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# Spread and Independent Technical Invention of the Earthen Material in the Southern Caucasus and Northern Mesopotamia during the sixth Millennium BCE

Emmanuel Baudouin

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# Earthen Construction Technology

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(4-9 June 2018, Paris, France)  
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Session IV-5

edited by

Annick Daneels and Maria Torras Freixa



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# FOREWORD TO THE XVIII UISPP CONGRESS PROCEEDINGS

UISPP has a long history, originating in 1865 in the International Congress of Prehistoric Anthropology and Archaeology (CIAAP). This organisation ran until 1931 when UISPP was founded in Bern. In 1955, UISPP became a member of the International Council of Philosophy and Human Sciences, a non-governmental organisation within UNESCO.

UISPP has a structure of more than thirty scientific commissions which form a very representative network of worldwide specialists in prehistory and protohistory. The commissions cover all archaeological specialisms: historiography; archaeological methods and theory; material culture by period (Palaeolithic, Neolithic, Bronze Age, Iron Age) and by continents (Europe, Asia, Africa, Pacific, America); palaeoenvironment and palaeoclimatology; archaeology in specific environments (mountain, desert, steppe, tropical); archaeometry; art and culture; technology and economy; biological anthropology; funerary archaeology; archaeology and society.

The UISPP XVIII World Congress of 2018 was hosted in Paris by the University Paris 1 Panthéon-Sorbonne with the strong support of all French institutions related to archaeology. It featured 122 sessions, and over 1800 papers were delivered by scientists from almost 60 countries and from all continents.

The proceedings published in this series, but also in issues of specialised scientific journals, will remain as the most important legacy of the congress.

L'UISPP a une longue histoire, à partir de 1865, avec le Congrès International d'Anthropologie et d'Archéologie Préhistorique (C.I.A.A.P.), jusqu'en 1931, date de la Fondation à Berne de l'UISPP. En 1955, l'UISPP est devenu membre du Conseil International de philosophie et de Sciences humaines, associée à l'UNESCO. L'UISPP repose sur plus de trente commissions scientifiques qui représentent un réseau représentatif des spécialistes mondiaux de la préhistoire et de la protohistoire, couvrant toutes les spécialités de l'archéologie : historiographie, théorie et méthodes de l'archéologie ; Culture matérielle par période (Paléolithique, néolithique, âge du bronze, âge du fer) et par continents (Europe, Asie, Afrique, Pacifique, Amérique), paléoenvironnement et paléoclimatologie ; Archéologie dans des environnements spécifiques (montagne, désert, steppes, zone tropicale), archéométrie ; Art et culture ; Technologie et économie ; anthropologie biologique ; archéologie funéraire ; archéologie et sociétés.

Le XVIII<sup>e</sup> Congrès mondial de l'UISPP en 2018, accueilli à Paris en France par l'université Paris 1 Panthéon-Sorbonne et avec le soutien de toutes les institutions françaises liées à l'archéologie, comportait 122 sessions, plus de 1800 communications de scientifiques venus de près de 60 pays et de tous les continents.

Les actes du congrès, édités par l'UISPP comme dans des numéros spéciaux de revues scientifiques spécialisées, constitueront un des résultats les plus importants du Congrès.

Marta Azarello

Secretary-General/Secrétaire général UISPP



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## Chapter 2

# Spread and Independent Technical Invention of the Earthen Material in the Southern Caucasus and Northern Mesopotamia during the sixth Millennium BCE

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### Abstract

The existence of relationships between Southern Caucasus and Northern Mesopotamian communities was inferred since the 1960s. Since 2008, international archaeological teams have focused on the Southern Caucasus in order to verify these hypotheses and understand the 'neolithisation process' on the periphery of the Near East. Here I will focus on the evolution of cob and mudbrick. An evolution of these earthen material techniques during the sixth millennium BCE is proposed by means of a re-examination of stratigraphic contexts, bibliographical data and also by recent discoveries in these regions. The spread of cob could be traced across Northern Mesopotamia since the end of the seventh millennium BCE, and then towards Eastern Anatolia and Southern Caucasus during the sixth millennium BCE. Simultaneously, the molded plano-convex mudbrick appeared in the Shulaveri-Shomu culture in the sixth millennium BCE. This special technique seems to be a local and independent innovation, according to other architectural characteristics.

**Keywords:** Neolithic, Earthen architecture, Sun-dried mudbrick, Cob

### Résumé

Les relations culturelles entre les communautés du Caucase et celles de Mésopotamie du Nord sont attestées depuis les années 1960. La reprise récente des investigations dans le Caucase a pour ambition de comprendre le processus de néolithisation en marge du développement des communautés mésopotamiennes. Je concentrerai mon propos sur l'évolution de la bauge et de la brique crue. Une évolution de ces techniques de construction au sixième millénaire AEC peut être proposée par une révision de la stratigraphie, de la bibliographie et par l'apport de données inédites. La question de la diffusion de la bauge au septième millénaire, du Nord de la Mésopotamie vers l'Anatolie orientale et le sud du Caucase durant le millénaire suivant, peut être posée, alors qu'en même temps, dans la culture de Shulaveri-Shomu, apparaît la brique crue moulée plano-convexe. Cette technique particulière semble y être une innovation locale et indépendante, hypothèse confortée par d'autres éléments architecturaux.

**Mots-clés:** Néolithique, architecture en terre, brique crue, bauge

## 1 Introduction

At the end of the seventh millennium BCE, the Syro-Mesopotamian were in an advanced stage of the Neolithic 'way of life' and three main cultural horizons can be identified in this period (Figure 1). The first is the Hassuna culture that appeared at the middle of the seventh millennium BCE in Iraqi Jezirah. Proto-Hassuna sites have been identified in the Upper Khabur (Le Mièrè 2000), but no proper 'Hassuna' sites have been discovered, while Hassuna-Samarra sites are attested in Upper Tigris at Hakemi Use (Tekin 2011), and lasted until the end of the seventh millennium BCE.

The second is the Samarra culture (6300-5800 cal. BCE), which is known in Eastern Jezirah and Central Mesopotamia. Based on ceramic data, research shows that Samarra represents a geographical extension of Hassuna in the Jezirah (Forest 1996: 36; Hole 1977: 12). This expansion could be explained by a movement of the Hassuna population to the south, in Central Mesopotamia, result of a demographic pressure applied by the arrival of the Halaf communities (Sauvage 2001: 426).



This opinion must be qualified (Butterlin 2018: 107) because of the unreliability of the stratigraphic contexts, especially for the Zagros foothills as at Choga Sefid (Oates 1987: 166).

The third is the Halaf culture that spread over a large area stretching from Cilicia to the east, as far as the Zagros foothills and occupying essentially all the High Jezirah. Some archaeologists suggested that Halafian communities originated from the mountains located between the Van Lake and the north Iraqi steppe (Mallowan 1936; Mallowan et al. 1935; Mellaart 1970). However,

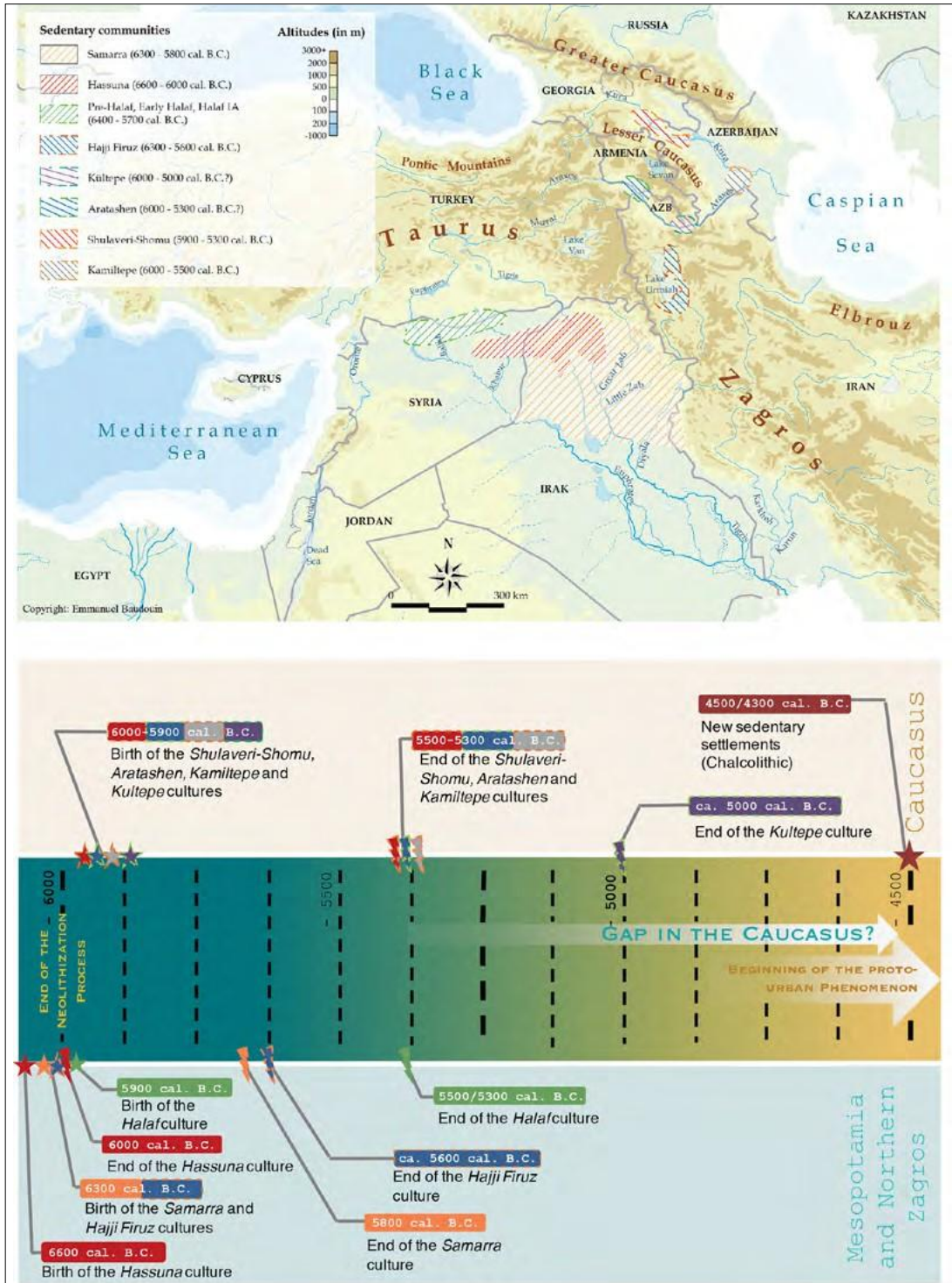


Figure 1. Map and chronology of the Northern Mesopotamia and Southern Caucasus communities from the end of the seventh millennium to the middle of the fifth millennium BCE.



other archaeologists trace the birth of Halaf around 5600 cal. BCE in High Jezirah, in the Balikh and Khabur region. Two main assumptions contrast about Halaf's origin and development: 1) the appearance of Halaf populations from Van Lake and Eastern Jezirah areas; 2) a local origin replacing previous cultures (Proto-Halaf, Proto-Hassuna, Hassuna, Samarra). Recent research (Campbell 2007) enabled to place the beginning of Halaf at the end of the seventh millennium BCE (Molist et al. 2007: 4; Akkermans et al. 2014: 30). But the origin of this culture still remains controversial (Akkermans 2000 2010; Breniquet 1996: 63–64) just as its disappearance at the end of the sixth millennium BCE.

Outside of Mesopotamia, the Hajji Firuz culture, that developed in Northern Zagros, close to the Urmiah Lake, is still poorly known and it is mainly documented by the eponymous site dated around 6300-5600 cal. BCE (Lawn 1974: 222; Stuckenrath 1963: 90).

On the other hand, the first studies on the sedentary communities of the sixth millennium BCE in the Southern Caucasus began in the middle of the XXth century. Excavations were carried out almost simultaneously in the Middle Kura Valley, Azerbaijan, and in the Kvemo-Kartli Plain, Georgia, where archaeologists identified a unique culture, so-called Shomu-Shulaveri or Shulaveri-Shomu (Dzhavakhishvili et al. 1975; Kiguradze 1986; Kushnareva 1997; Narimanov 1965 1987). At the same time, excavations were undertaken in the Ararat Plain, on the Araxes Valley, which revealed the archaeological remains of a contemporary occupation to the south of the Lesser Caucasus, a regional variant of Shulaveri-Shomu (Kiguradze 1976; Badalyan et al. 2014). Previously, other research had been undertaken at Kültepe, Nakhichevan (Abibullaev 1959 1982), where the discovery of Halaf ceramics has enabled archaeologists to hypothesise relationships with contemporary cultures in Mesopotamia (Abibullaev 1959; Narimanov 1987).

From the second half of the XXth century, the issues focused on the origin of Shulaveri-Shomu and especially on the neolithisation process in the region and three main hypotheses were made:

- a) A 'colonization' by communities from Mesopotamia (Munchaev 1975);
- b) Relationships and exchanges between Syro-Mesopotamian communities (Hassuna, Samarra, Halaf) and those of Southern Caucasus (Kiguradze 1986; Kushnareva 1997);
- c) An independent and local development (Lisitsyna et al. 1977; Niebieridze 1986).

The resumption of research since 2008 in the Middle Kura Valley, at Mentesh Tepe (Lyonnet et al. 2012 2016 2017; Lyonnet and Guliyev 2012), Göy Tepe (Guliyev et al. 2009 2012 2014; Nishiaki et al. 2015a), Hacı Elamxanlı Tepe (Nishiaki et al. 2015b) and Kiçik Tepe, in the Kvemo-Kartli Plain, at Aruchlo (Hansen et al. 2006 2007; Hansen et al. 2012) and Gadachrili Gora (Hamon et al. 2016) and in the Ararat Plain, at Aratashen (Arimura et al. 2010; Badalyan et al. 2007), Akhnashen-Katunarkh (Badalyan et al. 2014; Badalyan et al. 2007) and Masis Blur (Martyrosyan-Olshansky et al. 2013), has set as an objective questioning these assumptions.

Simultaneously, the identification of contemporary sites in the Mil Plain has enabled to identify another cultural horizon, known as the Kamiltepe culture (Lyonnet et al. 2012). In spite of the regional variants, it is customary to define a unique Neolithic culture, that of Shulaveri-Shomu. However, even if these communities homogeneously adopted a sedentary way of life based on agriculture and animal herding (Benecke 2017) from the beginning of the sixth millennium BCE, one of the main regionalised traits of these communities is represented by architecture. Technological differences conduct us to distinguish four 'cultural' entities: Shulaveri-Shomu, in the Kvemo-Kartli Plain, the Middle Kura Valley and the Karabagh Plain; Aratashen, in the Ararat Plain; Kültepe, in the Nakhichevan; and Kamiltepe, in the Mil Plain.



The purpose of this article is to define exchanges of know-how and techniques between communities of the Syro-Mesopotamian Basin and Southern Caucasus throughout the sixth millennium BCE. I will focus on the development of sun-dried mudbrick and cob. We posit two main hypotheses: technical transfer or autonomous inventions (Leroi-Gourhan 1945). We will see whether it is conceivable and relevant to define a ‘center’ and a ‘periphery’ or rather propose more diffuse relationships between the communities of these regions (Breniquet 2016: 208; Lombard et al. 2004). This study is based on the examination of 56 sites and more than 200 instances of mudbrick or cob inventoried and individually numbered in table 1 (inserted at the end of the chapter), intending to keep these records as objective as possible due to the ambiguity and variety of terms used in earthen architecture (Aurenche et al. 2011).

## 2 Methodology, CHAÎNE OPÉRATOIRE, identification

The study of building materials provides a better understanding of the mechanisms associated with technological changes and emphasises the choices made by certain populations, thus making it possible to identify ‘cultural’ entities (Sauvage 2001: 428). Over the last three decades, specialized studies have clarified the archaeological study of mudbrick, *pisé* or rammed earth, and cob (Figure 2 ; Aurenche et al. 2011; Chazelles et al. 2003 2011; Guillaud et al. 2007; Roux et al. 2010); each represents a different type of earthen construction, featuring different CHAÎNES OPÉRATOIRES.

### 2.1 ‘Terre MASSIVE’: *pisé* vs cob

The notion ‘*terre massive*’ (stacked mud) has been introduced by C.A. de Chazelles indicating a building technique which consists of setting the earth directly where the wall is planned to stand. The two main techniques are cob and *pisé*. In *pisé*, earth is compacted in a wooden formwork with a rammer (Doat et al. 1979: 13–92). This technique is not attested historically before the Roman period (Aurenche et al. 2011: 22; Chazelles 1997: 95).

Like *pisé*, cob is shaped directly on the location of the wall. As it’s made of mud, a drying time is necessary between each layer, in order to avoid any defect. J.C. Roux and C. Cammas (2010: 222–23) identify five implementation techniques. Two of them seem to be used frequently in

Near Eastern and Southern Caucasus: cob in lumps and in layers. In the Near Eastern, the earliest instances are from the ninth millennium BCE and appear simultaneously in the Levant, at Gilgal (Noy 1985; Noy et al. 1980), in Eastern Jezirah, at Nemrik 9 (Kozłowski et al. 1990: 352), in the Zagros foothills, at Tepe Guran (Melgaard et al. 1963: 110) and in the Middle Euphrates and Mureybet (Aurenche 1977).

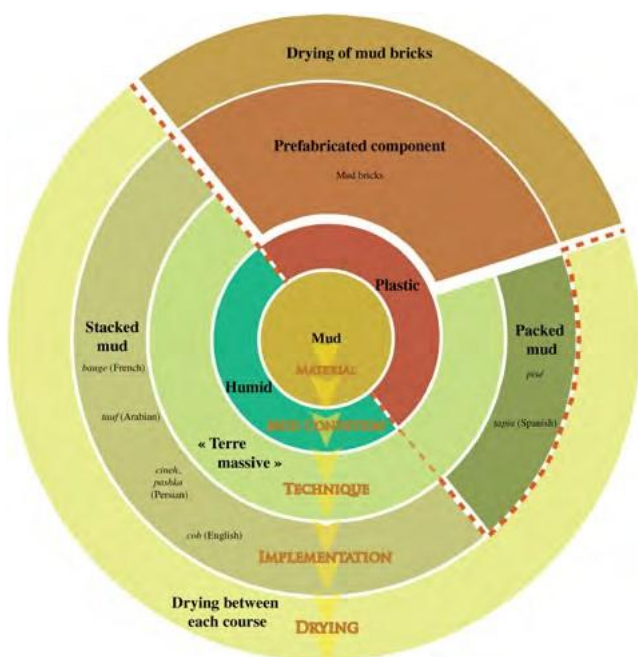


Figure 2. Summary diagram of implementation using earthen material (after Baudouin et al. 2018: 60, Figure 11).

### 2.2 PREFABRICATED components (mudbricks)

Unlike stacked mud, prefabricated components are made in series and in advance. After drying, they are bonded with mortar in superimposed courses to make the wall; this technique is much faster than cob. Mudbricks can be shaped by hands or made in a wooden mold. This second technique allows to



standardize both shape and size of the mudbricks and to increase the production rate (Aurenche 1981: 66). It should be noted that duly documented examples of molded mudbricks are rare and it is often only in terms of the regularity of the modules and the length/width ratio that it can be deduced that they are mold-made (Baudouin, *ibid.* 2020).

For the molded mudbricks, a thorough dismantling of the wall during the excavation enables to observe two features of the *CHAÎNE OPÉRATOIRE*: 1) the removal of the excess of mud by scraping leaves circular or longitudinal marks on the surface (Baudouin 2017: 11–12, 159–160); 2) the removal of the mold leaves often a tiny ridge clearly visible at the top edges of the mudbricks (Aurenche 1981: 18, 64; Baudouin 2017: 159–160, fig. 13).

At the current state of knowledge, the first mudbricks shaped by hand appear in different places in the Near East at the beginning of the ninth millennium BCE (Aurenche 1993: 84; Sauvage 1998: 192). Their shapes are diversified: plano-convex at Nemrik 9 (Kozłowski 1989: 27; Kozłowski et al. 1990: 11, pl. 1, 355) or also cigar-shaped at Jericho (Kenyon 1957: pl. 11B, 33A) and Choga Bonut (Kantor 1978: 191, pl. IIa). On the other hand, the first molded mudbricks appeared in the second half of the eighth millennium BCE in the Middle Euphrates Valley at Cafer Hüyük (Aurenche et al. 1985: 13–15), at Gritille (Aurenche et al. 1988: 5), at El-Kowm 2 (Stordeur 2000: 37–38), at Qdeir (Contenson 1985: 338, 340) and at Tell Halula (Molist et al. 2014: 108).

### 3. Results

#### 3.1. MESOPOTAMIAN AND Northern ZAGROS communities

##### 3.1.1 Cob

In Jezirah, at Telul eth-Thalathat n°197 (Proto-Hassuna, level XV), Japanese scholars identified elongated and irregular lumps, piled up without mortar (Fukai et al. 1970: 7, 22). My recent study<sup>1</sup> of the photographic archives of this level shows the regularity of courses (around 8–9cm) for some walls and the irregularity of lumps on each course.

At Tell Hassuna n°87 (Hassuna, levels I-II), ‘lumps of mud of various size’ (Lloyd et al. 1945: 273) are arranged in a wet state on the location of the wall. After drying, both sides of the wall were smoothed to homogenize the surface. At Tell Sabi Abyad n°124,126, lumps seem used from level 8 (Op. I, Pre-Halaf 6125–6075 cal. BCE), excavators recognized ‘layers of slabs’ (Akkermans et al. 2014: 36), as at Tell Arpachiyah n°7 (Halaf 6400–5400 BCE) where it is used for the construction of tholoi (Mallowan et al. 1935: 25). Layers of cob are attested at Tell Sabi Abyad n°132–133 (Op. I, Early Halaf, level 6) and namely a wall made of different layers of mud with different colours and textures; this technique continues at least up to level 3B, where excavators describe a similar alternation of layers (Verhoeven et al. 1996: 44, 94). At Yarim Tepe II (Halaf IA, level VI), the wall of tholos 41 n°201 consists of ‘clay layers’, joined with a yellowish mortar (Merpert et al. 1976: 45), close to the technique used for the circular buildings 44A and 44B n°202 (Merpert et al. 1977: 89). In the Northern Zagros, at Hajji Firuz n°76–80 (Hajji Firuz, levels J to A2), earthen beds are arranged in successive layers along the entire length of the wall (Voigt 1983: 33). This technique seems to persist in the region during the Dalma period where layers of cob have been identified at Dalma Tepe n°52 in levels 5–4 (Hamlin 1975: 113).

Nevertheless, many architectural features remain unspecified. At Tell Sabi Abyad n°125,128 (Op. I, Pre-Halaf, level 7B), the architectural elements appear as homogeneous ‘mud blocks’, maybe similar to the ‘slabs’ described in levels 8 and 7B (Akkermans et al. 2014: 37, 45, 52). At Mattarah n°109 (Hassuna, levels I-II), the walls are reported as packed mud (*tauf*), without additional precisions

<sup>1</sup> I thank Professor Y. Nishiaki (The University Museum, The University of Tokyo) for giving me access to these archives. This research was made thanks to the Japan Society for the Promotion of Science (JSPS) as part of a postdoctoral fellowship at the University of ToKyo.



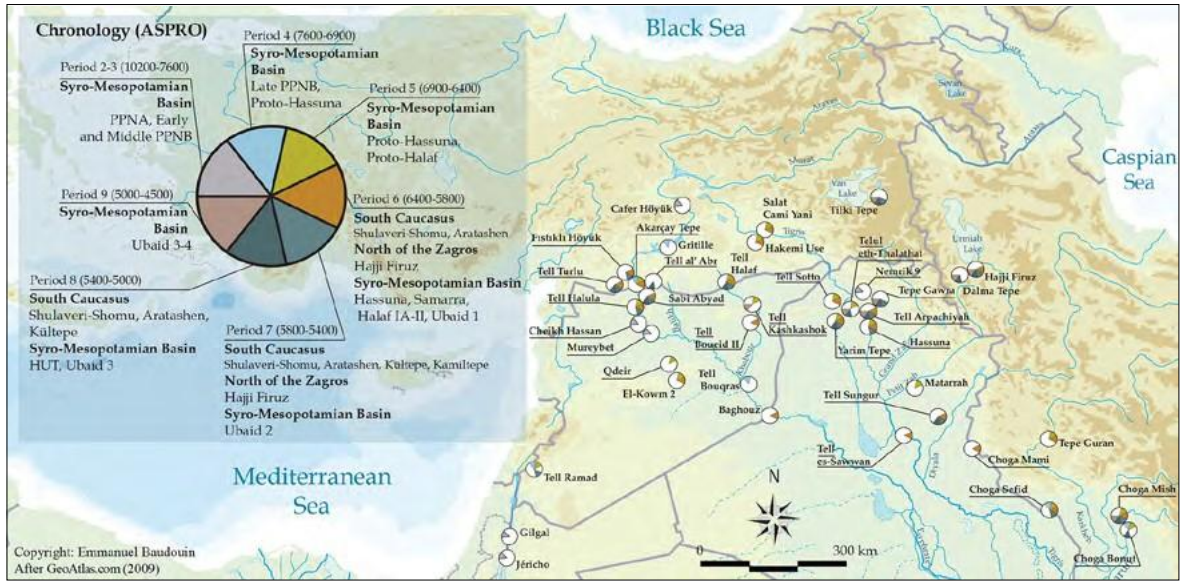


Figure 3. General map of Northern Mesopotamia with the sites mentioned in the text.

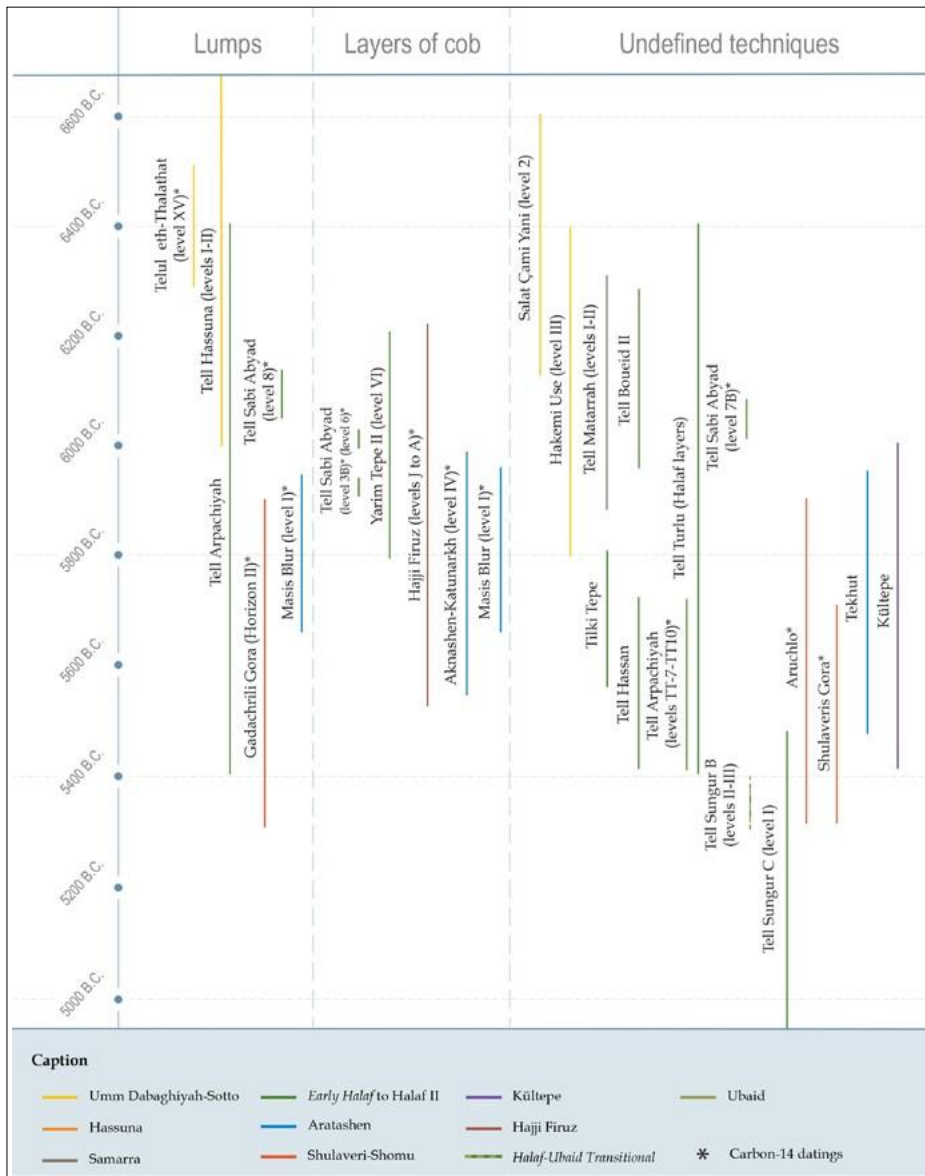


Figure 4. Summary diagram of the attestations of the stacked mud technique (seventh-sixth millennium BCE)



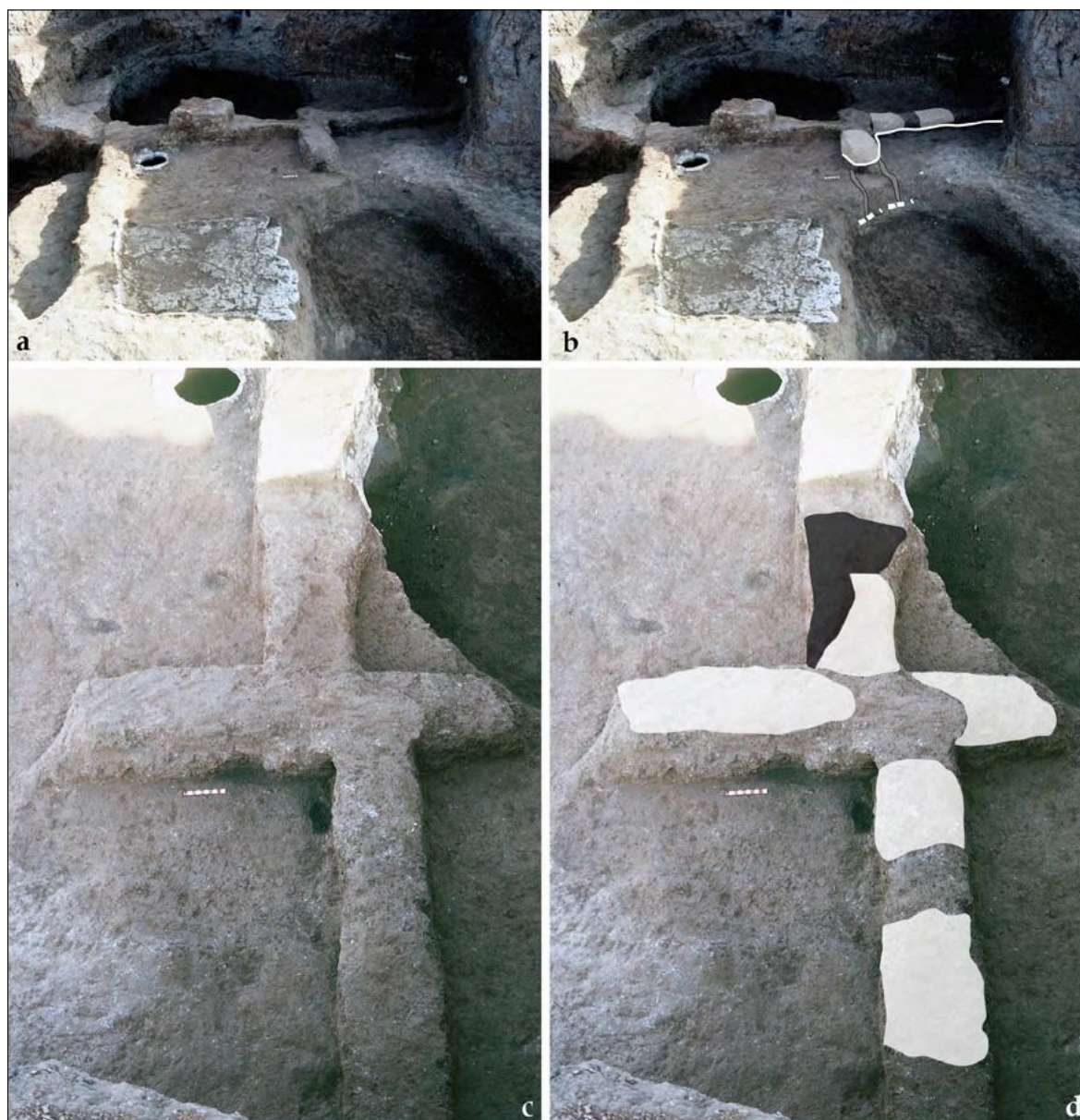


Figure 5. Telul eth-Thalathat II (level XVb): a-b.) Wall in cob in squares O-VIII, view from the west; c-d.) Walls in mudbricks in squares N-VIII, N-IX, view from the south-west. Japanese archaeological excavations at Telul eth-Thalathat (campaign 1976), unpublished archives of the University Museum, The University of Tokyo.

(Braidwood et al. 1952: 6). At Tell Boueid II n°39 (Proto-Hassuna/Pre-Halaf), at Tell Arpachiyah n°8 (Halaf II, TT7 to TT10), at Tilki Tepe n°198 (Halaf II), at Salat Cami Yani n°141 (level 2) and at Hakemi Use n°89 (Hassuna or Samarra, level III) buildings are made of cob, though incorrectly called *pisé* by the authors (Suleiman et al. 2002: 6; Mallowan et al. 1935: 25; Chataigner 1995: 59; Tekin 2011: 152–53; Miyake 2011: 131), or called *tauf*, as at Fıstıklı Höyük n°53 (Halaf I, level II) and at Tell Hassan n°92 (Halaf II) (Bernbeck et al. 2003: 164; Jasim 1985: 164). At Tell Turlu n°199 (Halaf), a similar material may be used though no precisions are available (Breniquet 1987: 113). Finally, data at Tell Sungur n°189-194 shows the use of cob in Halaf-Ubaid Transitional (HUT) and in Ubaid 2-3. At Tell Sungur B (HUT, levels I to III), the walls of buildings B1 and B2 are built with ‘tauf’ (Fuji 1981: 184, 190), just like at Tell Sungur C (Ubaid 2-3, level I) (Fuji 1981: 188, 190, 191; Jasim 1985: 156).



In addition, the recent recovery of the archives of the sites of Telul eth-Thalathat and of Tell Kashkashok shows that cob initially identified by the excavators in the Proto-Hassuna levels has to be questioned. Indeed, at Telul eth-Thalathat, some walls of level XVb (squares NVIII-NIX) seem built with mudbricks, the courses being apparently regular (around 8-10cm) with some modules being visible, as well as the mortar between these bricks and the interior plaster still preserved. At Tell Kashkashok (level 3, square G7), walls preserved on at least one course seem made of mudbricks (possibly 30x25cm) and not in *TAUF* (Matsutani 1991: 11, 13) (Figure 5 c-d, Figure 6).



**Caption**

- Courses of mud-bricks
- ⋯ Bottom of the wall

- Mud-bricks
- Plaster
- Mortar

Figure 6. Tell Kashkashok (level 3): a-b.) Wall in mudbricks in square G7, view from the south-west; c-d.) The same wall, view from the south-east. Japanese archaeological excavations at Tell Kashkashok (campaign 1988), unpublished archives of the University Museum, The University of Tokyo.



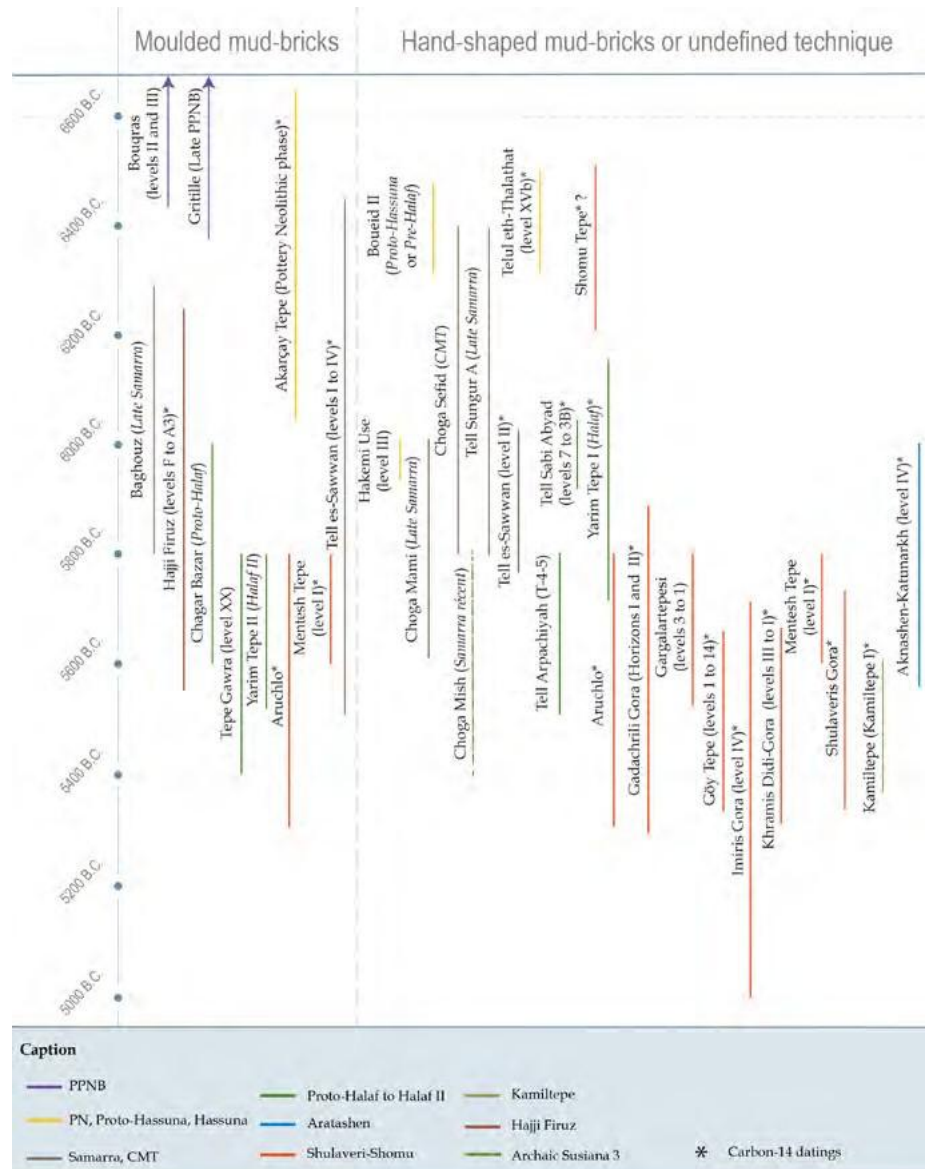


Figure 7. Summary diagram of the attestations of the mud-bricks shaped by hands and molded mud-bricks (seventh-sixth millennium BCE)

### 3.1.2 Mudbricks

Around 6000 BCE, in Eastern Anatolia, at Hakemi Use n°90-91 (Hassuna or Samarra, period III), the size of mudbricks is not standardized (Tekin 2011: 152), their length/width ratio varying between 1 and 2:1

Between 6400 and 5800 BCE, in Western Jezirah, hand-shaped mudbricks and cob are used concurrently at Tell Sabi Abyad (see above). During the Pre-Halaf phase n°129-131 (level 7), the mudbricks used in buildings 7.5 (Akkermans et al. 2014: 57) and 7.11 (Akkermans et al. 2014: 61) are close to square (ratio: 0.9-1.4:1). This type of mudbrick is used until level 3B n°137-140 where it becomes smaller as in *tholos*I (Verhoeven et al. 1996: 96) and *tholos*N/AE (Verhoeven et al. 1996: 97). Within a century (between 6020 and 5905 cal. BCE), there is a gradual decrease in the size while the length/width ratio is constant (Figure 9).

At Tell Boueid II n°40 (Proto-Hassuna or Pre-Halaf), rectangular mudbricks are used occasionally and are not standardized (Suleiman et al. 2002: 6). At Yarim Tepe I n°200 (Halaf), the large size of the elongated ‘mudbricks’, 90x15x6cm (Munchaev et al. 1973: 6), suggests that it is rather cob. In Eastern Jezirah, at Tell Arpachiyah n°9-12 (Halaf II, levels TT4-5), the mudbricks are irregular



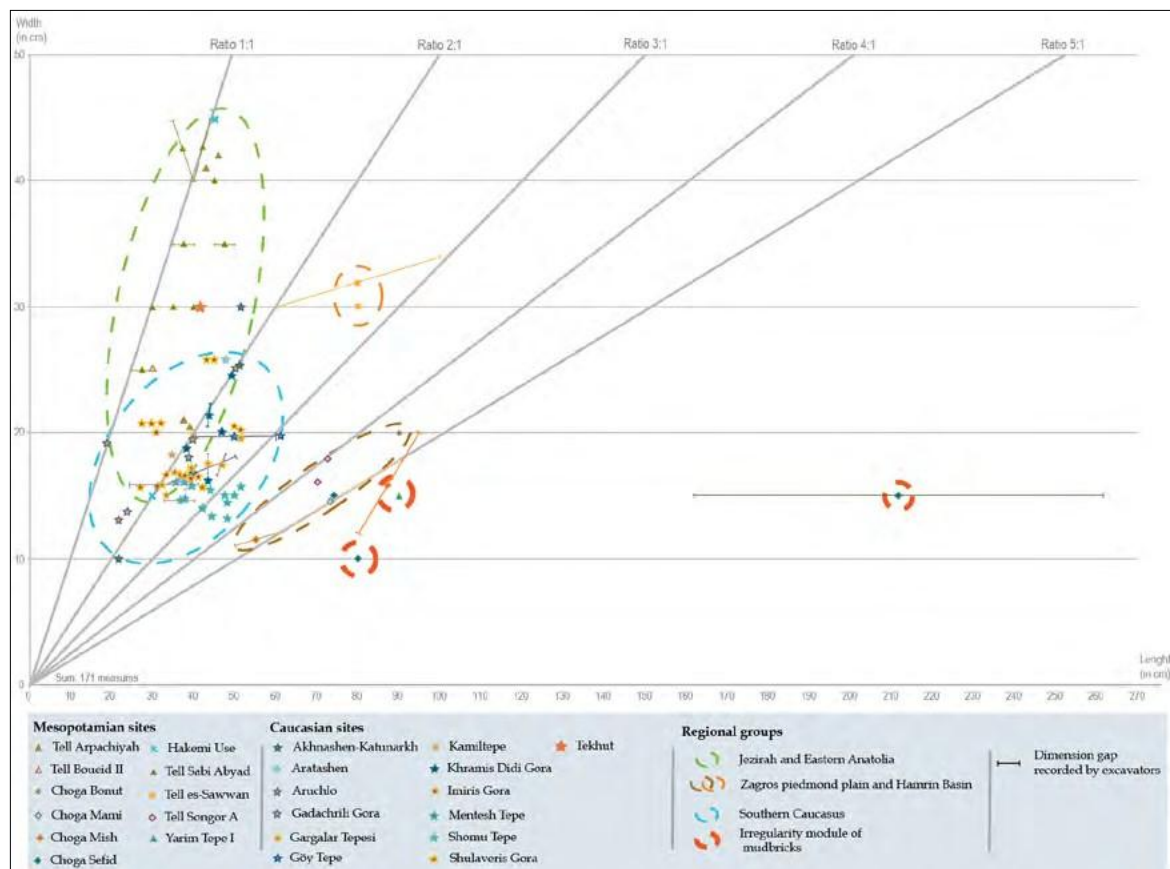


Figure 8. Summary diagram of the attestations of the mud-bricks shaped by hands in Northern Mesopotamia and Caucasus (seventh-sixth millennium BCE)

LEVEL	DATE	BUILDING	BRICK MODULE (IN CM)
8	6125-6075 BC	8.2	120 x 35 x ?
		8.3	100 x 35 x ?
7	6020-5995 BC	7.5	45-50 x 35 x 6-8
		7.11	40-44 x 40-45 x 4-7
6	6010-5995 BC	6.1	45 x 40 x 10
		6.13	40 x 40 x 4-6
5	6000-5945 BC	5.1	40 x 30-35 x 8
		5.2	30 x 30 x 12
4	5980-5925 BC	Tholos en Q15	25-30 x 25 x 8-10
		Tholos en Q15	40-45 x 30-35 x 8-10
3B	5940-5905 BC	Building I	35-40 x 35 x 10
		Tholos S	35 x 30 x 8
		Tholos I	30 x 25 x 8
		Tholos N/AE	35 x 30 x 8

Figure 9. Summary table of the evolution of mud-bricks sizes at Tell Sabi Abyad (Syria) (Op. I) between levels 8 and 3B (6125-5905 BCE), based on Akkermans et al., 2014 (after Baudouin et al., 2018: 66, fig. 16).

(Mallowan et al. 1935: 16) and the production is divided into two categories (Aurenche 1981, tab. 6): large and almost square mudbricks, with a ratio around 1:1, representatives of Halaf (Tell Sabi Abyad), and smaller mudbricks, with a ratio around 2:1, conforming to the standardized molded mudbricks of the same period.

In Central Mesopotamia, while the use of molded mudbricks is becoming widespread in Samarra (5800-5400 cal. BCE), some mudbricks are still shaped by hand: at Tell es-Sawwan n°151-152 (PN(?), level II), the length varying between 60 and 100 cm, for a ratio between 1.8 and 3.3:1 (Wahida 1967: 172). The weight of these bricks is estimated around 47 kg for the largest ones. Such bricks, difficult to transport (Wahida 1967: 172), may have been misidentified during the excavation according to J.D. Forest who identified half-bricks (Forest 1983: 13).



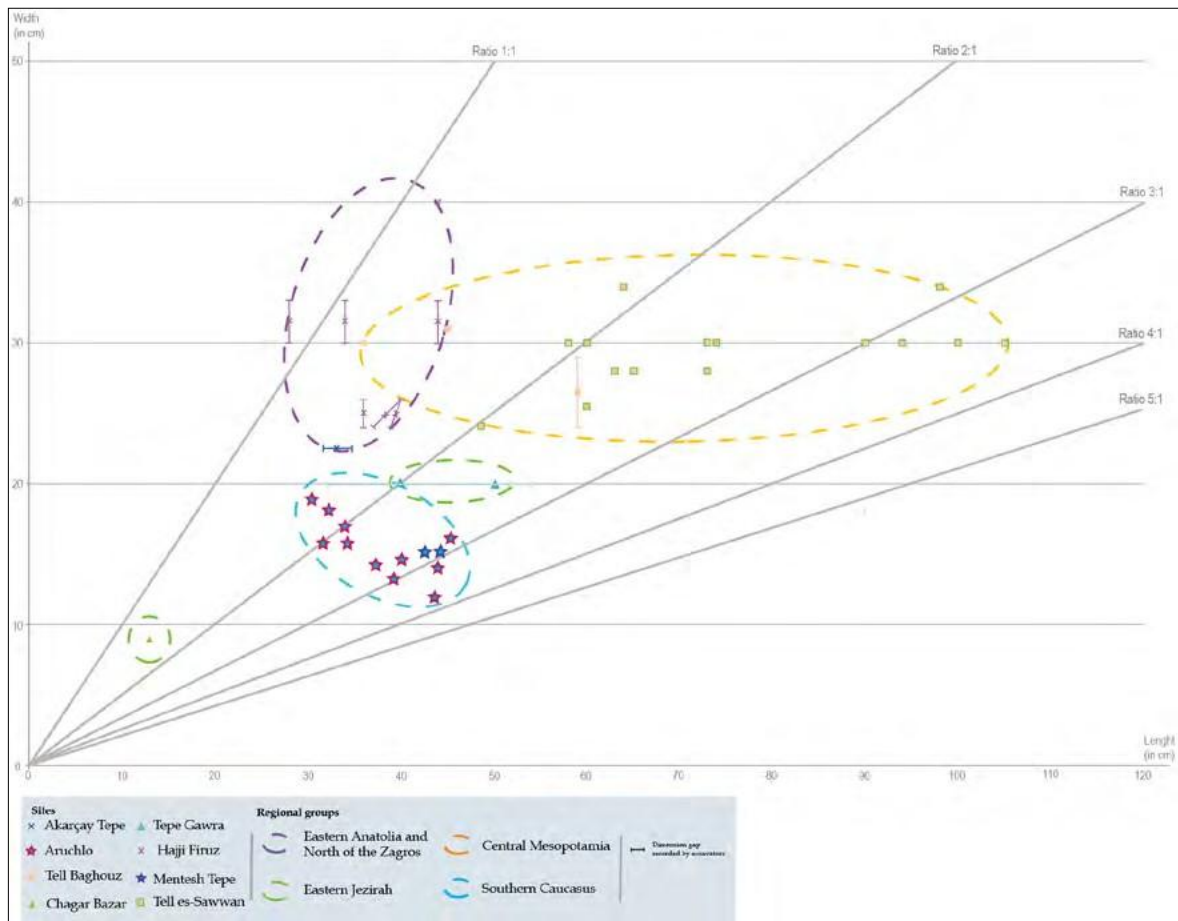


Figure 10. Summary diagram of the attestations of the molded mudbrick in Northern Mesopotamia and Caucasus (seventh-sixth millennium BCE)

In the Hamrin Basin, mudbricks at Choga Mami n°45-46 (Late Samarra, level III), are elongated (ratio: 3,3 to 7,5:1) and cigar-shaped like in the Halaf levels (level II), with fingerprints visible on the upper side (Oates 1969: 116, 117) and at Tell Sungur A n°187-188 during Late Samarra (Matsumoto 1984: 37; 1987: 189). In the Zagros foothills, similar mudbricks with fingerprints are produced at Choga Mish n°47-48 during Archaic Susiana 3 (Delougaz et al. 1972: 93) and at Choga Sefid n°49-51 (CMT) where the length reaches 160 to 260 cm (Hole 1977: 78). The maximum ratio of 1:7.3 by far exceeds the usual data, for an estimated weight of 93.6kg: such prefabricated elements are inconceivable to achieve because they would be difficult to transport without the risk of breaking the elements; it is more reasonable to interpret these ‘bricks’ as cob (Aurenche 1981: 195-199, but for an opposite argument, see Butterlin 2018: 124).

The molded mudbricks are attested before the middle of the seventh millennium BCE, in South-Eastern Anatolia, at Akarçay Tepe n°1-2 (Pottery Neolithic Phase, level F), where the excavators identified two different sizes with a ratio of 1.3 and 1.6:1 (Özbaşaran et al. 2011: 173).

After this period, in Northern Zagros, at Hajji Firuz n°81-88 (levels A to G), M. Voigt (1983: 19) identified molded mudbricks based on the steady of size and the regular shape close to square (Figure 10). In the Jezirah, at Chagar Bazar n°44 (Proto-Halaf, phase 10), the mudbricks used for circular buildings are shaped by hands or molded (Cruells et al. 2013: 471). At Yarim Tepe II n°203 (Halaf II, level VI), the wall of tholos 37 is made with molded mudbricks without, however, more precise information on their identification (Breniquet 1996: 84). At Tepe Gawra n°69 (Halaf, level XX), the regularity of size suggests that they are molded (Tobler 1950: 48).

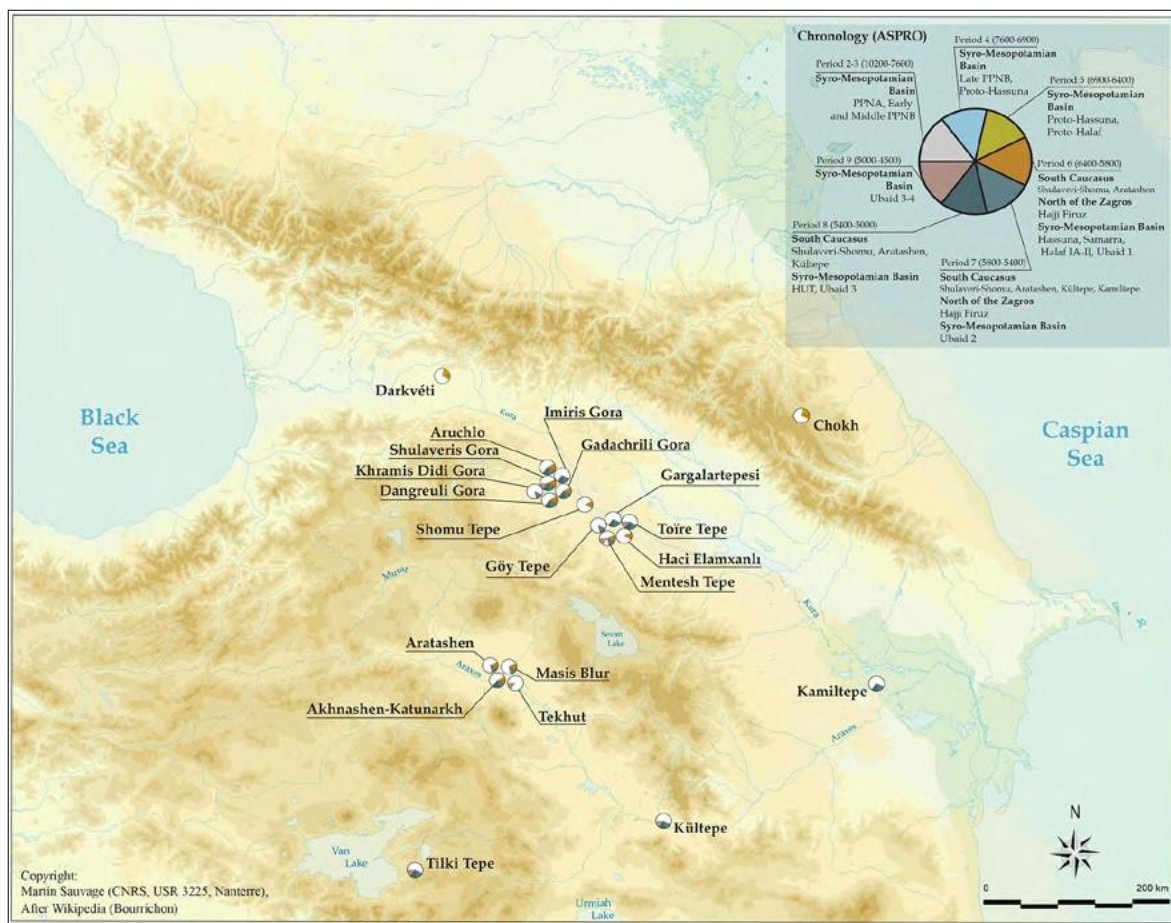


Figure 11. General map of Southern Caucasus with the sites mentioned in the text.



Figure 12. Gadachrili Gora, example of the wall 217 made of lumps (after Baudouin et al. 2018: 60, fig. 12).

In Central Mesopotamia, at Tell Baghouz n°36-38 (Late Samarra), R. Du Mesnil du Buisson (1948: 15; pl. XV-3) distinguished three different size and photographs enable to suppose that they are molded. At Tell es-Sawwan n°142-150, 153-164 (PN(?)/levels I-II), large oblong and molded mudbricks (El-Wailly et al. 1965: 21) are produced with a ratio between 2 and 3:1, while in level IV (Samarra) n°165-166, the molded mudbricks tend towards a ratio of 2:1 (Breniquet 1992: 9; El-Wailly et al. 1965: 21). The mudbricks at Tell es-Sawwan are considered by default as molded (Sauvage 1998: 101, 214). However, the weight of some bricks, reaching around 40 kg, makes them difficult both to make and transport.



### 3.2 Southern CAUCASUS communities

#### 3.2.1 Cob

In Southern Caucasus, recent discoveries record the use of lumps (Figures 4 and 11) in the Kvemo-Kartli (Georgia) and in the Ararat (Armenia) plains. At Gadachrili Gora n°54 (Shulaveri-Shomu, horizon II), wall 217 is built with lumps (Figure 12) (Baudouin et al. 2018; Hamon et al. 2016: 165, fig. 23), like in walls 139 and 164 (Hamon et al. 2016: 164) and at Masis Blur n°113 (Aratashen, level I) (Hayrapetyan et al. 2014: 180).

In the Ararat Plain, layers of cob seem used at Aknashen-Katunarkh (Aratashen, level IV) for wall T5W4 where strips of yellow clay divided horizontally by strips of darker clay have been identified (C. Chataigner, personal communication). At Masis Blur n°114 (Aratashen, level I), wall S011 is made with ‘straight row of alternating dark and light clay rectangles’ (Hayrapetyan et al. 2014: 180).

Several occurrences of cob could not be defined in detail. In the Kvemo-Kartli Plain, at Aruchlo n°13-14 (Shulaveri-Shomu, level I), cob, which is there called *pisé* (Chataigner 1995: 59; Kushnareva et al. 1970: 22), has been used for buildings 4 to 9. At Shulaveris Gora n°188 (Shulaveri-Shomu), A. Sagona (1993: 456) described this technique as ‘wattle-and-daub’, while the excavators as *pisé* (Dzhavakhishvili et al. 1975: 203). In these two cases, stacked mud and plano-convex mudbricks are used simultaneously (see below). In Nakhichevan, at Kültepe n°112 (Kültepe), Abibullaev (1963: 157–58) mentioned *pisé*, without specifics.

#### 3.2.2 Mudbricks

In Southern Caucasus, two morphological types of sun-dried mudbricks have been identified: plano-convex mudbricks, flat on the inside and curved on the outside, characteristic of Shulaveri-Shomu in the Kura Valley, and elongated and flat mudbricks, characteristic of Aratashen in the Araxes Valley (Chataigner 1995: 64) but also used in the Middle Kura Valley and the Kvemo-Kartli Plain. The publications usually describe the shape without specifying the manufacturing technique. C. Chataigner is the only one to identify plano-convex bricks as mudbricks shaped by hands, similar to the curved bricks produced during the PPNA (9500-8700 BCE) in the Near East (Chataigner 1995: 57).

Plano-convex mudbricks seem to be used from the beginning of the sixth millennium BCE in Shulaveri-Shomu. At Shomu Tepe n°167-175 (Narimanov 1987: 86), they have a length/width ratio always between 2:1 and 3:1, and two sizes: small and large (Figures 7 and 8). At Mentesh Tepe n°118-123 (level I), sizes is relatively homogeneous, with a ratio between 2.7:1 and 3.6:1. While the mudbricks of structure ST346 are certainly shaped by hands, other could be mold-made (see below). At Göy Tepe n°70-72 (levels 1 to 14), plano-convex mudbricks in level 13 are replaced by flat mudbricks in the other levels (Guliyev et al. 2014: 5, Y. Nishiaki, personal communication); medium mudbricks have a length of 30 to 40cm, and large mudbricks are 40-60cm (Guliyev et al. 2009: 47; 2012: 74; 2014: 5). At Gargalar Tepesi n°61-68, there is a clear decrease in size from levels 1 to 3 (Narimanov 1992: 20–21).

In the Kvemo-Kartli Plain, at Aruchlo n°15-23, scholars insisted on the irregularity of the size, with length varying between 18 and 50 cm (Hansen et al. 2013: 390). In addition, the stratigraphic data enable to associate the largest mudbricks to the oldest levels (Hansen et al. 2017: 209, fig. 22; p. 210, fig. 23). At Shulaveris Gora n°176-186 (Dzhavakhishvili 1973: 19), the same irregularity is attested, length varying between 25 and 50cm (Kushnareva et al. 1970: 28), but no stratigraphic data enable to assume an evolution of the size. At Gadachrili Gora n°54-60 (level I), mudbricks of building 2004 are elongated and flat with a ratio of 2:1 (Baudouin et al. 2018). In building 2003, mudbricks of the peripheral wall have a plano-convex shape, with a ratio of 2:1, and those of the dividing wall are square and flat (Hamon et al. 2016: 161–62). At Khramis Didi Gora n°104-111, plano-convex mudbricks





Figure 13. Molded plano-convex mud-bricks from Mentesh Tepe. a.: Detail of the four courses of mud-bricks, wall 293 (Sector 10) – View from the West; b.: Detail of the mortar between the mud-bricks, the wall 293 – View from the West; c.: Detail of the first course of mud-brick, wall 285 (Sector 15) – View from the North-East (after Baudouin et al. 2018: 58, fig. 8).

have a ratio between 1.9 and 2.7:1. At Imiris Gora n°88-94, such mudbricks are of different size (Dzhaparidze et al. 1971: 28; Dzhavakhishvili 1973: 48), varying between 32 and 50cm, but the lack of stratigraphic data does not enable to interpret an evolution.

In the Ararat Plain (Aratashen), flat and elongated mudbricks are attested at Aratashen n°6 in level I (Badalyan et al. 2004: 402) and at Akhnashen-Katunarkh n°3-5 where small and large mudbricks are identified in level VII (Badalyan et al. 2014: 165). At Tekhut n°196 (levels II and XII), mudbricks are also flat with a ratio of 1.3:1 (Torosjan 1976: 23–27).

In the Mil Plain, at Kamiltepe n°101-103 (Kamiltepe, phase Kamiltepe I), if Narimanov (1992: 35) identified rectangular mudbricks, those used for the terrace, shaped by hand, are smaller and square (Helwing et al. 2017: 17).

Recent research at Aruchlo (Ioseliani 2017) and Mentesh Tepe (Baudouin et al. 2018) confirmed the use of molded plano-convex mudbricks during the first third of the sixth millennium BCE

in Shulaveri-Shomu (Figure 7, Baudouin, *tbp*). At Mentesh Tepe n°110-111, mudbricks are clearly molded (Figure 13): the edges are perfectly straight and marks of clipping are visible at the top of these mudbricks (Baudouin 2018a: 150–51; Baudouin et al. 2017: 44-45, fig. 4). In addition, slight longitudinal ridges on the convex face of several mudbricks indicate a flattening of the surface before the removal of the frame. At Aruchlo n°24-35, molded plano-convex mudbricks have been identified in a burned collapse attributable to the oldest occupation. These mudbricks have a standard size and have specific stigmas (Ioseliani 2017: 282) similar of those observed at Mentesh Tepe.

## 4 Discussion

### 4.1 TECHNICAL evolution: the GRADUAL REPLACEMENT of cob by mudbricks

Stacked mud is used from the end of the seventh to the middle of the sixth millennium BCE. Lumps seems to be older, attested from Hassuna (Proto-Hassuna), but we observe the recurrence of cob in layers in the Jezirah, Northern Zagros and Southern Caucasus since 6200-6000 BCE: its use could be simultaneous during Early Halaf/Halaf I (ca. 6010-5800 BCE), Hajji Firuz (ca. 6200-6000 BCE), Aratashen (ca. 6000-5750 BCE) and Shulaveri-Shomu (from 5900 BCE). The use of cob seems significant from the end of the seventh millennium to the first third of the sixth millennium BCE but it gradually disappears during the end of Hassuna and Halaf in the Syro-Mesopotamian Basin, replaced by mudbrick.

Until the middle of the sixth millennium BCE, and whatever the manufacturing technique, the production of mudbricks testifies to extremely marked regional facies throughout the region considered, identifiable by differences in shapes or sizes. The reason of this heterogeneity is probably related to cultural particularisms. Both in the Syro-Mesopotamian Basin (Halaf) and in the Southern Caucasus, the appearance of molded mudbricks is not well defined. In the first area, they seem to appear late and perhaps as a result of an Ubaid impulse (Breniquet 1996: 84), during the Halaf II period (ca. 5800-5400 BCE). Their discovery in the Proto-Halaf levels at Chagar Bazar and in the Hajji Firuz levels on the eponymous site suggests that the East of the Euphrates was able to benefit from a technical spread from the Middle Euphrates at the end of the seventh millennium (Sauvage 2009: 195). Indeed, the use of the molded mudbrick on several sites (Cafer Hoyük, Tell Halula, Bouqras, Gritille) of Late PPNB (ca. 7000 BCE) in this region encourages to follow this assumption. In Southern Caucasus, mudbricks are duly molded since the beginning of the sixth millennium BCE.

### 4.2 Cob development: TECHNICAL TRANSFER or convergence?

The process of the spread of a technique can be considered through time and space. This process involves an imbalance between two (or more) communities (Leroi-Gourhan 1945: 460). However, other factors need to be considered, such as the technical degree of the communities and the natural setting. The former presence of cob in Jezirah and the large amount of archaeological evidence enable us to precisely track the technical evolution and its origin in Northern Zagros and in the Southern Caucasus communities.

#### 4.2.1 The development of HALAF Architecture

The assumption of the spread of cob in Halaf is conceivable. It was adopted gradually during the Halaf expansion, between 5900 and 5300 BCE, towards Central Mesopotamia, Western Jezirah and near the Van Lake in Northern Zagros (Figure 14): there would be a convergence between spatial organization and chronology, that can confirm the assumption of a slow spread, phenomenon already emphasized for ceramics (Breniquet 1996: 65).



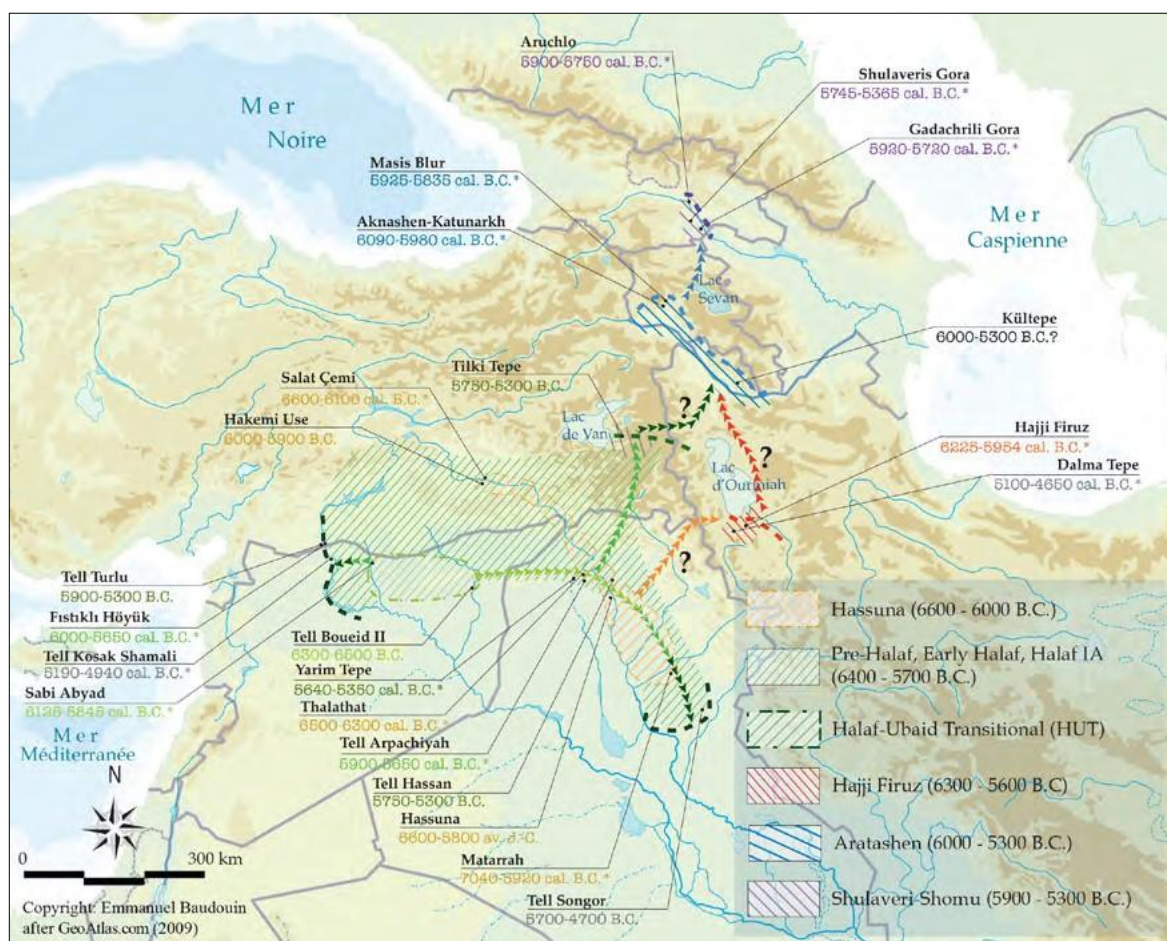


Figure 14. Use of cob and spread of the technique in the Syro-Mesopotamian basin, Eastern Anatolia, Northern Zagros and Southern Caucasus from the second half of the seventh millennium to the middle of the fifth millennium BCE.

#### 4.2.2 The development of cob in Northern ZAGROS AND Southern CAUCASUS

An analysis of the stratigraphic sequence at Hajji Firuz brings new informations. Firstly, cob is used alone until levels G-F (Figure 15). Furthermore, this technique has been used in ‘competition’ with molded mudbrick from levels D to B. In this case, the molded mudbrick may be interpreted as a technical invention which will totally replace cob from levels C-B.

In the current state of knowledge, it is likely that cob appeared from the beginning of the Hajji Firuz (ca. 6300 cal. BCE), perhaps as result of the stimuli of the Eastern Jezirah or High Tigris communities during Early Hassuna or Samarra, especially because these cultures share extra-architectural affinities, as in decorations and ceramic forms (Voigt 1983: 163).

In the Southern Caucasus, the issue is different. Halaf reaches the shore of the Van Lake ca. 5700/5300 BCE, at least two hundred years after first settlement in Southern Caucasus. Therefore it seems unlikely that this technique was older than the Halaf expansion to the northeast, although there could have been relations between these different communities at the beginning of the sixth millennium BCE, as represented by the discovery of sherds of ‘Mesopotamian’ style at several sites. On the other hand, the possibility of a spread from the Urmiah Lake (Hajji Firuz) and High Tigris (Hassuna or Samarra) regions is weak because, except cob, technical affinities seem extremely thin with Caucasian architecture (Baudouin, in progress, 2019, 2018a 2018b). It would be unusual that the technical input only affected one specific material without changing other material components. Thus, in our current state of knowledge, a local and autonomous origin of cob in the Araxes Valley is likely. Nevertheless, an ‘internal’ spread in the Southern Caucasus from the Araxes

LEVEL	RADIOCARBON DATING (CAL. B.C.)	COB (BUILDING N°)	MUD-BRICK (BUILDING N°)
L	6225-5954	NA	NA
K	/	NA	NA
J	/	XV2	
G-H	/	XIII-2	
F-G	/	XII-2	
E-F	/		X2-3
D	5944-5592		IX
C		VII	VII
C		VII	
B-C			II2
A3			III
A3			III1
A2-A3			I2

Figure 15. Summary table of the evolution of cob and mudbricks sizes at Hajji Firuz between levels L and A2, based on Voigt 1983.

to the Kura Valley is possible. However, lack of precise stratigraphic and chronological data does not enable for sure to support this assumption.

**4.3. The mudbrick technology: A medium for A TECHNICAL TRANSFER?**

The interpretation of an autonomous invention of the molded mudbrick during Late PPNB (ca. 7500-7000 BCE) in the Middle Euphrates and a spread to Samarra in Central Mesopotamia (ca. 6500 BCE) is argued by Sauvage (2009: 195). In the Jezirah, the molded mudbrick would have been adopted late (Halaf II) and gradually at the impulse of Ubaid communities (Breniquet 1996: 95). Such a technical change would correlate with the social transformations within Halaf communities.

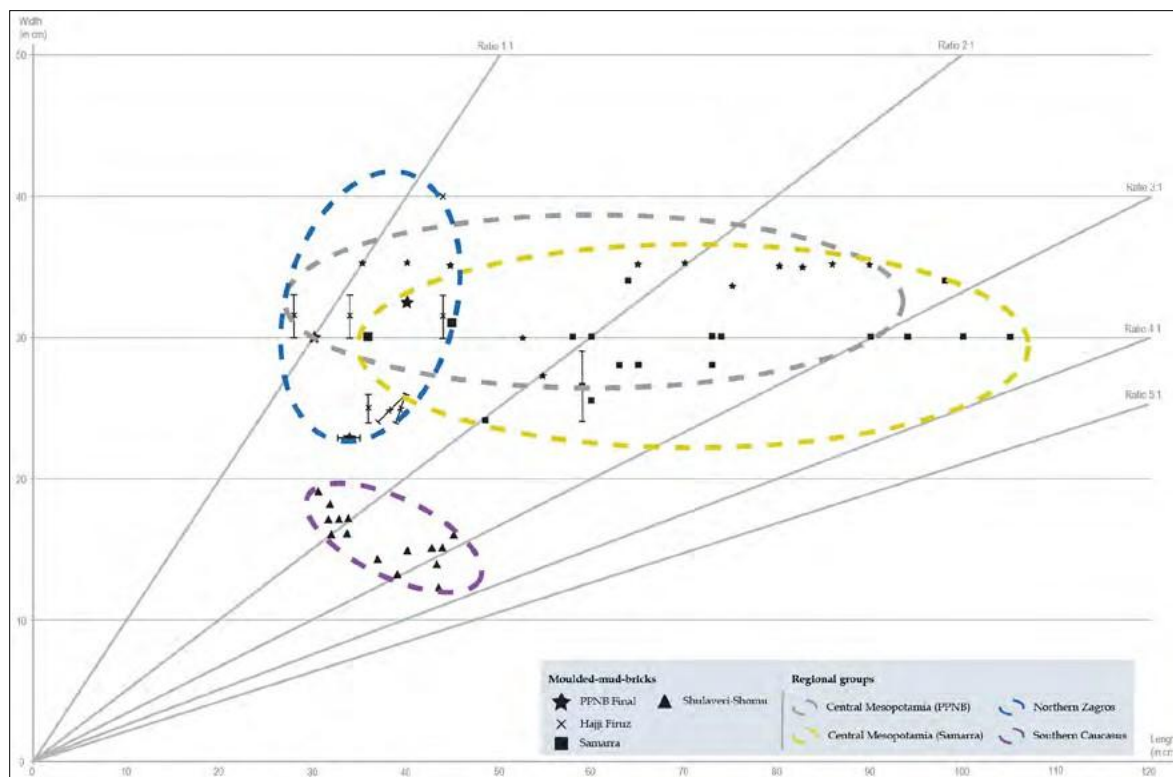


Figure 16. Sizes of molded mudbricks from the seventh millennium and the middle of the sixth millennium BCE in the Syro-mesopotamian basin, Northern Zagros and Southern Caucasus.



LEVEL	DATE	BUILDING BUILT WITH COB TECHNIQUE	BUILDING BUILT WITH MUD BRICKS
8	6125-6075 BC	8.1 ; 8.4	8.2 ; 8.3
7	6020-5995 BC	7.1 ; 7.2 ; 7.3 ; 7.5	7.5 ; 7.11
6	6010-5995 BC	6.1 ; 6.2 ; 6.4 ; 6.5 ; 6.6 ; 6.7 ; 6.8 ; 6.9 ; 6.10 ; 6.11	6.1 ; 6.13 ; 6.14
5	6000-5945 BC	5.1	5.1 ; 5.2
4	5980-5925 BC	/	Tholos Q15
3B	5940-5905 BC	Build. I	Buil. I ; Tholos S ; Tholos I ; Tholos N/AE

Figure 17. Summary table of the architectural techniques at Tell Sabi Abyad (Syria) with a gradual disappearance of the cob technique and its replacement by mudbricks, based on Akkermans et al. 2014 (after Baudouin et al. 2018: 67, fig. 17).

#### 4.3.1 The development of mudbrick in MESOPOTAMIA

Chronologically, the assumption of a spread of the molded mudbrick from the Middle Euphrates to Central Mesopotamia is conceivable (Sauvage 2009: 195). It is explained by a ‘late’ occupation in the Syrian desert at El-Kowm 2, ca. 7900-5600 cal. BCE (Stordeur 2000: 305, tab.1), and Qdeir, ca. 7290-5730 cal. BCE (Hours et al. 1994: 408), or in the Euphrates Valley at Bouqras, ca. 7100-6200 cal. BCE (Hours et al. 1994: 388–89), which thus extends Late PPNB and reduces the gap with the beginning of Samarra, ca. 6400-5700 cal. BCE (El-Wailly et al. 1965: 19; Burleigh et al. 1982: 247; Helwing 2016). The similarity of the size of mudbricks in Late PPNB (Bouqras n°41-43, Gritille n°73-75) and Samarra (Figure 16) corroborates relationships between these two chrono-cultural areas and confirms the assumption of a spread of the molded mudbrick technique from the Middle Euphrates to Central Mesopotamia at the beginning of the sixth millennium BCE. In addition, this spread can be corroborated by other technical elements adopted in Central Mesopotamia like buttresses, attested for the first time at Cafer Höyük, during Late PPNB, ca. 8500-6500 cal. BCE (Molist et al. 1991: 7), or the standardized plan (Aurenche 1981: 200; Breniquet 2000; Stordeur 2000; Aurenche et al. 2009: 156; Baudouin 2018a: 497-508) attested at Tell Bouqras and at El-Kowm 2.

#### 4.3.2 A technical improvement in Northern ZAGROS AND JEZIRAH

In Northern Zagros (Hajji Firuz), the typical mudbrick size at Hajji Firuz (Figure 16; in blue), with a ratio of 1:1, overlap very little with the production of Late PPNB (in grey) and Samarra (in yellow). The assumption of an autonomous technical evolution in Northern Zagros seems thus more viable and could explain the gradual disappearance of cob at the benefit of mudbrick (Figure 15). A similar assumption could be proposed in western Jezirah for hand-shaped mudbricks at Tell Sabi Abyad (Op. I) where we observed the same gradual displacement from level 8 to level 3B (6125-5905 cal. BCE), cob nearly totally disappearing ca. 6000 BCE (Figure 17).

#### 4.3.3 How to interpret the ORIGINAL SHAPE of the CAUCASIAN mudbricks?

Lastly, mudbricks made in the Kura Valley during the Shulaveri-Shomu are characteristic by their size and their shape (Figure 16). The hypothesis of a local invention would justify and corroborate the interpretation of an autonomous settling of communities in the Kura Valley. This assumption is strengthened by the presence of circular subterranean architecture in the Kura Valley, in the Mil Plain and in the Karabagh Plain at where in few sites these structures were built on the virgin soil and are the first settlement phases during the first third of the sixth millennium BCE. This ‘first’ architecture, compared with ethnographic examples, can be considered as the original settlement of former nomadic communities (Baudouin 2019: 145-146). Finally, the exclusive use of the circular plan throughout more than 700 years in the entire Southern Caucasus enables us to interpret a technical inertia in the region and confirms the assumption of an autonomous settlement of communities of this region.

## 5 Conclusion

The spread of cob in the entire area of the Halaf cultural expansion is most likely. However, in Northern Zagros and Southern Caucasus, such a hypothesis is unlikely because no other technologies were adopted. The search for the ‘way’ of spread of one single technique is constrained by chronological imprecisions and a lack of diagnostic markers. In addition, cob is often considered like a ‘basic’ technique characterizing communities who did not reach a high degree of technicality. Therefore, a local development in Northern Zagros and the Southern Caucasus, where the first settlement appeared at the beginning of the sixth millennium BCE, cannot be excluded. Later, the gradual disappearance of cob and its replacement by mudbrick is a phenomenon clearly visible at a local scale (Hajji Firuz, Tell Sabi Abyad), but it is not possible to generalize in the current state of data.

On the other hand, the appearance of molded mudbrick represents an undeniable technical development, the spread of which is clearly visible from Late PPNB to Samarra, and can only be approached by a general study of the ‘complex’ architecture in the Syro-Mesopotamian Basin. Therefore, the development of the Ubaid tripartite architecture represents a new stage of progress at the end of the fifth millennium BCE (Baudouin 2018a; 2018b: 407). This brief overview of the development of cob and mudbrick techniques shows the potential of this research and confirms the importance of systematizing such an approach in order to better define the contents of technical exchanges and cultural relationships between communities.

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### Table 1 Data on cobs and mudbricks

Data are arranged in alphabetical order of the site names. The call number in column one of the table corresponds to the return of the text. Columns three to five specify the cultural attribution, the level, the dating and the building or wall concerned according to the name given by the excavator. Columns eight to ten specify the size of mudbricks (length, width, height), as well as the length/width ratio and the estimated weight according to these size: the underlined weights correspond to the values greater than 28kg whose manufacture or transport are considered difficult. Columns eleven and twelve specify material used (cob or mudbricks), layout and form (abbreviations below). Finally, the authors' citations as well as the associated bibliographic references are listed in columns thirteen and fourteen. The references preceded by the sign '\*' are those of the radiocarbon dates.

#### Abbreviations:

C: cob  
 c: cigar-shaped  
 E: fingerprints  
 F: flat  
 L: lumps  
 LC: layers of cob  
 M: moulded mudbricks  
 m: mudbricks shaped by hands  
 Ob: oblong  
 Pl.-cx: plano-convex mudbricks  
 R: rectangular  
 und.: undetermined



N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/W)	Weight estimated (in kg)	Technique	Shape or implementation	Citation	Bibliographic references		
1	Akarçay Tepe	Pottery Neolithic phase	6630-6015 cal. B.C.*	F	40	32		1,25		M		"The kerpiç blocks measure 40 x 32 cm or 32/34 x 22 cm on average."	Özbaşaran et al., 2011:173; *Özbaşaran et al., 2011:167.		
2					32-34	22					M				
3	Aknashen-Katunarkh	Aratashen/VII	Before 6000 B.C.?		50	25		2		m	F	"The circular buildings demonstrate the presence of clearly evolved darker clay blocks, with dimensions 25 x 50 cm, and 19/20 x 14/15 cm."	Badalyan et al., 2014:165.		
4					19 à 20	14	5	1,36 à 1,43	2,13 à 2,24	m	F				
5					Aratashen/IV	5981-5370 cal. B.C.*		50	30	20	1,7			48	m
6	Aratashen	Aratashen/I	Before 5800 B.C.?		45	25	8	1,8	14,40	m	F	"All are built in flat, rectangular mud bricks of even size (about 45 x 25 x 8 cm). Remains of clay floors are evident in each of them, as well as in the orthogonal structure."	Badalyan et al., 2014:402.		
7	Arpachiyah	Halaf	6400-5400 B.C.	General						C	L	"All the tholoi in the Tepe rested on stone foundations, having a superstructure of <b>pisé or beaten clay.</b> "	Mallowan et al., 1935:25.		
8		Halaf III/TT7-10	5800-5500 B.C.	General						C	und.				
9		Halaf II/TT 4-5	5800-5500 B.C.	TT 4-5	43	41	10	1,05	28,21	m				"In TT 4.5 the following pisé sizes were recovered: 0.43x0.41x0.10 m. [...]. <b>The size were all irregular.</b> " (Mallowan et al. 1935: 16)	Özbaşaran et al., 2011:173; *Özbaşaran et al., 2011:167.
10					37,5	21	8	1,79	10,08						
11		Halaf II/TT 4-5	5800-5500 B.C.	TT 4-5	39	20,5	9	1,90	11,51						
12					46	42	11	1,10	34,00						
13	Aruchlo	Shulaveri-Shomu	5900-5750 cal. B.C.*	9						C	und.	"Le pisé est également connu dans le bassin de la Kura, puisqu'il servit pour quelques édifices circulaires d'Aruklo 1 (bât. N° 4-9) et de Shulaveri et qu'à Kechili III il est le seul matériau cité."	Chataigner 1995:59; Kushnareva et al., 1970:22; *Lyonnet et al., 2012:85, tab. 19.		
14		Shulaveri-Shomu/I	5900-5750 cal. B.C.*	4						C	und.				
15		Shulaveri-Shomu/Older Neolithic settlement	1st third of the 6th Millennium B.C.?	Complex III	30 à 50	20	5	1,5 à 2,5	4,8 à 8	m	Pl.-cx		"The bricks are 30 to 50 cm long, 20 cm wide and 5 cm in thickness. Normally they are plano-convex; however, the form and the size are variable: they can be smaller and more square."	Hansen et al., 2017:202.	
16					C030?	41	20	8	2,05	10,50	m	Pl.-cx	"The individual bricks are usually plano-convex in form, but there is no standard measurement. Nevertheless, in this particular structure some bricks measured 41 cm x 20 cm x 8 cm." (Hansen et al. 2013: 390)	Hansen et al., 2006, p.10; Hansen et al., 2013:390.	
17		Shulaveri-Shomu			General	40	15	8	2,67	7,68	m			Dzhavakhishvili, 1973:80; Chubinskivili et al., 1976:58; Munchaev, 1982:106.	
18				General	40	13	8	3,1	6,66	m					
19				General	27	17	10	1,6	7,34	m					
20				General	19	17	9	1,1	4,65	m					
21				General	18	15	5	1,2	2,16	m					
22				General	18	9	7,5	2,0	1,94	m					



N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or implementation	Citation	Bibliographic references				
23	Aruchlo	<i>Shulaveri-Shomu</i>		General	32	18	6	1,8	5,53	m			Dzhavakhshvili 1973:80;  Munchaev, 1982:106.				
24					37	14	11	2,6	5,50	M		"However due to their standardized size it is possible to assume that at least the majority of the bricks were not produced by hand. Moreover, some of them have <b>sharp edges and flattened sides suggesting the use of wooden frames.</b> " (Ioseliani 2017: 282)	Ioseliani, 2017:281, tab. 1.				
25					34	17	11	2,0	4,40								
26					34	17	10	2,0	4,60								
27					34	17	9	2,0	4,20								
28					34	16	10	2,1	4,40								
29					33	17	12	1,9	5,30								
30					32	18	11	1,8	4,30								
31					32	18	9	1,8	3,90								
32					32	17	12	1,9	5,30								
33					32	17	10	1,9	4,70								
34					32	16	9	2,0	4,10								
35					31	19	11	1,6	5,60								
36					Baghouz	<i>Late Samarra</i>		General	59					24 à 29	8 à 9	2,03 à 2,46	18,12 à 24,64
37	36	30	9	1,20					15,55								
38	45	31	10	1,45					22,32								
39	Boueïd II	<i>Proto-Hassuna or Pre-Halaf</i>	6500-6300 B.C.	General						C	und.	"The buildings were all built of <b>pisé</b> (...)."	Suleiman et al. 2002:6.				
40					30	25	8	1,20	9,60	m	R	"The buildings were all built of pisé, although mud bricks may have been used occasionally, in the western and the southern wall of building I. These bricks <b>do not appear to have a standardized size</b> (varying around 30x25x8 cm)."					
41	Bouqras	Late PPNB/II	7036-6605 cal. B.C.*	General	54	27	7	2,00	16,33	M		«Les murs sont désormais construits en briques quadrangulaires <b>faites au moule</b> , de 7 cm d'épaisseur et de 25 à 35 cm de côté."	Contenson, 1985:338; *Hours et al., 1994, pp. 388-389.				
42					30		7										
43		Late PPNB/III	6996-6472 cal. B.C.*		30	30			1								
44	Chagar Bazar	<i>Proto-Halaf</i> phase 10	6000-5600 cal. B.C.*	<i>Circular building</i>	50	20	8	2,50	12,80	M		"In general, their walls were erected in <b>moulded</b> or hand-shaped mud bricks [...]. This building was constructed with mud bricks measuring 25 cm x 50 cm x 8 cm."	Cruells et al., 2013:471; *Cruells et al., 2013:393, tab. 42.1.				



N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or implementation	Citation	Bibliographic references	
45	Choga Mami	Late Samarra/ III			60 à 90	12 à 18	15	3,33 à 7,5	17,28 à <u>38,88</u>	m	c	"The mud-brick employed in this building and elsewhere under on the site is long, cigar-shaped, and sun-dried, 60-90 cm. in length and from 12-18 cm. in diameter."	Oates, 1969:116.	
46		Halaf/III			55						c; E	«Like the surrounding wall, these were constructed of <b>cigar-shaped libn</b> (55 cm. long)."	Oates, 1969:117.	
47	Choga Mish	Archaic Susiana 3			80 à 95	12 à 20	10 à 12	4 à 7,92	15,36 à <u>36,48</u>	m	E		Delougaz et al., 1972:93.	
48					50 à 60	11 à 12	11 à 12	4,17 à 5,5	9,68 à 13,82					
49	Choga Sefid	Choga Mami Transitional (CMT)			80	10	10	8	12,80	m	E		Hole, 1977:78.	
50					75	15	15	5	<u>27,00</u>					
51					160 à 260	15	15	10,67 à 17,33	<u>57,60 à 93,60</u>					
52	Dalma Tepe	Dalma Tepe/5-4	5068-4698 cal. B.C.*	General						C	LC	"The walls at Dalma were constructed of <i>chineh</i> ( <b>layers of packed mud</b> ), separated in some cases by thin mortar-like clay layers, and were preserved to heights ranging from 15-60 cm."	Hamlin, 1975:113; *Hamlin, 1975:119, tab. 2.	
53	Fıstıklı Höyük	Halaf /III	6000-5300 B.C.	General						C	und.	"The only material used for the walls was pisé [...]. These two kinds of pisé could be observed: a crumbly reddish-brown pisé with chaff inclusions, and a more homogeneous, silty, tannish-colored material with little chaff."	Bernbeck et al., 2003:26.	
54	Gadachrili Gora	Shulaver-Shomu/II	5900-5300 cal. B.C.*	Wall 217						C	L	"These <b>blocks</b> are composed of clay mixed with organic inclusions (charcoal, bones, etc). <b>The clay used was sometimes sourced directly from anthropic levels or former soils</b> , which make it difficult to distinguish the walls from the surrounding destruction or fill layers (see for example Wall 217) (Fig. 23)."	Hamon et al., 2016:164; *Hamon et al. 2016:164, fig. 4.	
55		Shulaveri-Shomu/I		2002	20 à 26	12 à 14	8	1,43 à 1,67	3,07 à 3,58	m	Pl-cx		Hamon et al., 2016, pp. 160, 162-163; Personal data; *Hamon et al., 2016:1964, fig. 4.	
56				2003	19	19	5	1	2,89					F
57				2003	40	19	9	2,11	10,94					Pl-cx

N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or implementation	Citation	Bibliographic references	
58	Gadachrili Gora	Shulaveri-Shomu/I	5900-5300 cal. B.C.*	2004	50	25		2		m	F	"The building was constructed using elongated, flat, rectangular mud brick laid in a regular stretcher bond." (Hamon <i>et al.</i> 2016: 159)	Hamon <i>et al.</i> , 2016:159; Personal data; *Hamon <i>et al.</i> , 2016, p.164, fig. 4.	
59					38 à 40	15 à 20	8 à 10	2,53 à 2,67	7,3 à 12,8					Personal data; *Hamon <i>et al.</i> , 2016:164, fig. 4.
60		Shulaveri-Shomu		Wall 234	23		7							
61	Gargalar Tepesi	Shulaveri-Shomu/3		4	36	16	8	2	7,37	m		"Utility structure no. 4, 1.8 m in diameter, was built from brick of 36 x 16 x 8 cm (brick of dimensions 50 x 20 x 8-10 cm is also encountered in the third horizon)"	Narimanov, 1992:21.	
62				9	26 à 40	15	7 à 8	1,7 à 2,7	4,37 à 7,68					
63					50	20	8 à 10	3	12,8 à 16					
64		Shulaveri-Shomu/2		General	44	16 à 18	7 à 9	2,44 à 2,75	7,89 à 11,41					
65					40	16	8 à 11	3	8,19 à 11,26					
66					34	14	8	2	6,09					
67		Shulaveri-Shomu/1			46 à 48	16 à 18	7 à 9	2,56 à 3	8,24 à 12,44				"The bricks used to build the structures in the first horizon [...], and they were made of clay with chopped chaff; only the bricks of structure no. 20 were made of pure clay."	Narimanov, 1992:20.
68					40	16	8	3	8,19					
69	Gawra	Halaf/XX				13	9	5	1,44	0,94	M		"The bricks forming them were the smallest yet discovered, measuring <b>as a rule</b> about 13 x 9 x 5 cm."	Tobler, 1950:48.
70	Göy Tepe	Shulaveri-Shomu/1 à 14	5645-5460 cal. B.C.*		General	30 à 50	15 à 18	10	1,67 à 3,33	7,2 à 14,4	m	Pl-cx	"The walls are made of plano-convex mud bricks with straw temper, either in a yellow or grey color."	Guliyev <i>et al.</i> , 2014:5; *Nishiaki <i>et al.</i> , 2015:286, tab. 1.
71						60	20	8	3	15,36			"Hündür divarlı tikilerde kerpiclerin ölçüsü 60x20x8x8 sm, hörgüsü 12-15 cergeден ibaretdir."	Guliyev <i>et al.</i> , 2009:47; *Nishiaki <i>et al.</i> , 2015:286, tab. 1.
72				40 à 60		20	8 à 10	2 à 3	10,24 à 19,2	"The building materials were plano-convex-shaped mud bricks with straw temper, measuring approximately 40-60 x 20 x 8-10 cm. The bricks were made with yellow or brown clay."			Guliyev <i>et al.</i> , 2012:74; *Nishiaki <i>et al.</i> , 2015:286, tab. 1.	
73	Griffite	PPNB/Late PPNB	7500-6380 cal. B.C.*	General	80	35			2,29	M?			Aurenche <i>et al.</i> , 1988:5; *Hours <i>et al.</i> , 1994:396.	
74					45	35			1,29					
75					35	35			1					



N°	Site	Culture/Level	Date	Building	Lenght (in cm)	Width (in cm)	Hight (in cm)	Ratio (L/W)	Weight estimated (in kg)	Technique	Shape or implementation	Citation	Bibliographic references	
76	Hajji Firuz	Hajji Firuz/J	6225-5528 cal. B.C.* (phase Hajji Firuz)	Str. XV2						C	LC	"Structures I, and V <sub>1</sub> and perhaps the buildings dating to Phases L through G (see below), were constructed of <b>packed mud</b> . In this method of construction the clay is mixed with water and a tempering agent, and then <b>packed down in a layer which runs the entire length of the wall. After the layer dries <i>in situ</i>, the process is repeated until the desired height is reached.</b> "	Voigt, 1983:33; *Lawn, 1974:222.	
77		Hajji Firuz/G		Str. XII1										
78		Hajji Firuz/F		Str. XI1										
79		Hajji Firuz/C		Str. V										
80		Hajji Firuz/A2-A3		Str. I1										
81		Hajji Firuz/F (then G)		Str. XI1	12 à 58			6					"It is therefore unlikely that the bricks were <b>made in a frame or mold</b> . Clay mixed with water and vegetable matter (probably grass or straw) was presumably shaped into relatively thin slabs by hand, sun dried, and then set into mortar to form the walls."	Voigt, 1983:33; *Lawn, 1974:222.
82		Hajji Firuz/C		Str. VI		39	24	8	1,63	11,98	M			Voigt, 1983:48; *Lawn, 1974:222.
83						28	30 à 33	5 à 8	0,85 à 0,93	6,72 à 11,83				
84						34	30 à 33	5 à 8	1,03 à 1,13	8,16 à 14,36				Voigt 1983:47; *Lawn, 1974:222.
85						44	30 à 33	5 à 8	1,33 à 1,47	10,56 à 18,59				
86			Str. I1		44	40		1,10				*Lawn, 1974:222		
87	Hajji Firuz/B-C	Str. II2	36	24 à 26	6	1,39 à 1,5	8,29 à 8,99			Voigt, 1983:42; *Lawn, 1974:222.				
88	Hajji Firuz/Phase A3	Str. III	37 à 40	24 à 26	6	1,42 à 1,67	8,52 à 9,98			Voigt, 1983:43; *Lawn, 1974:222.				
89	Hakemi Use	Hassuna or Samarra/III	6000-5900 B.C.	General						C	und.	"The use of the <i>pisé</i> technique and the loosely bound texture of the walls is another common feature in the architecture of the site [...]. The majority of the walls in the buildings were produced using <i>pisé</i> , while some parts of the walls were constructed with adobe parts [...]. This oddity is observed at the upper level and only in three buildings."	Tekin, 2011, pp. 152-153.	





N°	Site	Culture/Level	Date	Building	Lenght (in cm)	Width (in cm)	Hight (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or implementation	Citation	Bibliographic references	
90	Hakemi Use	<i>Hassuna-Samarra/III</i>	6000-5900 B.C.	General	45	45	10	1	32,40	m		"The dimensions of the mudbricks are not standardized; the largest of them are 45 x 45 x 15 cm; the smallest ones 30 x 15 x 10 cm. It should be noted that these mudbricks are produced using a simple technique and have a thin surface tissue possibly due to only a short period's being allowed for drying process."	Tekin, 2011:152.	
91					30	15	10	2	7,20					
92	Hassan	<i>Halaf II</i>	5800-5500 B.C.	<i>Tholos</i>						C	und.	"It is a small <i>tholos</i> less than 3m. In diameter, of which only the <b>tauf</b> base remains."	Jasim, 1985:164.	
93		<i>Hassuna/I-II</i>	6600-5800 B.C.	General							L	"lumps of mud of various sizes"	Safar et al., 1945:273.	
94	Imiris Gora	<i>Shulaveri-Shomu/IV</i>	5730-4950 cal. B.C.*?	35	38	16	11	2,38	10,70	m	Pl-cx		Dzhaparidze et al., 1971:28; *Dzhaparidze et al., 1975:127.	
95					41	16	10	2,56	10,50					
96		<i>Shulaveri-Shomu</i>	General	50	20	10	2,50	16,00						
97				40	15	10	2,67	9,60						
98				38	15	10	2,53	9,12						
99				35	16	10 à 11	2,19	8,96 à 9,86						
100	32	20	7	1,60	7,17									
101					15	16		1						
102	Kamiltepe	<i>Kamiltepe/Phase Kamiltepe I</i>	5610-5380 cal. B.C.*?		19	20		1		m		"The construction of the platform was made with <b>hand-shaped</b> bricks of irregular shape [...]. The bricks were oblong, with an approximately square section; after the slabs has been dug out, they had apparently been smoothed along the long sides by hand, <b>and then the front ends were compressed to a flat surface by hand.</b> " (Helwing <i>et. al.</i> 2017: 17)	Aliyev et al., 2009:29; Helwing et al., 2017:17; *Aliyev et al., 2009:38, fig. 21.	
103														34
104	Khramis Didi-Gora	<i>Shulaveri-Shomu/III</i>	Before 5300 B.C.?	27	42	20	7 à 7,5	2,10	9,41 à 10,08	m	Pl.-cx?		Personal data.	
105	Khramis Didi-Gora	<i>Shulaveri-Shomu/I</i>	Before 5300 B.C.?		34	42	16	7	2,63	7,53	m	Pl.-cx?		Personal data.
106					34	48 à 49	24	7	2 à 2,04	12,9 à 13,17				
107					29	42 à 43	20 à 22	7,5	1,9 à 2,15	10,08 à 11,35				
108		<i>Shulaveri-Shomu</i>	General	48	24	7	2	12,90						
109				45	20	7	2,25	10,08						
110	42			20	7	2,10	9,41							
111					36	18	7,5	2	7,78	m			Kiguradze, 1986:70.	
112	Kültepe	<i>Kültepe</i>	6000-5300 B.C.?	General						C	und.		Abibullaev, 1963, pp. 157-158.	



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113	Masis Blur	Aratashen/I	5925-5630 cal. B.C.*	S003, S004, S005						C	L	"The second technique describes preparation of <b>mud "clods" or "pads"</b> ( <i>motte – fr.</i> ) from the mixture of clay tempered with cut straw ( <i>torchis – fr.</i> )."	Hayrapetyan, et al., 2014:180; *Martyrosyan-Olshansky et al., 2013:145, tab. 1.
114				S011								LC	
115	Matarrah	Hassuna/II	6300 - 5800 B.C.	General						C	und.	"The houses of this level were of four to six rooms, constructed of <b>packed mud or tauf.</b> "	Braidwood et al., 1952:6.
116	Mentesh Tepe	Shulaveri-Shomul	5800-5600 cal. B.C.*	285=689	44 à 45	15 à 16	9 à 10	2,75 à 3	9,5 à 11,52	M	Pl.-cx		Personal data; *Lyonnet et al., 2016:180, tab. 2.
117				293	43	15	10	2,87	10,32				
118				346	28	22	8	1,27	7,88	m	Pl.-cx		
119				284	43	14	9	3,07	8,67				
120				516	43	14	9	3,07	8,67	M?	Pl.-cx		
121				718=337	40	15	10	2,67	9,6				
122				1025	43	12	10	3,58	8,26	m			
123				1031	39	13	10	3	8,11	M?			
124	Sabi Abyad	Pre-Halaf/8	6125-6075 cal. B.C.*	8.1						C	L	"made of reddish, crumbly earth (representing either <i>pisé</i> or <b>difficult-to-recognize layers of slabs</b> ) mixed with small pieces of limestones"	Akkermans et al., 2014, pp. 36-37; *Akkermans et al., 2014:31, tab. 2.2.
125				8.2								und.	
126	Sabi Abyad	Pre-Halaf/7A	6015-5995 cal. B.C.*	7.5						C	L	"The eastern wall bounding the rectangular annex was constructed in two stages: its lower part consisted of compact brown clay, including irregular, reddish-brown wall pieces, to a height of about 50 cm, whereas its upper part was made of greyish clay layers, preserved to a height of about 60 cm. The use of different building materials may have been simply due to the simultaneous exploitation of various sources of clays for construction purposes."	Akkermans et al., 2014:57; *Akkermans et al., 2014:31, tab. 2.2.
127		Pre-Halaf/7B	6020-6005 cal. B.C.*	7.3						C	LC	"Its wall about <b>40 cm thick was made of compact brown clay</b> "	Akkermans et al., 2014:52; *Akkermans et al., 2014:31, tab. 2.2.
128		7.1								C	und.	"They were made either of <b>large slabs or of compact clay</b> often including slab fragments ( <b>re-used pieces</b> of earlier walls), or of combination of these."	Akkermans et al., 2014, p.45; *Akkermans et al., 2014:31, tab. 2.2.

N°	Site	Culture/Level	Date	Building	Lenght (in cm)	Width (in cm)	Hight (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or layout	Citation	Bibliographic references												
129	Sabi Abyad	Pre-Halaf/7-6	6020-5995 cal. B.C.*	7.5	45 à 50	35	6 à 8	1,29 à 1,43	15,12 à 22,4	m?		"Most walls seemed to consist of <b>regular</b> layers of grey-brown mud bricks, measuring about 45/50 x 35 x 6-8 cm, alternating with layers of a dark-brown mortar 1-3 cm thick."	Akkermans et al., 2014:57; * Akkermans et al., 2014:31, tab. 2.2.												
130				7.11	40 à 44	40 à 45	4 à 7	0,88 à 1,1	10,24 à 22,18			"They were mainly made of brown mud bricks, measuring 40-44 by 40-45 by 4-7 cm"	Akkermans et al., 2014:61; * Akkermans et al., 2014:31, tab. 2.2.												
131				6.13	40	40	4 à 6	1	10,24 à 15,36			"Extensive remains of this wall occurred due north outside the tholos, in the form of collapsed stretches of roughly square, reddish-brown to grey-brown bricks (each about 40 by 40 by 4-6 cm) set in a grey mud mortar."	Akkermans et al., 2014:74; * Akkermans et al., 2014:31, tab. 2.2.												
132	Sabi Abyad	Early Halaf/6	6010-5995 cal. B.C.*	6.1, 6.2, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11						C	LC	"The generally 40 cm wide walls of the level 6 buildings were simply founded on earth and were all built of pisé, laid down in <b>layers of various colours and, most likely, various consistency</b> . The order was always the same : a grey, 2 or 3 cm thick loam band followed by an orange-brown, ca. 2-4 cm thick deposit, in its turn covered by a buff layer, about 6-8 cm thick, etc. Apparently, various sources of clay were in use, which each must have had different qualities."	Verhoeven et al., 1996:44; * Akkermans et al., 2014:31, tab. 2.2.												
134														Early Halaf/5	5995-5925 cal. B.C.*	5.1	40	30 à 35	8	1,14 à 1,33	15,36 à 17,92	m?	"The walls were each ca. 25-50 cm thick and built either of compact grey pisé or <b>grey mud bricks</b> measuring ca. 40 x 35/30 x 8 cm."	Verhoeven et al., 1996:66; * Akkermans et al., 2014:31, tab. 2.2.	
135																5.2	30	30	12	1	17,28		* Akkermans et al., 2014:31, tab. 2.2.		
136														Halaf/3B		Tholos I						C	LC	"The walls were built of pisé, which was laid down in <b>two alternating layers of orange-brown bands</b> ca. 6-8 cm thick and grey bands ca. 2 cm thick."	Verhoeven et al., 1996:94; * Akkermans et al., 2014:31, tab. 2.2.
137																1	35 à 40	35	10	1 à 1,14	19,6 à 22,4	m?		"Commonly, large and more or less square mud bricks measuring ca. 35/40 x 35 x 10 cm were used as well."	Verhoeven et al., 1996:92; * Akkermans et al., 2014:31, tab. 2.2.
138														Early Halaf/3B	5940-5905 cal. B.C.*	Tholos S	35	30	8	1,17	13,44			"Tholos S had an interior diameter of about 2.85 m and stood to a height of ca. 40 cm. It was built of mud bricks each measuring ca. 35 x 30 x 8 cm."	Verhoeven et al., 1996:96; * Akkermans et al., 2014:31, tab. 2.2.
139																Tholos I	30	25	8	1,20	9,60			"The tholos gave evidence of a mud-brick wall, built of bricks measuring ca. 30 x 25 x 8/10 cm."	
140																Tholos N/ AE	35	30	8	1,17	13,44			"This second tholos was built of mud bricks each measuring about 35 x 30 x 8 cm, and joined by a grey mortar ca. 2 cm thick."	Verhoeven et al., 1996:97; * Akkermans et al., 2014, p.31, tab. 2.2.



N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or layout	Citation	Bibliographic references				
141	Salat Cami Yani	Level 2	6600-6100 cal. B.C.*	General						C	und.	"The pisé building were built without stone foundations."	Miyake, 2011:131; Miyake, 2011:149, fig. 30.				
142	Sawwan	PN(?) / I	6420-5525 cal. B.C.*	1	60	25,5	7	2,35	17,14	M			Youkana, 1997:15; *El-Wailly et al., 1965:19.				
143					90	30	8	3	<u>34,56</u>								
144					105	30	8	3,50	<u>40,32</u>								
145					100	30	8	3,33	<u>38,40</u>								
146					90	30	8	3	<u>34,56</u>								
147					94	30	8	3,13	<u>36,10</u>								
148					74	30	8	2,47	<u>28,42</u>								
149					70	30	8	2,33	<u>26,88</u>								
150					PN(?) / I-II		Trench 4	48	24		8	2	14,75			"Des lambeaux d'une installation appaurent à la surface: les restes d'un gros mur constitué d'au moins deux rangs de briques crues (48 x 24 x 8 cm) disposées en alternance boutisses/panneresses, orienté nord-ouest/sud-est et doté d'un parement de briques de chant et peut-être d'un contrefort de briques disposées dans le sens de la longueur, à l'ouest."	Breniquet, 1992:17.
151					PN(?) / II 5975-5704 cal. B.C.*?			80	30		12	2,67	<u>46,08</u>		Ob	"As in level I the walls were constructed of large rectangular sun-dried, mud-brick, chaff-tempered and moulded [...]. Some of the <i>libn</i> are extremely long, and in one room, or even one wall, there is a considerable variation in the length of the <i>libn</i> . The average size is approximately 80x30x8 cm [...]. The large elongated mud-brick used at Tell es-Sawwan would have presented considerable building problems: if moulded and dried on the ground they would have been very heavy and difficult to lift on to the walls yet if they had been moulded and allowed to dry in position, there would have been no need for mortar."	:Wahida, 1967:172; *Burleigh et al., 1982:247.
152				60 à 100		30 à 34	6 à 8	1,76 à 3,33	17,28 à <u>48,96</u>	m							



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151	Sawwan	PN(?)/II	5975-5704 cal. B.C.*?		80	30	12	2,67	<u>46,08</u>	m	Ob	"As in level I the walls were constructed of large rectangular sun-dried, mud-brick, chaff-tempered and moulded [...]. Some of the <i>libn</i> are extremely long, and in one room, or even one wall, there is a considerable variation in the length of the <i>libn</i> . The average size is approximately 80x30x8 cm [...]. The large elongated mud-brick used at Tell es-Sawwan would have presented considerable building problems: if moulded and dried on the ground they would have been very heavy and difficult to lift on to the walls yet if they had been moulded and allowed to dry in position, there would have been no need for mortar."	:Wahida, 1967:172; *Burleigh et al., 1982:247.
152					60 à 100	30 à 34	6 à 8	1,76 à 3,33	17,28 à <u>48,96</u>				
153					2	94	30	9	3,13	<u>40,61</u>	M		Youkana, 1997: 43; *Burleigh et al., 1982:247.
154						98	34	8	2,88	<u>42,65</u>			
155						64	34	9	1,88	<u>31,33</u>			
156						63	28	7	2,25	<u>19,76</u>			
157						73	28	8	2,61	<u>26,16</u>			
158						65	28	8	2,32	<u>23,30</u>			
159						58	30	8	1,93	<u>22,27</u>			
160						73	30	7	2,43	<u>24,53</u>			
161						94	30	8	3,13	<u>36,10</u>			
162						60	30	9	2	<u>25,92</u>			
163		Samarra			Trench 2	53	25		2,12			«Ces briques étaient de dimensions communes (53 x 25 x ? cm) et leur appareillage était encore discernable. Sur l'assise conservée, elles étaient placées en boutisses. Au nord-est, une rangée de briques de chant paraissait plaquée contre le mur (Fig. I).»	Breniquet, 1992:19.
164						69		8			«Légèrement en retrait de cette ouverture vers le sud-est, une structure (n°9) de nature indéterminée formée de six rangées de briques (69 x ? X 8 cm) disposées sur la tranche fut dégagée.»	Breniquet, 1992:21.	
165		Samarra/IV			Général	50 à 70	21 à 30	6 à 8	1,67 à 3,33	10,08 à <u>26,88</u>		"They were all constructed of rather large oblong mudbricks, <b>made in moulds</b> and measuring 50-70 by 21-30 by 6-8 cm. (fig. 56); the thickness of a wall is the normal width of a brick (21-30 cm)."	El-Wailly, 1965:21.
166					12	50	25	8	2	16		«Si le mur 38 semble avoir une largeur constante de deux largeurs de briques (environ 50 x 25 x 8 cm), il n'en va pas de même pour le mur 37 [...].»	Breniquet, 1992:9.



N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or layout	Citation	Bibliographic references
167	Shomu Tepe	<i>Shulaveri-Shomu</i>	6520-6200 cal. B.C.*?	General	50 à 55	22 à 25	8	2 à 2,5	14,08 à 17,6	m	Pl.-cx		Chataigner, 1995:72; *Kiguradze, 1986:112, tab. 5.
168					36	16	10	2,25	9,22				Narimanov, 1987:86; *Kiguradze, 1986:112, tab. 5.
169					34 à 36	15 à 16	8	2,13 à 2,4	6,53 à 7,37				
170					34	13,5	9	2,52	6,61				
171					32 à 35	13	8	2,46 à 2,69	4,57 à 6,74				
172					32 à 34	16	8 à 9	2 à 2,3	6,56 à 7,84				
173					32 à 33	15 à 16	8 à 9	2,13 à 2,2	6,14 à 7,6				
174					32	16	8 à 9	2	6,55 à 7,37				
175					32	15	8	2,1	6,14				
176					Shulaveris Gora	<i>Shulaveri-Shomu</i>	5745-5365 cal. B.C.*	General	50				
177	44	25	10	1,8					17,60				
178	43	25	7	1,7					12,04				
179	41	15	7	2,7					6,89				
180	35 à 37	15	7	2,33 à 2,47					5,88 à 6,22				
181	30	20	8	1,5					7,68				
182	30	15	8	2					5,76				
183	28	20	8	1,40					7,17				
184	25	20	8	1,25					6,40				
185	25	15	7	1,67					4,20				
186									C	und.	*Buildings at Shulaveris were constructed mainly of plano- convex, sun dried mud brick and some wattle-and-daub, and erected without stone foundation."  (Sagona 1993: 456)	Chataigner, 1995:59; Dzhaparidze et al., 1975:203; Sagona, 1993:456; *Kiguradze, 1976:168.	



N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or layout	Citation	Bibliographic references
187	Sungur A	Late Samarra	Beginning of the 6th Millennium B.C.?	1 to 6	70	16	8	4,38	14,34	m	E		Matsumoto, 1984:37; Matsumoto, 1987:189.
188					72	18	8	4	16,59				
189	Sungur B	HUT/II	5400-5300 B.C.?	B1						C	und.	"B1 measured 23 x 10 m. and 70 cm. wide, and is built of <i>tauf</i> ." (Jasim 1985: 155); «The wall made of " <b>tauf</b> " is 70 cm wide, and is poor in preservation [...]." (Fuji 1981: 183)	Jasim, 1985:155; Fuji, 1981:183.
190				B2								"The other building, B2, is symmetrically constructed with cross-shaped [...]. It is built of <i>tauf</i> about 80 cm. thick." (Jasim 1985: 155); "The wall made of "tauf" is about 80 cm thick." (Fuji 1981: 183-184)	
191		HUT/III		B1/B2								"The " <b>tauf</b> " wall is 1.0-0.7 m thick..."	Fuji, 1981:184
192	Sungur B, C	Halaf		General								" <b>Tauf</b> " is used for the building walls. Despite the fact that mud bricks were adopted in the Samarran buildings discovered at Songor A, this mode is not taken over into the Ubaid and Halaf Periods."	Fuji, 1981:190.
193	Sungur C	Ubaid 2-3/I	5700-4700 B.C.?									"No coherent plan can be detected for this building which was built of <i>tauf</i> about 70 cm. thick." (Jasim 1985: 156); " <b>The wall made of "tauf"</b> is irregularly about 70 cm thick." (Fuji 1981: 188)	Jasim, 1985:156; Fuji, 1981:188.
194		Ubaid	5700-4700 B.C.?								" <b>The buildings are built of "tauf"</b> , not of mud-bricks."	Fuji, 1981:191.	
195	Tekhut	Aratashen ?		General						m	F	«à Tekhut, dans la plaine de l'Ararat, les bâtiments, dont la base est toujours excavée dans le sol (de 0,6 à 1,1 m), ont des superstructures en briques crues parallélépipédiques (40 x 30 x 10 cm) (bât. II, XII), (ou bien en pisé) (pl. 19,3-4)." (Chataigner 1995: 59)	Chataigner, 1995:59.
196			II, XII		40	30	10	1,33	19,20			Chataigner, 1995:59; Torosjan, 1976, pp. 23-27.	



N°	Site	Culture/Level	Date	Building	Lenght (in cm)	Width (in cm)	Hight (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or layout	Citation	Bibliographic references
197	Teiul eth-Thalathat	<i>Umm Dabaghiyah-Sotto/XV</i>	6500-6300 cal. B.C.*	General						C	L	"No sherds of bricks were found since the construction <b>was not built with bricks</b> [...]. Here in the cross section we saw <b>oblong lumps of clay</b> which seemed to be sun-dried bricks. Some of them were reedish brown and some of them were blueish gray. Their sizes are not uniform: Some are 40 cm in lenght and 8 cm in thickness and some are smaller than that. If they are sun-dried bricks, joint would be necessary for connecting them. But <b>no joint</b> was recognized among lumps. If this observation is right, the lumps must have been in such a condition that they could be connected with one another without joint. Tempered wet soil would fit to this condition. But, in this case, <b>it cannot keep the form of square cakes</b> . The only possibility, then, is that they used <b>oblong lumps of halfdried clay</b> , which cannot be called sun-dried bricks [...]. If we see if from technological point of view, this method is forestep of the method of using sun-dried bricks, or it is a technological stage between the use of mud and the use of sun-dried [...]. But the writer before reported his discovery of similar clay lumps at Tali-Gap in Marv Dasht at the south-western part of Iranian Plateau." (Fukai <i>et al.</i> 1970: 15-16)	Fukai <i>et al.</i> , 1970, pp. 15-16; Fukai <i>et al.</i> , 1981:65; *Nishiaki <i>et al.</i> , 2005:65, tab. 2.
198	Tilki Tepe	<i>Halaf II</i>	5800-5550 B.C.	General						C	und.	«Il faut ajouter que le pisé, associé à la pierre, était le matériau de construction utilisé à Tilki Tepe, sur les bords du lac de Van, à la même époque (phase récente de la culture d'Halaf)»	Chataigner, 1995:59.
199	Tell Turlu	<i>Halaf</i>	6400-5400 B.C.	General						C	und.	"La matière argileuse qui constituait les murs ne subsistait qu'exceptionnellement."	Breniquet, 1987:113.





N°	Site	Culture/Level	Date	Building	Length (in cm)	Width (in cm)	Height (in cm)	Ratio (L/w)	Weight estimated (in kg)	Technique	Shape or layout	Citation	Bibliographic references
200	Yarim Tepe I	<i>Halaf</i>	6170-5678 cal. B.C.*?		90	15		6		m?			Munchaev <i>et al.</i> 1973: 6; *Merpert <i>et al.</i> 1976: 43.
201	Yarim Tepe II	<i>Halaf IAN/VI</i>	5640-4570 cal. B.C.*	<i>Tholos 41</i>						C	LC	"It was built of <b>clay layers</b> , 5 cm. thick on average, cemented with each other by a mortar of yellowish clay."	Merpert <i>et al.</i> 1976: 45; *Munchaev <i>et al.</i> 1981: 266.
202		<i>Halaf IA</i>	6100-5950 B.C.	44A-44B						C	LC	"The walls were made, in a conventional manner, of <b>clay layers</b> , held together by a stratum of grey-greenish loamy clay."	Merpert <i>et al.</i> 1977: 89.
203		<i>Halaf III/VI</i>	5800-5500 B.C.	<i>Tholos 37</i>						M		«Alors que les autres techniques sont indifféremment utilisées dès les premiers temps de l'époque de Halaf, <b>la brique crue moulée n'existe pas dans les premiers niveaux de Yarim Tépé II</b> . Son emploi est une des caractéristiques de l'architecture de basse Mésopotamie, mais ne semble avoir été introduite qu'à partir du Halaf moyen ( <b>Yarim II, niveau VI, tholos 37</b> ) dans le Nord et n'est pas limité à un type précis de bâtiment.»	Breniquet 1992: 84.

