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## Chapter 6

# Mud-bricks in Neolithic architecture at Göytepe

Yoshihiro Nishiaki, Farhad Guliyev, and Emmanuel Baudouin

### 6.1 Introduction

An increasing amount of evidence indicates that the Neolithic cultures of the South Caucasus underwent rapid cultural evolution in the early 6th millennium BC soon after the emergence of Neolithic society. Such evidence attests to autonomous development, regardless of whether Neolithic culture was introduced from southwest Asia (Nishiaki et al. 2019). One of the best examples of this cultural evolution is the production and use of pottery. Although the material culture of Fertile Crescent communities in southwest Asia around 6000 BC was characterized by the proliferation of pottery, the earliest southern Caucasus Neolithic sites do not always yield a comparably large amount of pottery. In the Middle Kura Valley of West Azerbaijan, the substantial production of pottery began only a few centuries after the introduction of the Neolithic economy (Nishiaki et al. 2015a; cf. Marro et al. 2019).

A local development can also be seen in architecture. Circular buildings were prevalent in the Neolithic cultures of the South Caucasus, although they have also been found in the Halafian culture of the Fertile Crescent. The classic architectural style is characterized by ring-shaped compounds consisting of a series of circular buildings 2–3 m in diameter connected with wing walls surrounding a courtyard (see Chapter 3). Recent field investigations in the Middle Kura Valley have revealed that this architectural style was a local development. In its early stages, a different style with snowman-shaped buildings was popular with a larger, roughly 5–6 m circular structure abutted by a smaller structure of 1.5–2 m and connected via a narrow passage (Nishiaki et al. 2015a). Furthermore, in the early stages, this building type was accompanied by

circular semi-subterranean buildings reminiscent of the domestic structures used by incipient farmers of the Fertile Crescent (Baudouin 2019).

These changes in architectural style are likely related to other socio-economic changes that occurred during the formative period of the Neolithic group in the region. The aim of this chapter is to provide new data on the architectural development of the Shomutepe culture of the Middle Kura Valley, namely regarding the production of mud-bricks at Göytepe. Based on stratigraphic data, we examine how mud-brick manufacturing technology might have developed during the Neolithic period in Göytepe.

### 6.2 Mud-bricks in Göytepe architecture

Mud-bricks can be examined from a variety of perspectives including those based on raw material and techno-morphology (Love 2012). The present study focuses on their morphology. The shape and size of mud-bricks excavated at Göytepe were examined in the field. Mud-bricks observable on the wall's surface were chosen for examination to avoid dismantling the walls. This study method was employed because Göytepe architecture was preserved intact for a planned archeological park. This method can admittedly result in uncertain identification and/or measurement of mud-bricks. For example, the precise thickness of mud-bricks cannot be determined unless they form a precise rectangular shape. Furthermore, the bonding mortar makes the edges and shape of the mud-bricks unidentifiable on the wall surfaces. Measuring the width of the mud-bricks is also difficult because of the clay plaster covering them; therefore, the measured width

depends on the amount of clay plaster removed during excavations. Given these constraints, the data presented below, which does not include thickness measurements, should be treated as preliminary. Nevertheless, our method allowed it to study a large number of mud-bricks. We believe that this pilot study of the data is worthy of analysis.

### 6.2.1 Mud-brick shape

The literature indicates that South Caucasian Neolithic communities manufactured at least two types of mud-bricks. Both are rectangular, but differ in their upper and/or lower surface shapes: there is a flat type and a plano-convex face type (Chataigner

1995). The latter displays a distinct morphology with a flat base and domed top with rectangular sides (Hansen and Ullrich 2017).

The representative shapes of the mud-bricks were recorded for each building level at Göytepe. Despite the constraints in determining the precise shape of the mud-bricks, our preliminary conclusion was that the mud-bricks of Göytepe were made principally in a plano-convex shape. The plano-convex mud-bricks were laid with a convex surface facing upward. Although plano-convex mud-bricks were identified throughout the sequence, the convexity seems more conspicuous in the earlier phase (Levels 14–8; Fig. 6.1) than in the later phase (Levels 7–1; Fig. 6.2). For



Fig. 6.1 Plano-convex mud-bricks from earlier levels of Göytepe. 1: Level 10, ca. 32 cm long; 2: Level 10, ca. 32 cm long.



Fig. 6.2 Larger and less-convexed mud-bricks from later levels of Göytepe. 1: Level 4, ca. 40 cm long; 2: Level 7, ca. 40 cm long.

the longer mud-bricks, which were more common in the later phase, the convexity seemed less clear. These samples led us to report the dual use of plano-convex and flat mud-bricks at Göytepe (Guliyev and Nishiaki 2012). However, it is still unclear whether any solid modality for flat mud-brick production exists. It may simply reflect the difficulty of identifying the convexity of longer mud-bricks. It is currently clear, however, that plano-convex mud-bricks were maintained throughout Göytepe.

### 6.2.2 Mud-brick size

A total of 1,080 mud-bricks from 78 structures at Göytepe were measured. Their lengths and widths are shown in Figs. 6.3 and 6.4, according to the cultural phases. First, the large variations in the sizes of the mud-bricks should be noted. The

lengths ranged between 16 and 52 cm (Fig. 6.3) and widths ranged between 11 and 24 cm (Fig. 6.4). Assuming that Neolithic builders employed molding frames for mud-brick production, this large variability is impressive. In this regard, however, we should acknowledge the possibility that mud-brick sizes could be misidentified in the field rather than presume the use of many types of molding frames during the same period or the shaping of mud-bricks by hand. Breakage in a single mud-brick may have been identified as a joint consisting of two bricks, and some joints may have been overlooked, leading to situations in which multiple bricks were measured as one large brick.

On the other hand, if our measurements more or less represent the archaeological reality, other noises in measurement can also be postulated. Short

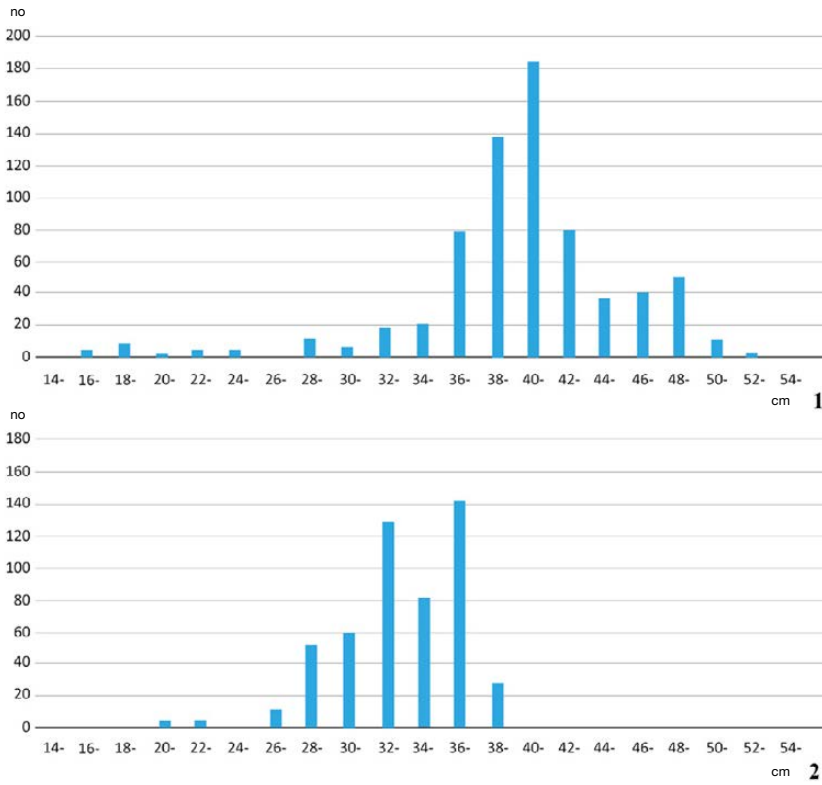


Fig. 6.3 Length of mud-bricks from Göytepe. 1: Levels 7-1 (n=924); 2: Levels 14-8 (n=156).

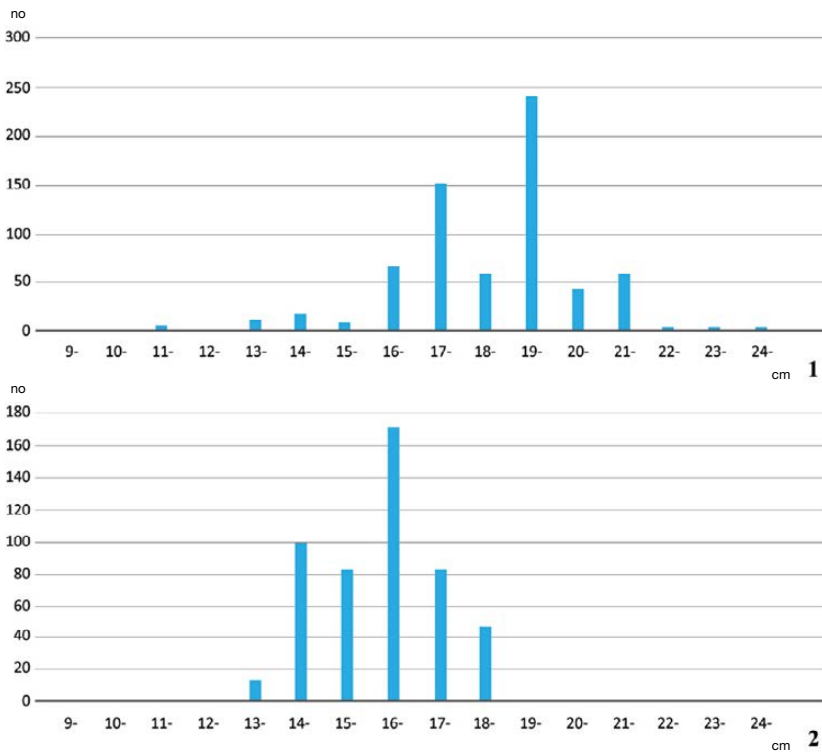


Fig. 6.4 Width of mud-bricks from Göytepe. 1: Levels 7-1 (n=153); 2: Levels 14-8 (n=131).



mud-bricks may indicate that Neolithic artisans deliberately broke longer mud-bricks to fit them into the length of a wall. This practice is often noted in ethnographic records as it is even used in modern stone block building construction in this region (Fig. 6.5). Thus, it would not be surprising if this practice was present in prehistoric times. Examples can be found in a number of photos of 6th millennium-BC sites in the Fertile Crescent such as those of Telul eth-Thalathat II Level XIV (Fukai and Matsutani 1981) and Tepe Gawra Level XIII (Tobler 1950).

Under such circumstances, it may be advisable to overlook detailed variations and instead emphasize the general patterns in size measurement (see Nishiaki et al. 2001). The histograms of the length and width measurements at Göytepe sites suggest at least two types (Figs. 6.3 and 6.4): a small type, approximately  $32\text{--}36 \times 16\text{--}17$  cm, and a larger (middle) type,  $38\text{--}42 \times 18\text{--}20$  cm. In addition, an even larger mud-brick might have existed, measuring  $48\text{--}50 \times 20\text{--}22$  cm (Fig. 6.3: 1). As expected, the longer bricks had a larger width. The proportional relationship was more securely maintained for some mud-bricks. Certain mud-bricks popular in the earlier phase were regularly manufactured with a size of ca.  $32 \times 16$  cm. This 2-1 length-width ratio allowed several standardized brick-laying methods (Fig. 6.6).

Fig. 6.7 shows the results of a seriation analysis in which the horizontal bars indicate the occurrence frequency (%) of mud-bricks with a specific length

and width at each level. We can define a marked size change through time. The mud-brick size showed a dramatic increase between the early and late phases of Göytepe (Fig. 6.7). The late phase apparently even includes very large mud-bricks, the largest type (ca.  $48\text{--}50$  cm long), though in a smaller number. On the contrary, in the early phase, the mud-brick size seems become smaller through time. These minor changes within each of the phases need to be verified in the future studies. In the meantime, the marked size change of mud-bricks in a single occupational sequence at Göytepe, an phenomenon previously unknown at any other South Caucasian Neolithic sites calls for much attention.

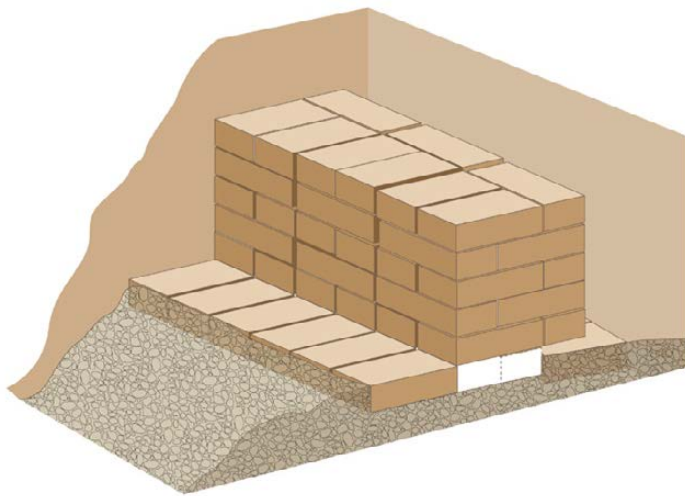
## 6.3 Discussion

### 6.3.1 Mud-bricks of the South Caucasian Neolithic

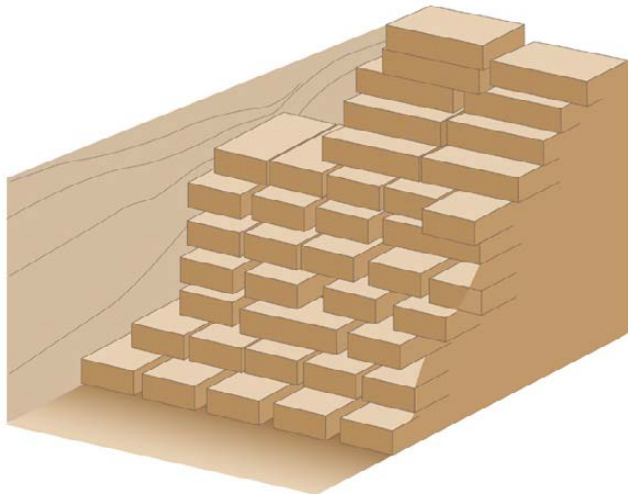
The dataset presented above is the first systematically collected from mud-bricks at a Neolithic settlement in the South Caucasus. Though excavation reports mentioning the shapes, sizes, and other features of mud-bricks from related sites do exist (Baudouin 2019), the accuracy with which each reference represents the archeological reality is unknown. As discussed in the previous section, it is not always easy to determine the morphological characteristics and size of sun-dried mud-bricks. Nevertheless, the patterns discovered in this study can be significant



Fig. 6.5 Modern stone block wall in Qovlar Village, Tovuz, Azerbaijan. 1: General view; 2: Close-up view. Note the large variability in block length visible on the wall surface.



1



2

Fig. 6.6 Isometric reconstruction of retaining walls of Göytepe. 1: Square 96F built on virgin soil (river gravel). See Fig. 5.10 of Chapter 5; 2: Level 13 of Square 4BII. See Fig. 4.50 of Chapter 4.

because they include previously unknown findings.

Evidence has been found for the use of mud-bricks from the beginning of the Neolithic Period in the Middle Kura Valley. One of the oldest Neolithic sites, Hacı Elamxanlı Tepe, already showed evidence of the mastery of mud-brick production technology (Nishiaki et al. 2015b). The early use of mud-bricks has also been recognized at other sites in the Middle Kura Valley, but not so evidently in other regions of the southern Caucasus. In the Ararat Plain of Armenia, the literature mentions the use of mud-bricks at sites such as Akhnashen and Aratashen, but the use of cob walls has also been reported as at Masis Blur (Martirosyan-Olshansky et al. 2013). In the Mil Plain in southeast Azerbaijan, the use of mud-bricks was confirmed only after 5600 BC, a few centuries later than the start of the Neolithic Period (Helwing 2017). Similarly, recent excavations confirmed the use of cob walls in the earliest Neolithic architecture at Kültepe, the Middle Araxes Valley (Marro et al.

2019).

Region-specific processes in the earliest mud-brick production history of the South Caucasus are also illustrated by the morphology of mud-bricks. Chataigner (1995: 58) has argued that the production of plano-convex mud-bricks is an important “technocultural” marker for Neolithic communities in the Middle Kura Valley, as opposed to the prevalent use of flat mud-bricks in the Ararat Plain. Our research at Hacı Elamxanlı Tepe demonstrated the use of plano-convex mud-bricks from their earliest occupational stage (Nishiaki et al. 2015b). Here, the use of such mud-bricks at Göytepe has been confirmed, showing that the communities of this mound followed the local architectural tradition. At the same time, it should be noted that most recent information from related sites suggests a need to revise this regional distinction (Fig. 6.8). For instance, plano-convex and flat mud-bricks are said to have been used in two different buildings



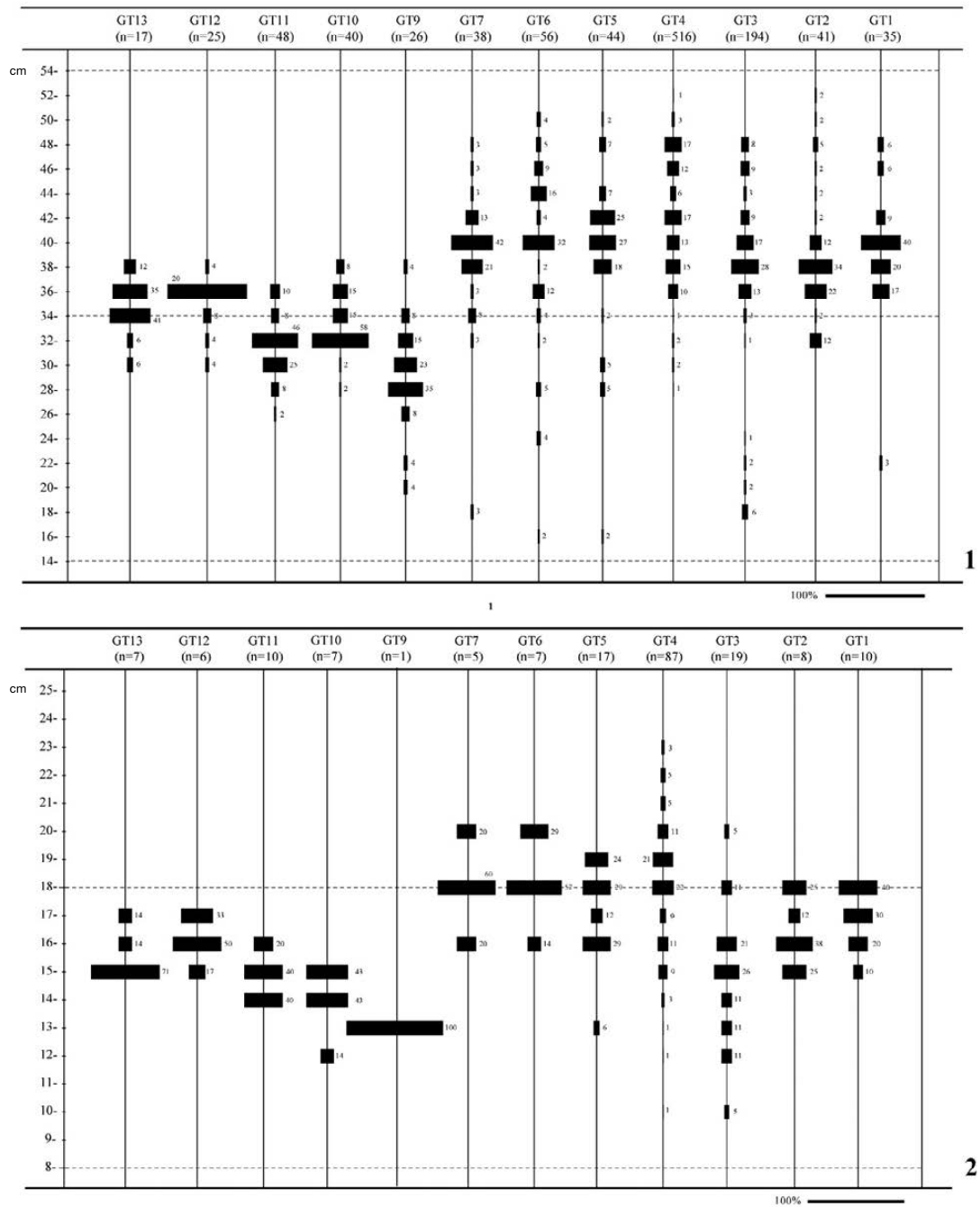


Fig. 6.7 Stratigraphic changes in mud-brick size at Göytepe. Later levels to the right. 1: Length (n=1,080); 2: Width (n=284).

on the same level as Gadachrili Gora (Hamon et al. 2016: 159–160). Additionally, the region in which flat mud-bricks were produced may have extended to the Lower Kura Valley and the Mil Plain. Further, the region with plano-convex mud-bricks seems to have extended beyond the Middle Kura Valley to the Ismail Tepe in the Karabagh Plain, which is situated on a tributary of the Kura River (Baudouin

2019). Nevertheless, it is important to note that there is no evidence of plano-convex mud-bricks in the Ararat Plain, the Araxes Valley, or the Mil Plain communities. Their absence in the Ararat Plain is particularly interesting when considering the current claim that the coeval Neolithic culture of the region should be grouped with that of the Middle Kura Valley as part of the Aknashen-Shulaveri-Shomutepe

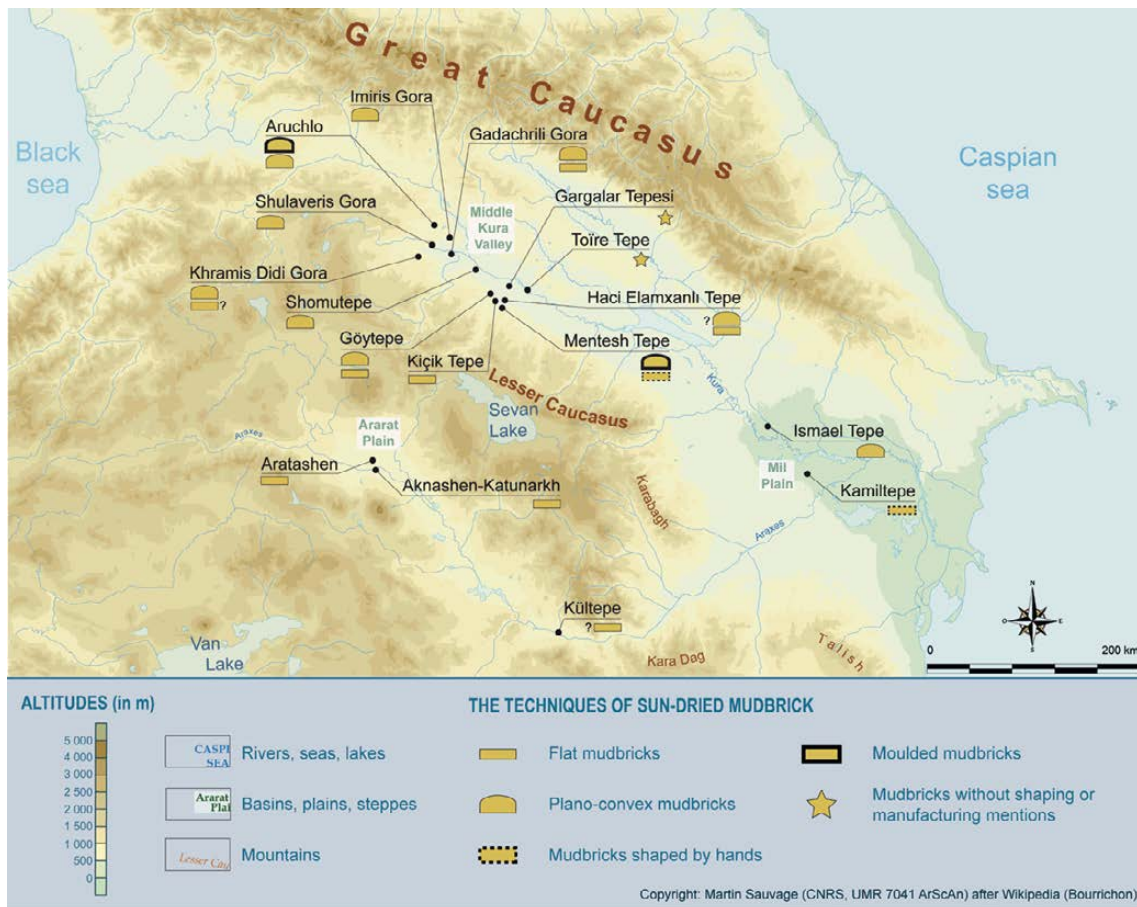


Fig. 6.8 Map showing regional variability of Neolithic mud-brick types in the southern Caucasus.

culture (Badalyan et al. 2010).

This regional variability can also be identified in the use of molding frames. Although the shape and size of the mud-bricks recovered at each site are regularly discussed, considerations of their manufacturing techniques are limited. So far, Chataigner (1995: 57–58) seems to be the first to have mentioned such details. She surmised from the then-available data that mud-bricks at the Kura Valley Neolithic sites were shaped by hand as in the Pre-Pottery Neolithic mud-bricks of the Levant. However, recent discoveries at Aruchlo (Ioseliani 2017) and Mentesh Tepe (Baudouin et al. 2018) confirm the production of molded plano-convex mud-bricks in the Kura Valley. At these sites, careful examination revealed two sets of data. The first is related to the rim at the top of the bricks, which is considered to be a consequence of the removal of the frame by the top (Fig. 6.9: 1 and 2). The potential rim on the bottom could indicate a depression of the frame, indicating the use of a specific technique called *moule enfoncé* (pastry cutter) (Aurenche 1981: 65; Sauvage 1998: 22).

Second, slight longitudinal ridges on the convex face of several mud-bricks could indicate an equalization of the surface before the removal of the frame (Fig. 6.9: 3), unless these ridges were intended for easier bonding with mortar during construction (Aurenche 1981: 62; Sauvage 1998: 41–42). They could also indicate both. Third, the straight edges of the mud-bricks indicate the use of molding frames (Fig. 6.9: 3, 4). In the Ararat Plain, no site produced such evidence (Fig. 6.8). In fact, the mud walls at those sites were not standardized. Accordingly, based on the current knowledge available from the literature, the production of the molded plano-convex mud-brick seems to represent a regional cultural trait of the Kura Valley. Although comparable analysis has not been completed at Göytepe, the regularity of the size as well as the shape closely resembling that of Aruchlo and Mentesh suggests the use of molding at this site.

Data from recently excavated sites such as Mentesh Tepe, Aruchlo, and Gadachrili Gora provide useful perspectives for mud-brick size comparison.

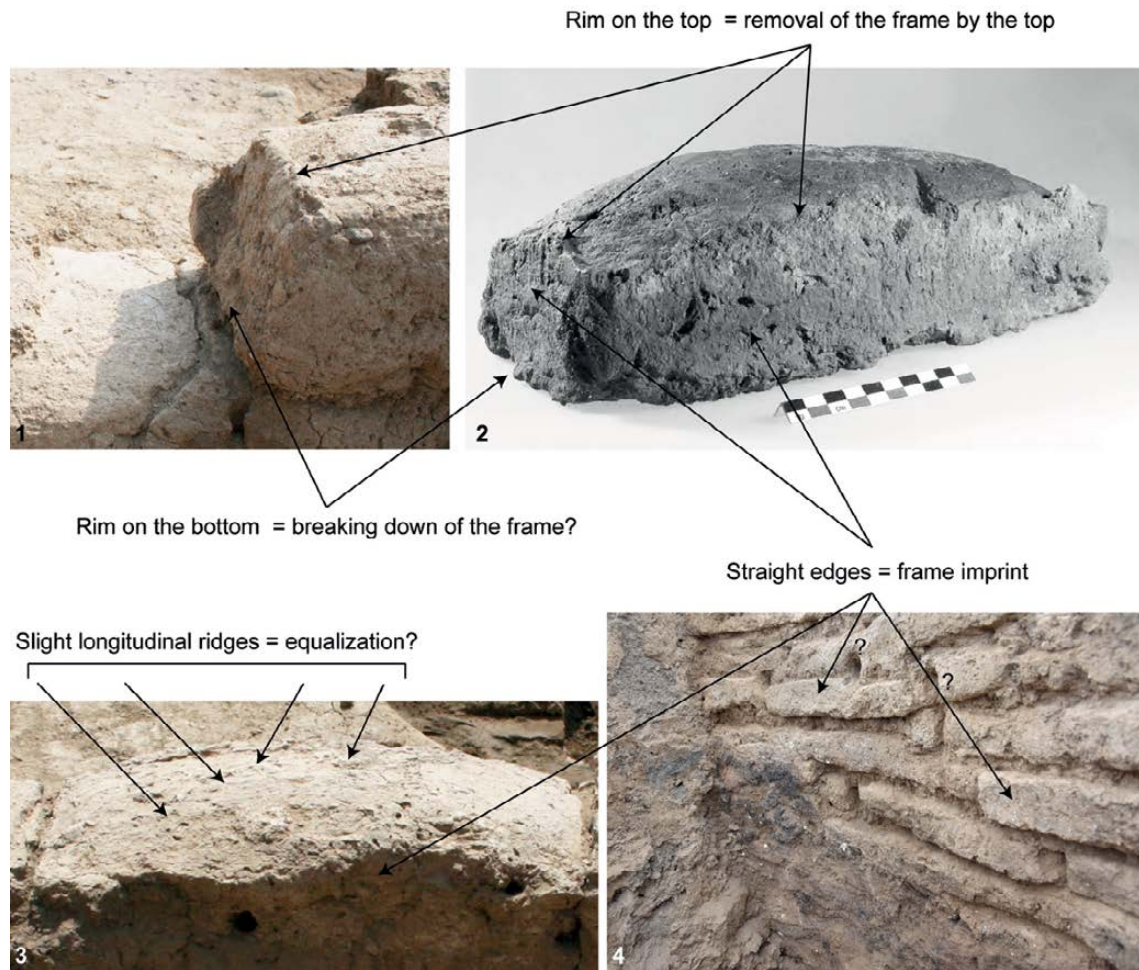


Fig. 6.9 Ridges on molded mud-bricks. 1 and 3: Mentesh Tepe, Azerbaijan; 2: Aruchlo, Georgia; 4: Kichik Tepe, Azerbaijan.

The brick size at Aruchlo has been reported to be 30 to 50 cm long and 20 cm wide (Hansen and Ullrich 2017: 202). However, more specific references are also available: a group of complete mud-bricks showed a size of 32–34 cm long and 16–18 cm wide (Ioseliani 2017: 281, tab. 1). The excavators also mentioned the existence of mud-bricks measuring 41 by 20 cm (Hansen and Mirtskhulava 2012). In other words, these two specific types of mud-bricks perfectly match the small and middle types noted at Göyetepe. However, if the Aruchlo samples include larger ones of 50 by 20 cm as stated (Hansen and Ullrich 2017: 202), they can best be compared to our largest type. A similar size range was also reported for Gadachrili Gora. The excavator of this site mentioned the use of mud-bricks sized 30–40 by 15–20 cm and a large type measuring 50 by 25 cm (Hamon et al. 2016: 164). Interestingly, the literature also refers to a far smaller mud-brick measuring 20–26 by 12–14 cm.

This latter type may correspond to our smallest limit of the size range identified at Göyetepe (Level 9, Fig. 6.7). At Mentesh Tepe, specimens of approximately 40 by 15 cm were claimed to have been common, associated with a larger size measuring 44–45 by 15–16 cm and a smaller one measuring 28 by 22 cm (Lyonnet et al. 2016: 180). These are also more or less comparable to the data from Göyetepe.

These measurements of mud-brick size demonstrate that the datasets obtained at Göyetepe fall in the range of mud-brick types that have been identified at other sites in the Middle Kura Valley. We should note that the measurement data from the above-mentioned sites did not exceed 20 samples per site, while the Göyetepe data is based on a far larger number of measurements from stratified contexts. The stratified dataset from Göyetepe can provide a more comprehensive basis for future studies.

### 6.3.2 Chronological change

This study revealed changes in the shape and size of mud-bricks in the Neolithic sequence of Göytepe. While it was previously known that the architectural layout changed from snowman-shaped (Hacı Elamxanlı Tepe) to ring-shaped (Göytepe) buildings, the change in mud-brick production in the later phase is a new finding. Changes occurred in both shape and size during the middle 6th millennium BC. The shape change is that from plano-convex bricks to “less-convex” forms. This change has been noted on the basis of our field notes without quantified data. Therefore, it needs to be verified when the walls are dismantled and metric data become available to characterize mud-brick shape. The timing and process of this change also require specification. On the other hand, the size change is stratigraphically defined: mud-bricks in the excavated squares of Göytepe showed an abrupt increase in the later phase starting from Level 7 (Fig. 6.7). One may wonder if the changes in mud-brick size were related to changes in the size of circular buildings themselves over this period. Indeed, the shorter mud-bricks may have facilitated the construction of smaller buildings with enhanced circular arcs. However, this proposition does not fit with the fact that the mud-brick size increased in Level 7 and later, when no radical size change in the architecture was detected (Chapter 3). Indeed, earlier buildings tend to have been larger in diameter in the Shomutepe culture (Nishiaki et al. 2015b).

The stratigraphic and radiocarbon data demonstrate that this change in mud-brick size at the middle of the occupation sequence at Göytepe was a radical phenomenon without a transitional stage, suggesting the introduction of a new tradition. It should be noted that this change occurred during a period of significant changes shown in other material records (see Chapter 1), including the rapid increase and technological changes in pottery development (Nishiaki et al. 2015a). Similarly, a sudden shift in the use of obsidian from sources in Northeast Anatolia to Central Armenia also occurred during this time period (Nishiaki et al. 2019). Our Bayesian analysis of radiocarbon dates has established a high-resolution chronology for the Göytepe occupation sequence, which suggests a boundary between Levels

9 and 8 of 5530 BC, Levels 8 and 7 of 5520 BC, and Levels 7 and 6 of 5510 BC (Nishiaki et al. 2018). Assuming the mud-bricks were a product of the local communities occupying this settlement, the sudden change in mud-brick manufacturing traditions may suggest the arrival of a community with a different architectural tradition or the swift acceptance of a new tradition by the local communities. To determine this, we need more data on mud-bricks from well-dated levels in the neighboring settlements. With such data, an evaluation can be made from a variety of perspectives, including the possible introduction of the cubit system developed in the Fertile Crescent in the Neolithic period (Haklay and Gopher 2019; Nishiaki et al. 2001).

### 6.4 Conclusions

This chapter presents preliminary data regarding the shape and size of mud-bricks at Göytepe. This study produced two major findings. The first is the demonstration of the common use of plano-convex mud-bricks, which confirms that the mud-brick manufacturing process at Göytepe belongs to the local tradition of the Middle Kura Valley. The second important finding is that the shape and size of mud-bricks at Göytepe changed during the mid-6th millennium BC. The most significant change occurred in size around 5520 BC. The background of these changes should be studied from multiple perspectives as it appears to have coincided with changes in other lines of evidence, including the shift of obsidian procurement sources and pottery production and use. To further develop this research, quantitative data from mud-bricks discovered at other sites should be gathered for comparison. The large variability in the shape and size of mud-bricks at Göytepe points to the need to treat metric data from a large sample. When more data from other sites become available, the preliminary data from Göytepe discussed in this chapter can be interpreted in a deeper manner.

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