riwaq columns were constructed in same principle with “alma ık” masonry walls. Besides there were few examples of riwaq columns which were constructed with solely cut stone and brick. For instance in Bursa Hüdavendigâr Madrasa riwaq columns were constructed with solely brick material (Ersen 1986).