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Brick as a Construction Material in the Modernization Process of The Ottoman Architecture

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Abstract Brick used with stone in an alternate order -especially on monumental masonry buildings- is one of the basic construction materials in Ottoman classical architecture. Parallel to the announcement of Tanzimat Declaration (1839), to the political and economical relations improved with European states and to the Industrial Revolution in Europe, an effective change had been seen on design concept and construction techniques in Ottoman architecture. Many new buildings were built using modern materials and imported techniques such as solid brick (in western norms) masonry walls, steel beams at the horizontal and vertical bearers, cement and concrete. The product of modern solid bricks in western standards had been realized in Ottoman territories in the last quarter of 19th century. The base of this research is constituted on 334 imported and local product solid bricks which remain to Zihni Göğer's (firstly documented for this research), to Uzay Yergün's, to Aynur Çiftçi's and to the Yıldız Techical University, Department of Architectural Conservation's private collections. Most of the bricks are in a good condition, clean and have stamps. From the stamps one learns where they were produced, in which country or even city, the names of the plants, the logos and the dates of product. During the documentation every brick is numerated, photographed and a catalogue is prepared including the dimensions of the bricks. The demolotion of the buildings made of solid brick masonry walls-especially those which are not registered as an essential cultural asset- the interventions undertaken and the use of new materials during restoration of bearer walls have damaged the original bricks. Finally they were not conserved and documented. The aim of this paper is to determine the change of the production and the standarts of the bricks, to indicate their varieties, their fields of use and their conservation problems before and after the modernisation period of Ottoman architecture. It is intended to take into consideration the conservation and documentation of this material during renovations reflecting the original construction technique of the period that belongs to monumental and civil architecture.

Keywords: brick, Ottoman, architecture, modernization, imported, factorial, traditional, local, catalogue, collection, inscription, sign, stamp.

Introduction

The bricks have been produced in three different sizes depending on the use of their place in Ottoman architecture before the industrial period namely as follows; "tuğla-i carşu" (full brick), "tuğla-i miri carşu" (half brick) and "tuğla-i harci carşu" (large bricks) (Arseven 1965). Full brick is 24x24, 28x28, 30x30 cm in size and has 3, 3.5, 4, 4.5 cm thickness (Fig. 1). The Piripaşa and Kırkağaç districts located along the shores of the Büyükdere and the Golden Horn are very important production centres since the Byzantine period (İnciciyan 1976).

The standard bricks have been produced which have improved physical properties and increased mechanical strength, in 19th century in Europe in parallel to technological developments in the industrial revolution process. Saint-Henri and Saint-André settlements in the city of Marseille in France became well known production centres all around the world with their brick and tile factories in the middle of the 19th century (Brion 1996). The first tile and pottery production in Marseille is dated to 1809, according to the document signed by Napoleon. The raw bricks were replaced with

baked bricks because of its strength to the pressure after 1830's. The first mechanical brick machines which have products in modern techniques first emerged in the UK in 1840's (Guillerme 1985).

The second brick oven which makes fabrication product has been a model to many ovens in Marseille with its chimney of 6 m. diameter and as much height, according to a document dated to 1866. During this period, the central chimneys were built 2 m. higher than the ovens, after 1870s they were built in 10-15 m. in height to prevent the emission of the smoke to the land, eventually after the Hoffman ovens that ends the artistic production which burns constantly the chimneys were built in 30-40 m. in height. The old style ovens did not used from 1880s. A different type of hollow bricks has emerged in the process of industrial development between the years 1850-1895 in Marseille. This bricks have not been moulded as old bricks; they have produced in rolling mill benches. Previously they have produced 5-7x11x22 cm in size close to traditional bricks, gradually the dimensions were in 11x11x22 and lastly reached to 15x20x40 cm (Ratier 1989).

The Usage of Imported Factorial Brick in Ottoman Architecture

The Ottoman Empire has tried to change firstly its military organization, the life values of the palace and the environment, after all the concept of the architectural approaches, by contacting to the European states to reach the level of modern era's civilization since the first quarter of the 18th century. The breakpoint of the modernization process which is called as "Westernization" is the Tanzimat in 1839. The view of the Tanzimat period in architectural field was to gain an image of a Western capital to Istanbul. Therefore, it is aimed to build the new type of structures in accordance with the principles of the western architectural design, using modern building materials and construction techniques. The Russian Embassy Building that was built with industrial brick, which was commissioned by Russia, has been appreciated by the Tanzimat administrators in 1838 in Istanbul. Therefore, G.T. Fossati, the architect of the Russian Embassy building, was commissioned to build the "Bab-ı Serasker-i Hastanesi"/Military Hospital (1843)" and "Darülfünun"/University (1845)" buildings that imported bricks were used for the first time. The intensive construction activities of Tanzimat era were carried out by Fossati and foreign architects coming from European countries rather than Balyan family who were the palace architects (Yergün 2002). Some incentives and legal arrangements were provided to the public to promote the industrial brick usage in the civil architecture as well as public buildings.
Various building materials were imported from European countries as a result of the treaty of amities and trade agreements accomplished by the endeavours to snatch the Ottoman market since the first half of the 19th century. It can be understood from the scrutiny of period buildings that bricks are usually imported from Marseille of France and Livorno of Italy for the simple reason that shipping would make the transportation easier. According to documents, 1.167.000 pieces of baked clay materials (brick, roof tile and floor tiles) were exported from Marseille to Turkey in 1860 (Ratier 1989). Roof tile and brick was imported from Livorno because of the low quality and high production costs of the factory in Büyükdere which the State was also a significant shareholder (Önsoy 1988). It is possible to reach the names and addresses of the companies that imported these materials from the Ottoman trade annuals of the 19th century. Among these companies, P. Gulbenkian & Cie, S. Cappou & J. Pelletan etc. can be named (*Annuaire Oriental 1889-1890*).

The data of the producer's names and product locations have been reached from number of 8 bricks that have writings and stamps which belong to the collection that is the topic of the research. 6 pieces of bricks from Marseille in France: "GUICHARD FRERES ST HENRI MARSEILLE " (Fig. 2), "JAG / GUICHARD FRERES HENRY ST HENRY MARSEILLE", "GUICHARD &PIERRE FRERES SÉON ST HENRY MARSEILLE FRERES ", "... ... BRIQUETERIE SÉON MARSEILLE", " PIERRE AMEDEE ST HENRY MARSEILLE ", 1 brick from Livorno in Italy:" A.C. TASS ... . LIVORN... "; 1 brick from Belgium: "ESAPB ST GHISLAIN" have been identified that they have been imported have been identified.

It is thought that the other 3 bricks have been imported from Marseille, the one which has a heart sign from "Roux Frères", the one which has an anchor sign from "Antoine Sacoman", the one which

has a star sign from "Pierre Sacoman" or "Pierre Maurel," or "Lançon Pierre ". The numbers of 21 produces are known from the signs that they use on the products through the produces that make the product from baked soil in Marseille (Ratier 1989).

The Plants that Produce Fabricated Bricks in Ottomans

It has been possible to identify the names and locations of a series of brickyards in Istanbul from the maps dating back to the 19th and beginning of 20th centuries. According to Moltke Map dated 1268/1851-52, there were 1 brickyard nearby the waterfront in between Selimiye Artillery Barracks and Haydarpaşa Hospital and 3 brickyards in the area of intersection between Golden Horn with Kağıthane River. It is stated that there were brickyards along Şişli-Darülaceze, Şişli-Büyükdere and Şişli-Halıcıoğlu roads, the vicinity of Levent Farms, and "Şahbaz Oğlu Brick Factory*"*in Karaağaç on Golden Horn coasts as well as 4 others nearby, on the coast. In the maps of German Blue of 1913-14, too, brick production plants can be observed Eyüp Bahariye Street along Golden Horn.

According to written sources, brickyards have been established in Karaağaç along Golden Horn in 1874, in districts of Feriköy and Hasköy in Büyükdere in 1876, outside the Istanbul, on the other hand, in Mürefte and Eceabat near Çanakkale (Mori 1906). According to an archive document of 1304/1886, there is a brick factory around Yıldız Palace (Çiftçi 2004). According to Ottoman trade yearbook dated 1894, "J. Camando" in Göksu "Mustafa et Cie" in Galata, "Pasquale Rossi" in Feriköy and "M. Pierre Salomone" (Fig. 3) in Büyükdere are indicated as major brick producers. Furthermore, these factories are founded in the following locations and dates; "Pedotti" factory in 1913 in Tuzla (Göğer ve Sandalcı 1997), "Şahbaz Agia" factory in 1882 in Sütlüce, "Paşabahçe" factory in 1910, "Haznedar" factory in 1918 in Merter, "Topser" factory in 1951 in Büyükdere, (Köksal ve Ahunbay 2006, Koçu 1963).

The information of the various brick producer's names and the location of the product places are reached from the writings which take place on the bricks that are part of a special collection constituting the source of the research. The plants have been identified from the examination of different places. These are: 14 complexes in Büyükdere: "BRIQUTERIE D. DEMETROPOULO BUYUKDERE", "BRIQUTERIE HALILBINTIHAMED BUYUK-DERE" (Fig. 4), "BRIQUES BUYUKDERE A.N.", "BIEN PRESSE B.I. BUYUKDERE""ATM ST .... BRIQUETERIE BUYUK DERE", "HALIL AHMED BRIQUETERIE BUYUK-DERE", "MANİZADE & TACHDJOGLOU BUYUK DERE / CONSTANTINOPLE", "SARAF BUYUK-DERE", "BOUYOUK DERE 1901", "D. F BUYUKDERE", "B-DERE" / "AMS", "ALI NAM BOUYOUK DERE", "ΚΩΣΤΗΣ-ΚΟΡΦΙΑΤΗΣ MITONMAP ΣΣΕ BUYUCKDERE" and "TOPSER BÜYÜKDERE". 2 plants in Istanbul: "CONSTANTINOPLE", "K. DEMIRDJIAN CONSTANTINOPLE"; 3 plants from Kararağaç at the shore of the Golden Horn, in the Kırkağaç and in the Hasköy: "CARA-AGATCH CONSTANTINOPLE", "KERK-AGATCH CHAHBAZIAN CONSTANTINOPLE" (Fig. 5), " CHAHBAZIAN HAS- KEUY BRIQUETERIE DE TOUTES QUALITES"; 5 plants from Paşabahçe and Göksu in the Bosporus "SOCIETE OTTOMANE TUILERIE PACHA-BAGTCHE" (Fig. 6), "BRICFIELD COMPANY Ld PACHA -BAGHTCHÉ", "H GÖKSU- in Ottoman writing -T", "BRIQUETERIE TUILERIE GUEUK-SOU", "CHENNE BOSPHORE"; 2 plants in Tuzla near Istanbul: "PEDOTTI" (Fig. 7) and "S. P. TOUZLA".

2 plants have been identified in Mürefte near Çanakkale outside of Istanbul: "AXMET AΛH ΠΑΣΣΑ MYPIOΦYTON" (Fig. 8) and "DEMETREIUS X LAGHIAS MYRIOPHYTON"; also 3 plants in Eceabat: "IΓ MAΔTOΣ", "NK MAΔTOΣ" and "ΔΔM MAΔTOΣ " from the inscriptions and the signs on the bricks. The "FRATELLI ALLATINI SALONICCO" (Fig. 9), an important company is also one of the significant producers which sent bricks to Istanbul from the city of Thessaloniki in Greece (www.allatini.gr).

These plants that were active in the 19th century did not survive to the present day. There are only ruins of 2 of these plants (Köksal ve Ahunbay 2006). Therefore, the detailed information regarding the genuine architectural characteristics of the brick factories and ovens cannot be obtained. It is only possible to have a general opinion about the architecture of "Ömer Çetinel Brick Factory" in Kağıthane that can be seen in the photography collection organized in the 19th century.

The Use of Fabricated Brick in Buildings

There are original information regarding how bricks are produced and where they are used in the architectural books published in the 19th century. Among them, according to the illustrations in the book "Traité Théorique et Pratique de l'Art de Bâtir" by Rondelet published in 1827 in Paris brick walls can be laid in 13 different manners.

In a published work in Ottoman language, which was a military architectural book dating to the end of 19th and beginning of the 20th century, there are information regarding the characteristics of bricks produced in the 19th century and the places they are used under the headings of "Masonry Construction Above the Ground", "Mud-brick Walls", "Masonry Walls", "Brick Constructions", "Chimneys", "Baths & Laundries" and "Brick". According to the book, there is a profound variety of bricks. The least qualified is the slime brick. Dry brick can be classified into degrees according to its production and baking process. Mechanical bricks are usually more appropriate for regular use. Pressed bricks are mainly used for purposes of decoration. Bricks imported from Europe are more expensive even if they are of better quality when compared to local bricks. However, there are local bricks which are convenient for use. Good quality brick should have plain and regular faces elevations should be dense and fine, should not contain foreign substances, and should give a clear and metallic sound while being laid with other bricks. Bricks are usually in dimensions of 22-25x11-12x 5.5-10 cm.

Bricks are used in buildings for foundations, walls, floors, door and window arches and jambs. The building parts weight of which needs to be reduced is laid with hollow bricks. Stove chimneys in mud-brick walls are laid either by stone or brick. Ovens and chimneys of places that deal with fire such as kitchen, bakery, iron-workshops and blacksmith workshops are made of fire-bricks (*Demirbaş*.....).

General Evaluation and Conclusion

The total of 334 bricks 263 pieces of which belong to the collector Zeki Göğer, and 71 pieces of which belong to the collections of Uzay Yergün, Aynur Çiftçi and the Yıldız Technical University Department of Restoration comprise the basis of this research. The specialities of bricks are given generally in this part because the catalogue which includes the sizes and the photos of all bricks and classified according to the various criteria, could not take place within the limitations this paper. It is identified that, of the 334 pieces of brick in total with each of them are different according to the inscriptions and signs, number of 175 bricks are local product from Ottoman Era and Republic Era after 1923, 8 of the bricks have been imported. The 23 bricks which have only the sign and emblem on their surface have indicated that 7 of them are local product and 3 of them are imported. The numbers of 13 brick's producers could not be identified. The 97 local product bricks can be dated from the second half of the 19th century up to the first quarter of the 20th century. The producer's names and location are indicated on; 25 of them which are written in Ottoman (Fig. 10), 28 of them which are written in Greek, 1 of them which is written in Ottoman-French-Armenian and 1 of them which is written in French-Jewish. The 41 bricks were produced in the Republican Era after 1923. There are inscriptions and a script signs on 6 of the locally produced bricks, 2 of the hollow bricks have it on their sides and the 7 of the corner bricks have it on their front surface (Fig. 11), The various symbols of anchor, moon and star, star, bird, heart, etc. have been identified on the number of 24 bricks from the total 334 brick (Fig. 12-14).

It is observed that brick sizes change in a range of 9-13, 5 (width) x 18-27 (length) x 3-8, 5 (height) cm. According to this, it is identified that the thinnest brick is a local production and belongs to after Republican Era, which has a stamp written "ARSLAN" in 3 cm. height size, the thickest brick is also thought to be a local production which has a stamp written "C .... B" in 8, 5 cm height size, the longest brick's producers cannot be known but it has a stamp written "V ...." in 27 cm. in height, and the shortest brick is an unwritten and unstamped one in 18 cm. length, while the narrowest brick which belongs to after Republican Era has a stamp written " PALA ", the widest brick is thought to be local

production, which has a stamp written moon and star is in 13.5 cm. width size. It is observed that the colour of the bricks changes with light and dark colours between yellow and red according to the degree of their scouring and the properties of the raw material used in the production. The brick producers in Istanbul seem to have accumulated in the Golden Horn and the Bosporus, because of the abundance of the raw material and the ease of the shipping.

It is observed that brick material could not be preserved due to the removal of various load bearing and partition walls as well as traverse floors because of the changes made in the genuine construction techniques during the repair and restorations conducted on the buildings. A special significance should be given to the conservation of the bricks that provide important data in dating of the cultural heritage under preservation because of the inscriptions, signs and the dates on their surfaces. The bricks should be preserved without changing the shape and the material properties in restoration process because of they are original elements in terms of industrial and architectural history, in special cases whereby it is impossible to preserve them in their original places they should be preserved in a different place after being documented. A few bricks should be left visible during the repairs as they constitute important data from the viewpoint of the dating and displaying the construction technologies. The collection of 334 bricks which forms the basis of research must be preserved and exhibited in a convenient place under the supervision of experts.

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Figure 1: Traditional Ottoman

Figure 2: Imported brick from Marseille

Figure 3: Local production of Büyükdere

Figure 4: Local production of Büyükdere

Figure 5: Local production of Şahbaz plant

Figure 6: Local production of Pasabahce

Figure 7: Local production of Pedotti plant in Tuzla

Figure 8: Local production of Mürefte

Figure 9: Local production of Allatini Plant in Thessaloniki

Figure 10: Local production of Göksu

Figure 11: Local production corner brick

Figure 12: Anchor stamped brick

Figure 13: Lighthouse stamped

Figure 14: Moon and star stamped brick