

RESEARCH ARTICLE

# Traditional manufacturing of clay brick used in the historical buildings of Diyarbakir (Turkey)



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## Abstract

Clay brick is the most common construction material used in the historical buildings of Diyarbakir (Turkey). Many clay brick manufacturing workshops and numerous brick masters have emerged. Diyarbakir currently has two clay brick workshops that face the problem of being closed down. Therefore, manufacturing of clay brick by traditional methods may be forgotten in Diyarbakir. This study investigates the manufacturing phases of traditional clay bricks in Diyarbakir's local workshops, which have not been documented.

The manufacturing phases of the clay bricks in Diyarbakir were examined for the first time based on in-situ observations, investigations, and interviews. The research indicated the general phases of clay brick manufacturing. Raw materials are first prepared, formed, and dried. The firing of clay bricks is then performed through hacking, heating, burning, cooling, and de-hacking. The clay bricks are finally packaged and dispatched. The traditional manufacturing of clay brick methods in Diyarbakir is similar in many regions of the world. The clay bricks are currently and extensively used in the restoration of historic structures. Therefore, their production must be continuous.

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## 1. Introduction

Clay brick is a product of a brick dough, which consists of clayey soil and water. It is formed primitively, naturally dried,

and fired in the kilns in the workshop (Gür et al., 2012). Clay brick is the oldest and most used building material, has been manufactured at the waterfronts where suitable soil could be found (Ward-Perkins, 1981; Fernandes et al., 2010). Soil is a cheap, environmentally friendly, and abundantly available building material (Ren and Kagi, 1995).

People always seek for accessible building materials to build a shelter. Thus, people from certain time periods and

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locations used stone and timber or mud brick and brick as their main building materials.

Mud-bricks and bricks are not used in their natural forms and require a specific technical knowledge and preparation phase, unlike stone and timber. Therefore, the materials are the first building materials manufactured in accordance with the required forms and dimensions. Moreover, they developed structural forms and techniques compatible with the natural properties of these materials (Oppenheim, 1977; Bakirer, 1981). Clay bricks were widely used in ceilings because they are manageable to prepare, are lighter than stone, allow easy control of thickness and alignment of rows, and are possibly used with a lightweight mold (Yavuz, 2005).

Bricks have been manufactured since ancient times (Bakirer, 1981). They were a fundamental building material in the Mesopotamian, Egyptian, and Roman periods (Fernandes et al., 2010). Best examples can be found before the fourth century in Mesopotamia (Moorey, 1999; Saner, 2005), Syria, and Iraq (Ahunbay, 2012). The use of clay bricks was increased and specialized in maximizing the benefits during the Roman period (Fernandes et al., 2010). The first industrial fired bricks were produced and used by the Lydians in Anatolia in the fourth century BC (Görçiz, 1996).

Byzantines made further improvements in the use of bricks and tiles in Anatolia. Some prominent examples of bricks and stones combination were later seen in Seljuk architecture (Bakirer, 1981). The first standards of production were introduced during the Ottomans. No further advancement was observed in brick production until the industrial revolution (Görçiz, 1996).

The brick manufacturing technology of the Ottomans in Anatolia remained in use until the mid-20th century. Thus, obtaining relevant information on the brick manufacturing is possible (Binan, 2005).

The ancient civilizations inhabited the wide river basins, which were suitable for the accumulation of alluvial sediments and manufacture of bricks. The art of building with bricks was developed in that period. The need to build highly durable high-rise structures was the motivation for fired brick manufacturing. Clay bricks have been widely preferred as a building material because of their high compressive strength, durability, fire and weathering resistance, and thermal and sound insulation. Therefore, fired bricks were more favorable than sun-dried bricks (Shakir and Mohammed, 2013).

Many studies have been carried out on the physical, chemical, and mechanical properties of clay bricks and their use in architecture (Ren and Kagi, 1995; Dondi et al., 1999; Arce and Guinea, 2005; El-Gohary and Al-Naddaf, 2009; Fernandes et al., 2010; Lourenço et al., 2010; Shakir and Mohammed, 2013; Yavuz and Sağiroğlu, 2016; Sağın, 2017). However, few studies have described the traditional brick production technique in detail. This article aims to overcome this deficiency in the literature.

## 2. Traditional clay brick manufacturing in Diyarbakir

Diyarbakir is located in southeastern Turkey along the western bank of the River Tigris (Dicle). Diyarbakir is a settlement with thousands of years of history, embodied in its walls, monuments, and traditional residential buildings.



Fig. 1 Diyarbakir air photograph and location of clay brick workshops. Source from Google Earth.

Many brick manufacturing workshops have existed in Diyarbakir,<sup>1</sup> and the brick masters in the city were numerous.<sup>2</sup> Only two active workshops exist at present<sup>3</sup> (Fig. 1).

The study gained information mainly from the observations and site investigations between August 2013 and June 2015<sup>4</sup> with intervals at a clay brick workshop, which belongs to the Sümer family.<sup>5</sup> The workshop is located to the west of the ten-arched bridge on the old Mardin Road, 5 km away from the city center. This workshop was chosen because it regularly manufactures bricks using traditional methods.

Workshops are active during summer months, between June and September, due to climatic conditions. Loading and selling are done in the rest of the year. To protect workers from damages caused by sunlight, the daily working schedule is from dawn until noon. They work with their bare

<sup>1</sup>In the 1950s, most of the brick workshops were located at the skirts of the Kırklar Mountain, Mardin Gate and Ben û Sen Vicinity, Silvan Road, and Ten-Arched Bridge. Two of the workshops were right below Yedi-Kardeş Tower, and three were right outside the same tower.

<sup>2</sup>Brick masters: Remezan, İbrahim, Süleyman, Zeki Zanbo, Sofi Hüseyin, Abdulfafur, Hacı Hüsnü, Kemal and Süleymane Hınese.

<sup>3</sup>Only the Sümer family workshop regularly manufactures. Thus, the reviews focus on this workshop.

<sup>4</sup>The authors were living in Diyarbakir during this research. They went to the Sümer family brick workshop during their production period in the summer months and conducted on-site inspections. Clay brick kilns are installed when needed. Thus, the workshop does not always work. The authors have attempted to document every phase of brick production during the time allowed by the workshop owners.

<sup>5</sup>Remezan Sümer, Seyfettin Sümer, and Bedrettin Sümer, i.e., Sumer brothers, are masters in this job. They stated that they have been doing this job since they were children and that they learned brick manufacturing from another master, Rahmi, from Eskişehir (Turkey).

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