

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE
ACTES DU COLLOQUE INTERNATIONAL

**From the Caucasus to the Arabian Peninsula:
*Domestic Spaces in the Neolithic***

**Du Caucase à l'Arabie :
*l'espace domestique au Néolithique***



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LES 16 ET 17 OCTOBRE 2015, nous avons organisé, en tant que doctorantes en archéologie et sous le patronage de l'association Routes de l'Orient, un colloque international sur le Néolithique du Proche-Orient. Dans le cadre de la dynamique instaurée par l'association depuis ses débuts, nous avons invité la jeune communauté scientifique à se rencontrer au Collège de France à Paris autour de la thématique suivante: « Du Caucase à l'Arabie: l'espace domestique au Néolithique oriental ».

Nous avons ainsi eu le plaisir de recevoir nos collègues français, allemands, polonais, danois, espagnols, syriens, turcs, iraniens, chypriotes, grecs et australiens.

La réussite de ces deux journées doit autant au dynamisme et à la rigueur scientifique

de ses 83 participants, qu'à la mobilisation active des membres de l'association et au soutien apporté par de nombreux chercheurs et institutions à notre démarche¹.

À travers le prisme de la sphère domestique, ce colloque avait pour objectif d'exposer et de questionner la complexité du processus de néolithisation au Proche-Orient. Les recherches archéologiques qui se sont développées dans de nouvelles régions du Proche-Orient, notamment dans le Caucase et en Iran ont permis une meilleure caractérisation des apparitions et des évolutions locales de ce phénomène. Toutefois, regrettant le caractère encore très régionalisé de ces recherches, notre volonté était de favoriser les discussions méthodologiques et scientifiques entre les différentes équipes de recherche. Ce colloque con-

1. Le colloque a reçu les soutiens financiers de l'association Routes de l'Orient, des Universités Panthéon-Sorbonne (Collège des Écoles Doctorales et ED 112) et Paris-Sorbonne (ED 124 et FIR), de l'UMR 7041 - Archéologies et Sciences de l'Antiquité et son équipe VEPMO, de l'UMR 8167 - Orient et Méditerranée et sa composante Antiquité Classique et Tardive, de l'UMR 7209 - Archéozoologie, archéobotanique: sociétés, pratiques, environnements et la Région Ile-de-France. Nous tenons ici à exprimer nos sincères remerciements envers ces institutions et ces équipes de recherche sans lesquelles l'évènement n'aurait pu avoir lieu. Ont également apporté leur soutien scientifique les personnalités suivantes: F. ABBÈS (UMR 5133-Archéorient) ; P. ANDERSON (UMR 7264-Cepam) ; É. COQUEUGNIOT (UMR 5133-Archéorient) ; C. CHATAIGNER (UMR 5133-Archéorient); R. CRASSARD (UMR-5133-Archéorient) ; G. DURU (Université d'Istanbul) ; J. J. IBÁÑEZ ESTÉVEZ, (IMF-CSIC) ; L. KHALIDI, (UMR 7264-Cepam) ; F. LE MORT (UMR 5133-Archéorient) ; B. LYONNET (UMR 7192 - PrOCaulaC) ; M. MASHKOUR (UMR 7209-Archéozoologie, Archéobotanique) ; S. MÉRY (UMR 6665-CReAAH) ; M. ÖZBAŞARAN (Université d'Istanbul) ; G. WILLCOX (UMR 5133-Archéorient).

stituait donc pour nous un lieu de rencontre privilégié pour présenter, confronter et interroger les nouvelles données sur l'émergence des premières sociétés agro-pastorales du Caucase à la péninsule Arabique.

Le colloque était organisé en quatre sessions thématiques au cours desquelles 24 communications orales et 10 posters ont été présentés. Chaque session a été animée par un chercheur statutaire et un étudiant.

Ainsi, Sophie MÉRY² et Kévin LIDOUR³ ont présidé la session 1 « Mobilité et conséquences ».

Günes DURU⁴ et Rémi HADAD⁵ ont dirigé la session 2 « Construire et investir l'espace ».

Marjan MASHKOUR⁶ et Müge ERGUN⁷ ont animé la session 3 « Ressources et pratiques alimentaires ».

Enfin, Juan-José IBÁÑEZ-ESTEVEZ⁸ et Laurent DAVIN⁹ dirigé la session 4 « Outils et artisanats ».

Ce numéro ne rend pas totalement justice à la grande diversité des contributions présentées ces deux jours. Malgré tout, il reste très riche et différentes thématiques sont abordées au travers des 7 articles qui le composent.

Trois articles traitent des problématiques liées aux techniques architecturales, à l'espace construit et à sa gestion.

Ainsi, à partir de l'exemple d'Asikli Höyük en Turquie, Melis UZDURUM et Devrim SÖNMEZ présentent les activités domestiques attestées sur le site grâce à l'étude, notamment spatiale, des restes archéobotaniques et archéozoologiques, des outils de pierre taillée et de mouture et de l'analyse chimique des sols d'occupation. Les auteures montrent que les activités domestiques, qui se tenaient principalement dans les espaces publics durant le 9ème millénaire B.C., prennent place au sein de l'habitat au cours du 8ème millénaire B.C. .

Emmanuel BAUDOIN, Bertille LYONNET et Caroline HAMON s'associent pour présenter une synthèse des techniques architecturales (fondations, techniques de construction, couverture et couverture) sur les sites néolithiques du Caucase (culture de Shulaveri-Shomu) et de Mésopotamie (culture de Halaf) au début du 6ème millénaire B.C. . À partir de l'étude chrono-culturelle des techniques architecturales, l'objectif des auteurs est de définir les relations culturelles entre ces deux régions.

S'appuyant sur la neurophysiologie et la neuropsychologie, Sarah DERMECH tente

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d'éclairer le phénomène de la sédentarisation au Proche-Orient et son impact cognitif sur l'homme. À partir des données archéologiques, l'auteure développe l'hypothèse que l'habitat géométrique et permanent qui se met en place progressivement durant le Néolithique a constitué un environnement favorable à l'homme et aurait contribué au développement de ses capacités.

Deux autres articles abordent la question des modes d'acquisition et de traitement des ressources alimentaires par les hommes du Néolithique.

À partir de l'exemple du site de Dja'de el-Mughara en Syrie, nous présentons les résultats inédits d'une étude qui associe l'analyse archéobotanique des macrorestes végétaux et l'analyse fonctionnelle des outils de moisson. La confrontation de ces deux approches dresse un premier aperçu de l'évolution des stratégies agricoles dans l'une des premières communautés villageoises du Proche-Orient et l'identification des végétaux exploités par les habitants permet d'aborder leur éventuelle utilisation à des fins domestiques.

À partir de l'étude des restes archéobotaniques provenant du site néolithique de Khirokitia à Chypre, Andréa PARÈS montre l'évolution de l'économie de subsistance sur près de 1000 ans d'occupation et met en évidence les chaînes opératoires agricoles. L'auteure révèle également que les espèces végétales identifiées ont, pour la plupart, été introduites sur l'île.

Enfin, la question des productions techniques et symboliques est abordée au travers de deux articles.

S'appuyant sur l'étude des éléments de parure (perles, colliers, bracelets et boucles de ceinture) provenant du site néolithique d'Asikli Höyük en Turquie, Sera YELÖZER et Devrim SÖNMEZ mettent en évidence les processus de changement et/ou de continuité dans le mode de vie et l'organisation sociale de la communauté néolithique.

B. ROBERT et M. POULOT-CAZAJOUS s'intéressent au sujet des « Déesses-Mères » et de ses représentations figurées au cours du Néolithique au Proche-Orient. En raisonnant de manière diachronique en parallèle d'œuvres issues des champs des arts plastiques et du design contemporains, elles interrogent les liens existants entre les productions et les messages symboliques, idéologiques, politiques et sociaux qu'elles véhiculent.

La parution de ces actes marque la finalisation d'un projet que nous avons eu à cœur de porter. C'est donc avec une grande fierté, et une certaine émotion, que nous présentons ce numéro dédié au premier colloque organisé par l'association. Celle-ci a depuis continué sa route et d'autres rencontres internationales, toutes aussi passionnantes et fédératrices, ont vu le jour. Nous tenons à remercier sincèrement l'ensemble des personnes qui ont participé à cette aventure, et particulièrement les auteurs pour leur contribution à ce numéro.

Bonne lecture !

Carolyne DOUCHÉ et Fiona PICHON

ON OCTOBER 16TH AND 17TH, 2015, as part of our PhD studies in archaeology and with the support of the Routes de l'Orient association, we organised an international seminar on the topic of Middle East Neolithic. In line with the interests of the Routes de l'Orient we invited the young scientific community at the Collège de France in Paris to discuss the topic "From Caucasus to Arabia : domestic life during oriental Neolithic" , during which we met likeminded colleagues from all around the world (France, Germany, Poland, Danemark, Spain, Syria, Australia...).

The success of the seminar was the result of both the dynamism and the scientific rigour of the 83 participating researchers, the active involvement of the organisation members and

the support provided by the many external researchers and institutions¹⁰.

Using 'domestic life' as a lens, this seminar aimed to highlight and question the complexity of the néolithisation process in the Middle East. The recent archeological research that had been developed in key Middle East regions, specifically in the Caucasus region and Iran, had enabled a better classification of the findings and local evolution of that néolithisation process. Acknowledging that each team of researchers brought with them very localised expertise we wanted to provide an environment that could open up scientific discussions and debate between the teams. Accordingly, the seminar became a unique space for presenting, confronting and questioning the new data on the emergence of the first agro-pastorales com-

10. The seminar received financial support from the association Routes de l'Orient, Universities Pantheon-Sorbonne (College of Doctoral Schools and ED 112) and Paris-Sorbonne (ED 124 and FIR), UMR 7041 - Archéologies et Sciences de l'Antiquité and its team VEPMO, UMR 8167 - Orient et Méditerranée and its component Antiquité Classique et Tardive, UMR 7209 - Archéozoologie, archéobotanique : sociétés, pratiques, environnements and the Region Ile-de-France. We would like to express our sincere thanks to these institutions and research teams without which the event could not have taken place. The following personalities also provided scientific support: F. ABBÈS (UMR 5133-Archéorient); P. ANDERSON (UMR 7264-CEPAM); É. COQUEUGNIOT (UMR 5133-Archéorient); C. CHATAIGNER (UMR 5133-Archéorient); R. CRASSARD (UMR-5133-Archéorient); G. DURU (Istanbul University); J. J. IBÁÑEZ ESTÉVEZ, (IMF-CSIC); L. KHALIDI, (UMR 7264 -CEPAM); F. LE MORT (UMR 5133-Archéorient); B. LYONNET (UMR 7192 - Digitorient); Mr. MASHKOUR (UMR 7209-Archéozoologie, archéobotanique); S. MÉRY (UMR 6665-CReAAH); Mr ÖZBAŞARAN (Istanbul University); G. Willcox (UMR 5133-Archéorient).

munities from Caucasus to the Arabic peninsula.

The seminar was divided into four parts during which 24 talks and 10 posters were presented to the audience. Each part was lead by an official archeological researcher accompanied by a student.

The first section looking at « Mobility and consequences » was lead by Sophie MÉRY¹¹ and Kévin LIDOUR¹².

Günes DURU¹³ and Rémi HADAD¹⁴ presented the second section on « Construire et investir l'espace ».

The third section on « Ressources et pratiques alimentaires » was introduced by Marjan MASHKOUR¹⁵ and Müge ERGUN¹⁶.

Finally, Juan José IBÁÑEZ-ESTEVEZ¹⁷ and Laurent DAVIN¹⁸ lead the « Outils et artisanats » topic.

The publication of these works does not reflect the diversity of contributions presented during this seminar, however this published issue is already a rich and comprehensive material composed of 7 distinctive articles.

Three articles deal with questions related to architectural techniques, the built environment and its management.

Thereby, taking the example of Asikli Höyük in Turkey, Melis UZDURUM presents the domestic activities of that region attested onsite thanks in particular study of the archaeobotanic and archaeozoologic remains, of the carved stone tools, of the milling and of the chemical analysis of the inhabited ground. The author shows that the domestic activities, held mainly in the public space during the 9th millenium BC, take place in settlements during the 8th millenium BC.

Emmanuel BAUDOUIN, Bertille LYONNET and Caroline HAMON provided a synthesis of the architectural techniques (foundations, building techniques, couverture and roofing) proven to happen on neolithic sites of the Caucasus (Shulaveri-Shomu culture) and Mesopotamia (Halaf culture) at the beginning of the 6th millennium BC. From the chronological study of these architectural techniques the authors aim to define the cultural relationships between the two regions.

Using neurophysiology and neuropsychology, Sarah DERMECH shed a light on the settlement phenomenon in the Middle East and its cognitive impact on humans. Based on the archeological data, the author develops the hypothesis that the geometrical and permanent

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habitat that progressively spreads out during the Neolithic period has enabled the establishment of an environment beneficial to humans and would have contributed to the development of their abilities.

Two other articles address the question of the attainment modes and the handling/processing of alimentary resources by the Neolithic people.

From the example of the Dja'de el-Mughara site in Syria, we present the results of a study associating archeobotanical analysis of plant macrorests with functional analysis of harvesting tools. The confrontation of these two approaches provides a first insight on the evolution of agricultural strategies in one of the first village communities in the Near East and the identification of plants exploited by the inhabitants makes it possible to address their possible use for domestic purposes.

The study of archaeobotanical remains from the Neolithic site of Khirokitia (Cyprus), led by Andréa PARÈS, shows the evolution of the subsistence economy over nearly a thousand years of occupation and highlights the agricultural operating chains. The author also reveals that the identified plant species were mostly introduced on the island.

At the end, the question of technical and symbolic productions is addressed through two articles.

Based on the study of finery elements (beads, necklaces, bracelets and belt buckles) from the Neolithic site of Asikli Höyük in Turkey, Sera YELÖZER highlights the processes of change and/or continuity in the way of life and social organization of the Neolithic community.

B. ROBERT and M. CAZAJOT-POULOS investigates the "Mother Goddesses" and her figurative representations during the Neolithic. Using diachronic reasoning together with oeuvres taken from visual arts and contemporary design, they question the links between the productions and the symbolic, ideological, political and social messages that they convey.

The publication of these works marks the finalization of a project that we had at heart to carry. It is therefore with pride and emotion that we present you this issue dedicated to the first symposium organized by the association. The latter has since resumed its journey and other international meetings, equally exciting and federative, happened. We wish to sincerely thank all the people who participated in this adventure, and especially the authors for their contribution to this issue.

Enjoy the read !

Carolyne DOUCHÉ and Fiona PICHON

SOMMAIRE

Melis UZDURUM

Live together around fire: Hearths and the use of space at the onset of sedentism. Aşıklı Höyük (Turkey), a case study 11

Emmanuel BAUDOUIN, *Bertille* LYONNET & *Caroline* HAMON

Architectural Techniques and Cultural Relationships between the Caucasus and Mesopotamia at the beginning of the sixth millennium B.C. 49

Sarah DERMECH

La sédentarisation au Proche-Orient : éléments de réflexion sur le rapport de l'être humain à l'espace à l'aube de la Néolithisation 85

Carolynne DOUCHÉ & *Fiona* PICHON

Agricultural Strategies at Dja'de el-Mughara, Northern Syria (10th - 9th millennium cal. BC) 119

Andrea PARES & *Margareta* TENGBERG

En marge du PPNC, le Néolithique précéramique récent chypriote (7-6^e millénaires av. J.-C.).

Étude des pratiques d'exploitation et d'utilisation des ressources végétales du village de Khirokitia (Chypre) 151

Sera YELÖZER & *Devrim* SÖNMEZ

Continuity and change through personal ornaments : Aşıklı Höyük, Central Anatolia, Turkey 169

Béatrice ROBERT & *Maëlis* POULOT-CAZAJOUS

Des Femmes et des Formes :
« Sex-Symbols », Déesses, Parturientes... ? 207

Annuaire des contributeurs 220

Quelques mots sur Routes de l'Orient 221

Architectural Techniques and Cultural Relationships between the Caucasus and Mesopotamia at the beginning of the sixth millennium B.C.

Emmanuel BAUDOUIN¹, Bertille LYONNET² and Caroline HAMON³

Résumé

Les relations entre la Mésopotamie et le Caucase furent au cœur des problématiques des archéologues soviétiques dès le milieu du XX^e siècle, et cela du fait de la découverte d'objets de style mésopotamien retrouvés sur le site de Kültepe, au Nakhichevan (Azerbaïdjan), et plus récemment sur le site d'Aknashen-Katunarkh, en Arménie. Cependant, il faudra attendre les années 1990 pour que des équipes internationales entreprennent des recherches plus détaillées sur les différents aspects de cette présence exogène sur les sites caucasiens.

Cet article est l'occasion de faire un bilan des techniques architecturales (fondations, techniques de construction, couverture et couverture) utilisées au Néolithique dans la région du Caucase et en Mésopotamie. Nous mettrons en lumière l'hétérogénéité des techniques architecturales, ainsi que leurs similarités, observés sur les sites de la culture de Shulaveri-Shomu (à Mentesh Tepe, Göy Tepe, Gadachrili Gora, Aruchlo, Aknashen-Katunarkh...) et de la culture de Halaf (à Tell Sabi Abyad, Tell Arpachiyah, Yarim Tepe, Tell Yunus...) au début du 6^e millénaire avant notre ère.

À partir d'exemples archéologiques précis, nous tenterons de définir les relations culturelles entre ces deux entités au travers une analyse chrono-culturelle des techniques architecturales, dans le but de comprendre les mécanismes qui ont conduit à l'éclosion de la culture de Shulaveri-Shomu.

Mots-clefs : Shulaveri-Shomu, Halaf, Caucase, Mésopotamie, techniques architecturales

Abstract

Relationships between Mesopotamia and the Caucasus were first studied in the mid-20th century by Soviet archaeologists after the discovery of artefacts seemingly Mesopotamian in style at Kültepe, Nakhichevan (Azerbaijan), or more recently at Aknashen-Katunarkh, Armenia. However it was only in the 1990s that scholars started more detailed investigations on the different aspects of this southern presence.

This presentation will offer an overview of the architectural techniques (foundations, buildings techniques, covering and roofing) used during the Late Neolithic in the Caucasus and in Mesopotamia. We will highlight both the heterogeneous nature of the architectural traditions and the similarities of techniques observed in the Shulaveri-Shomu culture (at Mentesh Tepe, Göy Tepe, Gadachrili Gora, Aruchlo, Aknashen-Katunarkh...) and in the Halaf culture (at Tell Sabi Abyad, Tell Arpachiyah, Yarim Tepe, Tell Yunus...) at the beginning of the sixth millennium B.C.

From precise archaeological examples, we will try to determine possible relationships between these two cultures. Hopefully, this should contribute to a better understanding of the mechanisms behind the genesis of the Shulaveri-Shomu culture.

Keywords: Shulaveri-Shomu, Halaf, Caucasus, Mesopotamia, architectural techniques

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Introduction

DURING THE 1960'S MAINLY, soviet archaeologists identified in southern Caucasus, between the Kura and the Araxes rivers, a sixth millennium B.C. culture that they named Shomu-Shulaveri or vice-versa (DZHAVAKHISHVILI & DZHAPARIDZE, 1975; KIGURADZE, 1986; NARIMANOV, 1987; KUSHNAREVA, 1993). They proposed the existence of relationships between Mesopotamia and the Caucasus, especially because of the discovery of Halaf ceramics at the site of Kültepe, in Nakhichevan (ABIBULLAEV, 1959; NARIMANOV, 1987), but reasons for these relationships were not clearly established. Since the 1990's, research in the Caucasus region has intensified. International archaeological teams have specifically focused in this region in order to understand the neolithisation process, and to precise the chronological context of the Aknashen-Shulaveri-Shomu⁴ culture (BADALYAN *et al.*, 2007), renamed by the recent discoveries at Aknashen-Katunarkh (BADALYAN & HARUTYUNYAN, 2014; HARUTYUNYAN, 2014), at Aratashen (BADALYAN *et al.*, 2007; BADALYAN & HARUTYUNYAN, 2014) and Masis Blur (MARTIROSYAN-OLSHANSKY *et al.*, 2013) in Armenia. The beginning of the Shulaveri-Shomu culture in the Kura plain is also documented since 2013 by excavations at Haci Elamxanlı (NISHIAKI *et al.*, 2015a, p. 292). Sherds and a few other items in a “Mesopotamian” style related

to the Pre-Halaf and Halaf cultures found at Aknashen-Katunarkh (BADALYAN & HARUTYUNYAN, 2014, p. 175: fig. 6 and p. 176: fig. 7.3-4; HARUTYUNYAN, 2014, p. 194), and Haci Elamxanlı (NISHIAKI *et al.*, 2015a, p. 284: fig. 3f) stress the need to understand the cultural relationships between these two regions.

Three main theories have been advanced to explain the sudden appearance of the Shulaveri-Shomu culture in the region: 1) a local and independent development with a “regional” neolithisation process (LISITYSYNA & PRISCHPENKO, 1977; NEBIERIDZE, 1986; AMIRKHANOV, 1987); 2) relationships with northern Mesopotamia, like exchanges of traditional craftsmanship (KIGURADZE, 1986; KUSHNAREVA, 1997); 3) “colonization” of southern Caucasus by Mesopotamian communities (ABIBULLAEV, 1959; NARIMANOV, 1987). Recent radiocarbon data (see below) have shown that the onset of the Shulaveri-Shomu culture began around the beginning of the sixth millennium B.C (i.e. at time when a major change happened in Upper Mesopotamia linked with the arrival of the Samarra components).

Architecture is one among several archaeological remain (AURENCHE, 1983, p. 3). Unlike the others which are linked with material culture (pottery, lithic tools, figurines...), its technical inertia (LEROI-GOURHAN, 1945, p. 243) makes it a reliable medium for the determination of cultural traditions. Technical innovations may depend on the diffusion of techniques and know-how based upon movements

4. For convenience, we will use in the following article the term « Shulaveri-Shomu » to define this culture.

of population: they, therefore, may underline different degrees of acculturation.

The analysis of the architecture can help answering the three previous hypothesis presented above for the neolithisation process: for instance, in the first case, a local development can be detected in the slow architectural development with a graduate evolution of the techniques observed during the PPN period in Mesopotamia (CAUVIN, 1978). In the second case, the exchange of know-how is a phenomenon well known in the Near East with the diffusion of the mud-brick technique between the ninth and the seventh millennia B.C. (SAUVAGE, 2009). And in the last case, the

example of Khirokitia in Cyprus, a settlement dated to the seventh millennium B.C., shows how a long lasting local architecture has developed after the sudden appearance of techniques issued from an older Mesopotamian tradition (LE BRUN, 1995).

The aim of this paper is to characterize the architectural techniques attested in the Shulaveri-Shomu horizon and to compare them with the architectural features identified in the Halaf one in order to evaluate the nature of the relationship between the two cultures. Here, we do not rule out the hypothesis of relationships with other cultures in northern



Figure 1: General map of the Caucasus (based on Martin Sauvage and Wikipedia).

Mesopotamia (Hassuna or Samarra cultures) but this is beyond the scope of this paper⁵.

In Northern Mesopotamia, the first testimonies of the Halaf culture have been discovered in the 1910's at Tell Halaf (OPPENHEIM VON, 1943) and since this period, our knowledge about the Halaf culture has much improved thanks to many excavations and publications (BRENIQUET, 1996; NIEUWENHUYSE *et al.*, 2013; AKKERMANS *et al.*, 2014).

The first Halafian elements make their appearance, after a long gestation, at Tell Halula (MOLIST *et al.*, 2013, p. 446) or at Tell Sabi Abyad (AKKERMANS, 1996, AKKERMANS, 2013, p. 43, AKKERMANS *et al.*, 2014).

In this article, we shall mainly refer to recent excavations in the Caucasus in which we actively participated and where we have explored in details about twenty architectural structures, at Mentesh Tepe in Azerbaijan and Gadachrili in Georgia.

5. These elements are presented in BAUDOUIN, 2018.

1. The Shulaveri-Shomu culture

1.1. Geography and chronology

In Southern Caucasus, the Shulaveri-Shomu settlements are located in the alluvial plain along the tributaries of the Kura and Araxes rivers (Figure 1 and Figure 15), on top of the Holocene terraces (OLLIVIER & FONTUGNE, 2012, p. 125), where rainfall is actually varying between 200 and 400 mm/year (CHATAIGNER, 1995, pl. 4, 5 and 6).

Mentesh Tepe is situated in the middle Kura Valley, in the western part of Azerbaijan. Excavations⁶ started in 2008 under the direction of Bertille Lyonnet and Farhad Guliyev (Azerbaijan National Academy of Sciences Institute of Archaeology and Ethnography). The site had been destroyed by bulldozer in the 1970's, but destructions affected only the later periods and not the Chalcolithic and Neolithic levels.

Radiocarbon samples attest of a continuous Neolithic occupation of about two centuries within the first half of sixth millennium B.C. (around 5800 and 5600 cal. B.C.: LYONNET *et al.*, 2016, followed after a break by later successive occupations during the Chalcolithic period (around 4800 and between 4300 and 4100 cal. B.C.), and, after another break, during the Kura-Araxes period from the late fourth to ca. the middle of the third millennium B.C.

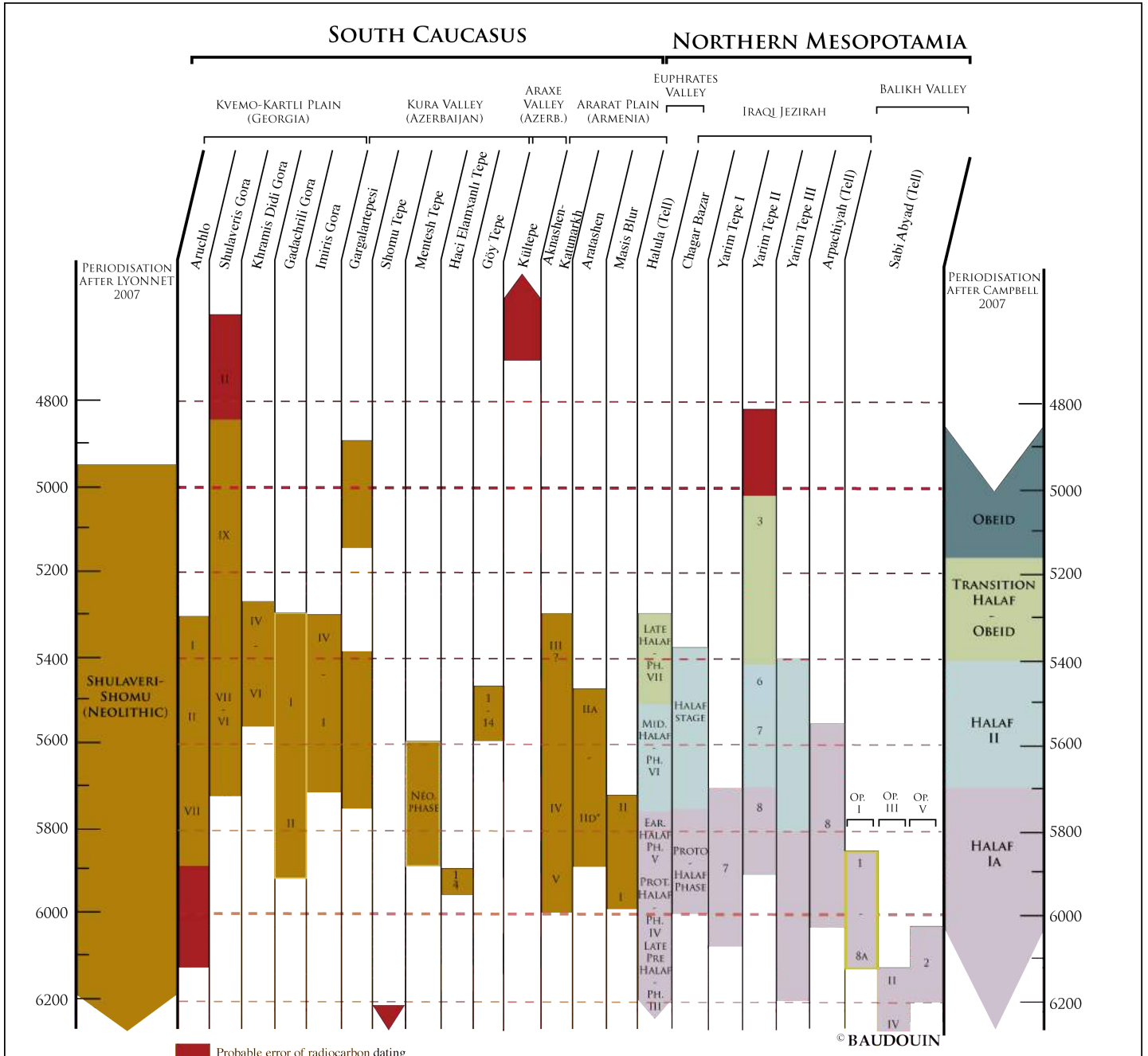
(LYONNET & GULIYEV, 2012; LYONNET *et al.*, 2012).

Gadachrili Gora is a small mound situated on a tributary of the Chramis River, in the Kvemo-Kartli plain of Georgia. It belongs to one of the four “Shulaveri group” of mounds of the region. A first expedition had been conducted by the Georgian State Museum in the 1960's (DZHAVAKHISHVILI & DZHAPARIDZE, 1975). Faced with the destruction of the site by constant erosion, Georgian archaeologists decided to start new excavations in 2006, directed by Mindia Jalabadze (Georgian National Museum). Further archaeological investigations were done in 2012-2013 with a French collaboration supported by different programs⁷, under the direction of Caroline Hamon (HAMON *et al.*, 2016, p. 156: fig. 1). The latest data coming from these excavations show the existence of two separate levels during the Neolithic period, both placed within the first third of the sixth millennium B.C. (HAMON *et al.*, 2016).

Among the purposes of these new investigations, one was to precise the chronology of the Shulaveri-Shomu culture (Figure 2). Up to now, the oldest known dates come from Aknashen-Katunarkh (BADALYAN *et al.*, 2010, p. 210: tab. 1) and Masis Blur (MARTIROSYAN-OLSHANSKY *et al.*, 2013,

6. Financed by several institutions: Ministère des Affaires Étrangères et du Développement International (MAEDI), Laboratoires Internationaux Associés (LIA) AzArLi, LIA AzAr2, Agence Nationale de Recherche (ANR) Ancient Kura, ANR Kura in Motion!

7. Georgian Wine Agency, LIA GATES, ANR Kura in Motion, ANR Orimil.



Bibliographic references used for radiocarbon dating above chronological table:

Aknashen-Katunarkh: Badalyan *et al.* 2010: 210, tab. 1.
 Aratashen: Badalyan *et al.* 2007: 40, tab. 1.
 Arpachiyah (Tell): Stuckenrath & Ralph 1965: 188.
 Aruchlo: Chelidze 1979: 31; Goridze 1979: 425; Dzhavakhishvili & Kiguradze 1984: 29; Kiguradze 1986: 112, tab. 5; Lyonnet *et al.* 2012: 85, tab. 19.
 Chagar Bazar: Cruells *et al.* 2013: 475, fig. 42.1.
 Gadachrili Gora: Hamon *et al.* 2016: 158, fig. 4.
 Gargartepesi: Narimanov 1977: 57.
 Göy Tepe: Guliyev & Nishiaki 2012: 75; Nishiaki *et al.* 2015a: 286, tab. 1.
 Haci Elamxanlı Tepe: Nishiaki *et al.* 2015a: 287, tab. 2.
 Halula (Tell): Molist *et al.* 2013: 446.
 Imiris Gora: Dzhaparidze *et al.* 1975: 127 and 209; Burchuladze *et al.* 1976: 356.
 Khramis Didi Gora: Linick 1977: 30; Dzhavakhishvili & Kiguradze 1984: 29; Kiguradze 1986: 112.
 Kültepe: Artemev *et al.* 1961: 11; Jessen 1965: 12.
 Masis Blur: Martirosyan-Olshansky *et al.* 2013: 145.
 Mentesh Tepe: Lyonnet *et al.* 2012: 92, fig. 136; Lyonnet *et al.* 2016: 176, fig. 5.
 Sabi Abyad (Tell): Akkermans 1997; Verhoeven & Akkermans 2000: 2, tab. 1.1, Akkermans *et al.* 2006: 127, tab. 1.
 Shomu Tepe: Semestov *et al.* 1969: 256; Kiguradze 1986: 112, tab. 5.
 Shulaveri Gora: Dzhaparidze *et al.* 1975: 127 and 209; Kiguradze 1976: 168; Chubinishvili & Chelidze 1978: 66; Kiguradze 1986: 112.
 Yarim Tepe: Munchaev & Merpert 1981: 266; Campbell 2007: 120, tab. 5.

Figure 2: General chronology of the sixth millennium B.C., with Shulaveri-Shomu and Halaf sites (E. Baudouin).

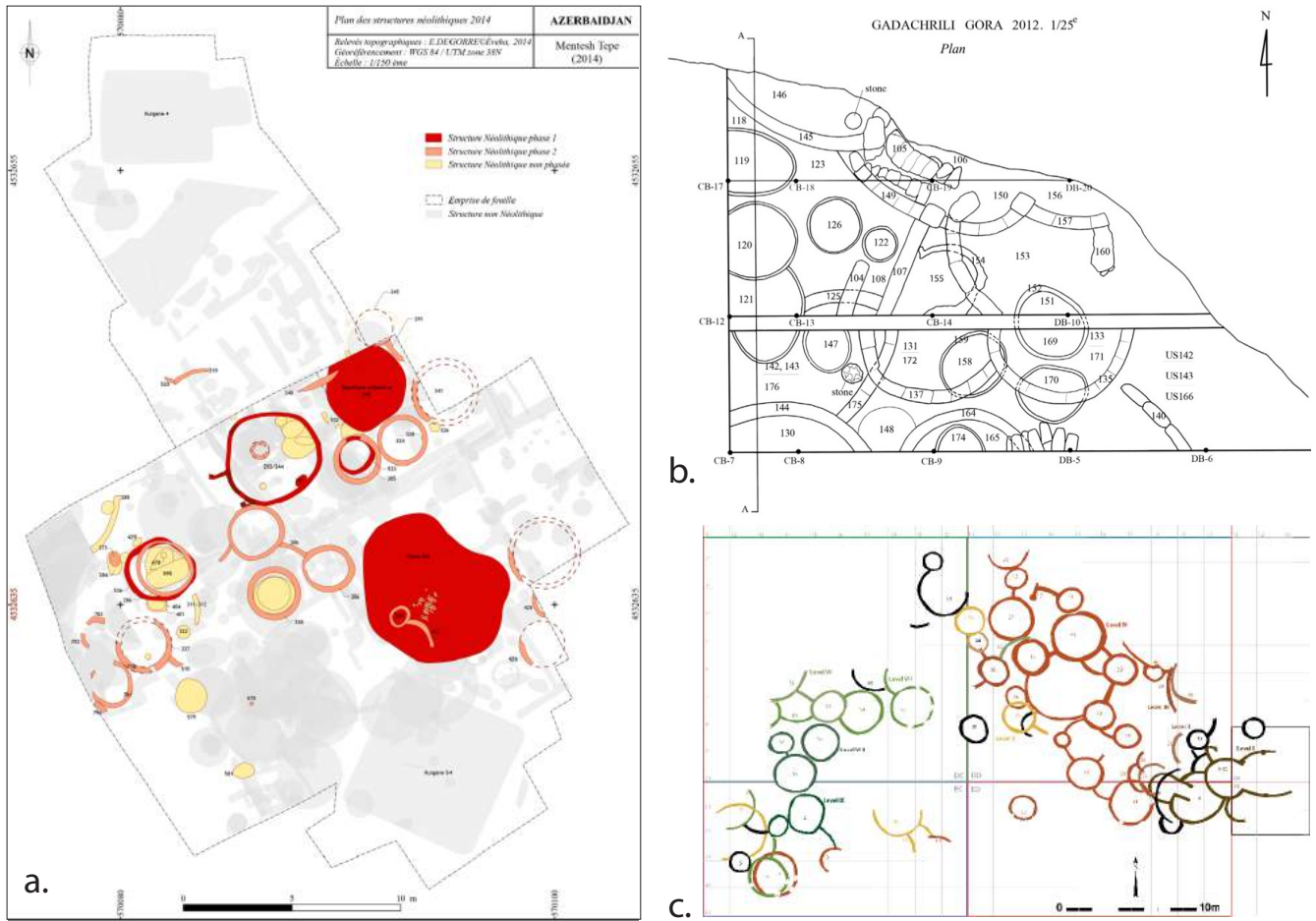


Figure 3: a. Mentesh Tepe (Azerbaijan), plan of the Neolithic levels (LYONNET *et al.*, 2016, p. 173: fig. 2). b. Gadachrili Gora (Georgia), plan of sector 1 (HAMON *et al.*, 2016, p. 165: fig. 21). c. Imiris Gora (Georgia), plan of the Neolithic levels (levels IX to I) (based on the Georgian National Museum (GNM)).

p. 145: tab. 1) in the Ararat Plain, Armenia, and from Haci Elamxanlı Tepe in the Kura Valley, Azerbaijan (NISHIAKI *et al.*, 2015a, p. 287: tab. 2). These recent radiocarbon analyses place the birth of the Shulaveri-Shomu culture around the beginning of the sixth millennium B.C., but currently, a precise global phasing is difficult to establish because of the lack of precise stratigraphic context of the sites excavated before the 1990's. Most of publications and reports do not give enough stratigraphic information and, usually, the exact position of the radiocarbon samples in the general stratigraphy is unknown.

1.2. Architectural techniques

The Shulaveri-Shomu culture is characterized by its exclusively circular buildings, often less than 4 m and exceptionally more than 5 m in diameter. Buildings can be adjacent, like at Mentesh Tepe (Figure 3a.), Gadachrili Gora (Figure 3b.), or Haci Elamxanlı Tepe (NISHIAKI *et al.*, 2015b, p. 9: fig. 9), or are isolated but linked with separations walls, like at Aruchlo, Georgia (HANSEN & MIRT-SKHULAVA, 2012, p. 62: fig. 81) or Imiris Gora, Georgia (Figure 3c.).

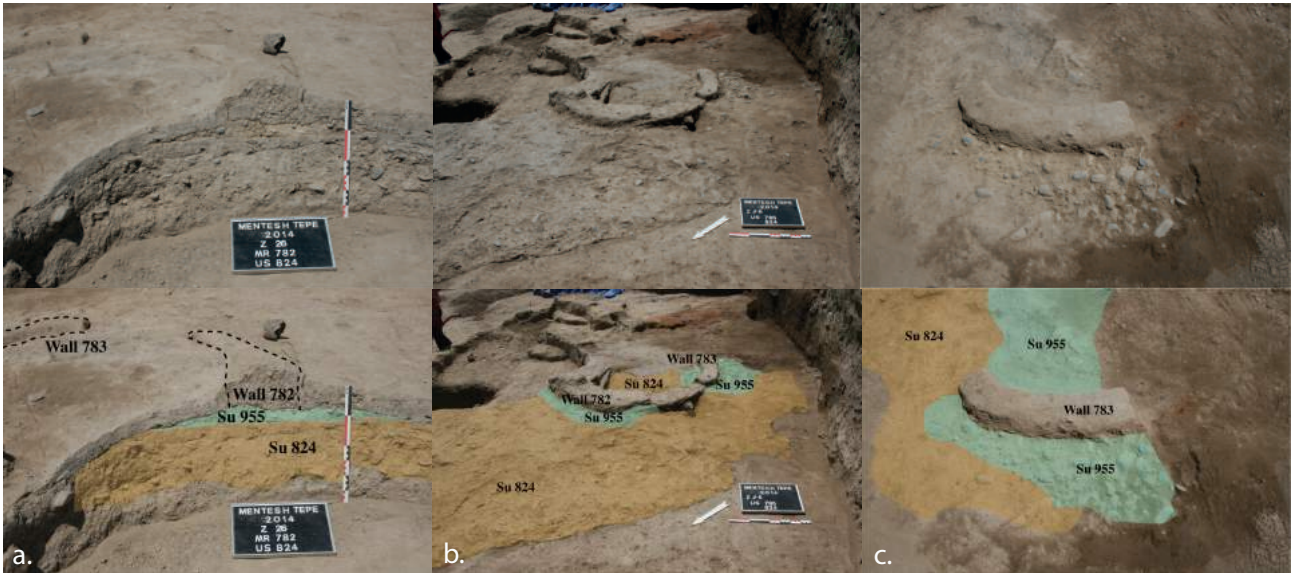


Figure 4: **a.** Mentesh Tepe, pebble layers (Su 955 and 824) under walls 782 and 783 – View from the East; **b.** Pebble layer (Su 824) extended to the northern part – View from the North; **c.** Detail of the pebble layers (Su 824 and 955) under wall 783 – View from the West, sector 26 (Mission Mentesh Tepe).



Figure 5: Mentesh Tepe, pebble layer (Su 943) under the wall 718. View from the North, sector 26 (Mission Mentesh Tepe).

1.2.1. Foundations

In 2012, at Mentesh Tepe a pebble layer (Su 943) was discovered lying under the wall 718 (Figure 5). This showed the use of a preliminary layer before building installation (BAUDOUIN, 2017). This pebble layer had a limited extent protruding under the wall nearly 20 cm inwards. In 2014, the continuation of the excavations confirmed the presence of this pebble layer to the west, and allowed to precise its

stratigraphic context: this layer was also set up under the first floor of the building. No foundation trench was observed.

This practice seems to be documented at other sites, like at Kültepe in Nakhichevan for example, where Abibullaev describes a stone layer mixed with a mud mortar (NARIMANOV, 1987, p. 87). Unfortunately, he does not specify if this layer was used as a foundation layer or as the footing of the wall.

Another type of installation layer was found in 2014 in sector 26 at Mentesh Tepe. A pebble layer (Su 824) was excavated on a surface of 4 x 2 m. It was composed of relatively small pebbles, measuring between 3 and 6 cm long, mixed with a hard silt layer (Figure 4).

It was unfortunately disturbed by later Chalcolithic and Kura-Araxes pits to the north, the south and the west. This layer covers another pebble layer (Su 955), composed of small pebbles mixed with a hard yellow stratum. This one extends under the walls 782 and

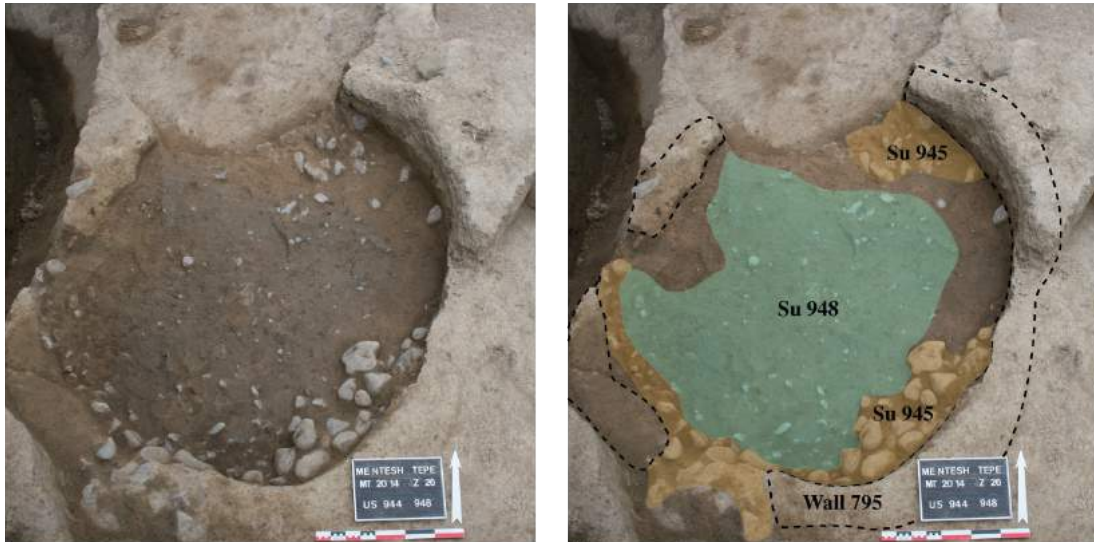


Figure 6: Pebble layers (Su 945 and 948) under the floor (Su 944) – View from the South, sector 26 (Mission Mentesh Tepe).

783 up to 1,5 m and was covered by internal and external floors.

Two pebble layers were also set up in building 795 (Figure 6). The first one (Su 945) was composed of large pebbles (module between 5 and 20 cm long), 30 cm thick. The pebbles were mixed with an homogeneous and very compact yellow silt. This layer was set up against the bottom of the wall. The second layer (Su 948), made of smaller and finer pebbles than the first one, was laid in the centre of the building and covers partly the first one. The first floor was set up on top of these two pebble layers. Similar examples are attested at Imiris Gora or Khramis Didi Gora in the Kvemo-Kartli region⁸.

From the presence of different techniques of implementation described above, three major functions can be distinguished (Figure 7):

- 1 Pebble foundations/footings to protect the walls from humidity and to avoid a premature wear of the base of the wall⁹ (wall 718 at Mentesh Tepe; Kültepe ?);
- 2 Pebble foundations around and under the building to level the earth before the installation of the floors and/or the walls (walls 782, 783 at Mentesh Tepe);
- 3 Pebble foundations only inside the building to clean or purify the soils before the installation of the floors and to protect them from moisture infiltration (building 795, Mentesh Tepe; Imiris Gora, Khramis Didi Gora).

8. Unpublished documentation of Georgian National Museum (GNM)

9. Called by Jean-Claude Margueron « sillon destructeur » (MARGUERON, 1985)

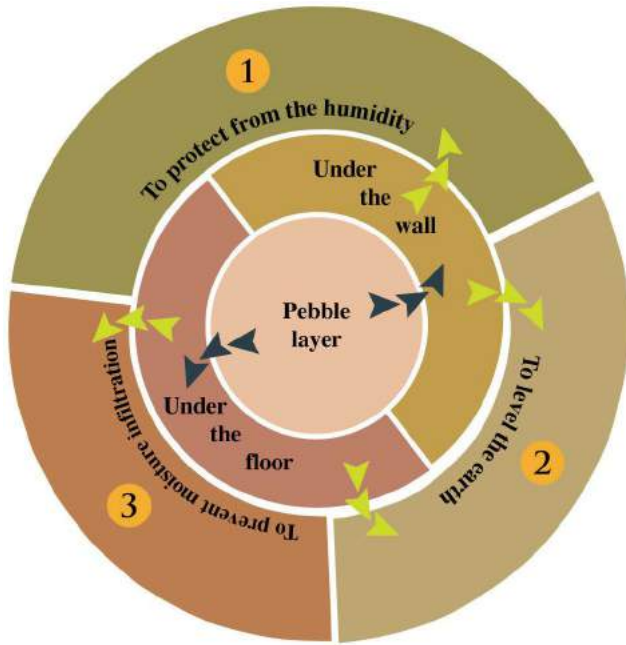


Figure 7: Summary diagram of the foundations techniques studied in this paper (author).

1.2.2. Building techniques

Two main techniques are used, one made of manufactured mud-components like mud-bricks and the other made of packed-mud (cob or *bauge*) used directly on the wall location.

- a. Mud-bricks The Shulaveri-Shomu group is characterized by the use of sun-dried, shaped, plano-convex mud-bricks (CHATAIGNER, 1995, p. 58): this is the case at Aruchlo (LYONNET *et al.*, 2012, p. 66: fig. 92), Imiris Gora (DZHAVAKHISHVILI, 1973, p. 48), Shulaveris Gora (DZHAVAKHISHVILI, 1973, p. 19) in Georgia, or Göy Tepe (GULIYEV & NISHIAKI, 2014, p. 5) and Shomu Tepe (NARIMANOV, 1965, p. 46) in Azerbaijan. But Kushnareva and Narimanov also mentioned the use of flat mud-bricks at Shulaveris Gora and Imiris Gora (KUSHNAREVA & CUBIN-

SHVILI, 1970, p. 28, KUSHNAREVA, 1997, p. 32), and this has been confirmed recently at Gadachrili Gora (HAMON *et al.*, 2016, p. 159). Moreover, recent discoveries have shown the existence of the *bauge* technique at Aknashen-Katunarkh (BADALYAN *et al.*, 2010, p. 191-192) in Armenia. In the Neolithic level of Mentesh Tepe, several examples attest of the use of plano-convex mud-bricks like in circular buildings n° 293 or n° 285 (Figure 8). The size of the bricks is more or less constant (41-45 x 12-16 x 8-10 cm), and the mud consists of silt mixed with sand and another mineral temper. The walls are preserved on four courses at best, and arranged in one single row in a stretcher pattern.



Figure 8: 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 (Mission Mentesh Tepe).

The mud-bricks are bound together with a mortar made of brown silt mixed with organic temper. The interior face of the building is covered by a thick (3-4 cm)

plaster with a material similar to that of the mud-bricks. Similar materials were found at Gadachrili Gora where building 2003 (horizon II) on sector 2 was built with sun-dried plano-convex mud-bricks (Figure 9). All are of a standard size (40 x 19 x 9 cm), and are arranged in a stretcher pattern in the single surviving course. This technique is well known in the Kura valley and occurs, for example, at Aruchlo (HANSEN & MIRTSKHULAVA, 2012, p. 63: fig. 83) or Göy Tepe (GULIYEV & NISHIAKI, 2012, p. 15: fig. 5). The regularity in the dimensions and shape as well as some traces, like a tiny ridge, observed on the top of the plano-convex mud-bricks in the Shulaveri-Shomu culture allow the hypothesis that they were moulded and not shaped individually by hands: micromorphological analysis are under way on different samples at Gadachrili Gora and Mentesh Tepe to confirm it or not¹⁰.



Figure 9: Gadachrili Gora, building 2003 with plano-convex mud-bricks – View from the South, sector 2 (C. Hamon).

However, at Gadachrili Gora, the building 2004 (horizon II) was built using irregular elongated, flat, rectangular mud bricks (25-50 x 8-10 x 9 cm) laid in a regular stretcher bond, on the three surviving courses (Figure 10).



Figure 10: Gadachrili Gora, building 2004, with three surviving courses of mud-bricks – View from the East, sector 2 (C. Hamon).

This technique is uncommon in the Shulaveri-Shomu culture, and is only described in another case at the base of a building in Shulaveris Gora (KIGURADZE, 1986, p. 18-19). This variation in length of the mud-bricks could be the result of intended trimming, like it has been proposed for the seventh millennium B.C. site of Khirokitia (Cyprus) (DAUNE-LE BRUN, 2003, p. 156), but we do not have enough examples to prove it for the moment. Nevertheless, these differences in building techniques between contemporaneous buildings in horizon II are striking.

10. These micromorphological analyses are carried out with the collaboration of Institut des sciences et industrie du vivant et de l'environnement AgroParisTech and Cécilia Cammas (INRAP, CNRS).

b. Packed mud: cob or *bauge*

Some walls are made of packed mud, cob or *bauge*, also called *terre massive* in french by Claire-Anne de Chazelles (AURENCHE, 2003, p. 279, AURENCHE *et al.*, 2011, p. 16: fig; 2) (Figure 11). We must underline here that there is a great confusion in the terms used in the archaeological literature of the Near East concerning this technique.

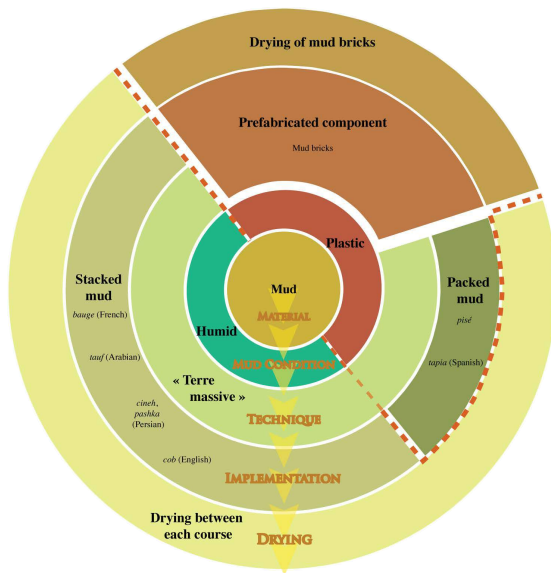


Figure 11: Summary diagram of implementation techniques using mud material (author).

The word *pisé* is often erroneously used to determine any mud-building techniques (AURENCHE, 1977, p. 138). However, the real “*pisé* technique” points to plastic mud packed between shutters with a hammer, and was certainly unknown during the Neolithic periods. This technique is completely different to that of mud stacked directly on the location of the wall which has several names according to the area where it occurs (AURENCHE, 2003, p. 279: tab. 1, AURENCHE *et al.*, 2011, p. 19-20): cob

in English, *bauge* in French (ROUX & CAMMAS, 2010), *tauf* in Arabic, *chineh* in Iran or *pakhsa* in the eastern Iranian world (SCHERRER, 2003), etc. Further work is needed to revisit the confusing old archaeological literature and to correct this “outdated” terminology.



Figure 12: Gadachrili Gora, example of a wall made with the cob building technique (?). **a.:** To the left, wall 217, constructed with mud blocks, made of clay mixed with charcoal and organic material; **b.:** Detail of wall 217 – View from the South, sector 1 (C. Hamon).

At Gadachrili Gora, in horizon I, wall 217 was difficult to identify and to follow at the time of the excavations (Figure 12). It may have been constructed of cob. This technique involves the piling up of mud blocks of different sizes and shapes: these blocks are composed of clay mixed with organic inclusions (charcoal, bones...) and the walls are then difficult to distinguish from the surrounding

destruction or fill layers. It is possible that this was also the technique identified at Aknashen-Katunarkh under the term *pisé* and dated to the beginning of the sixth millennium B.C. (BADALYAN & HARUTYUNYAN, 2014, p. 165).

1.2.3. Covering and roofing

Archaeologists often use the traditional picture of beehive buildings to represent the villages of the Shulaveri-Shomu culture like at Shomu Tepe (MUNCHAEV, 1975, fig. 4) or Imiris Gora (DZHAVAKHISHVILI & DZHAPARIDZE, 1975, fig. 26). This roof-covering might be possible in a few cases, like at Shulaveris Gora building n° 11 (Figure 13). There, the inner diameter is 4,45 m, the span without support is supposed to be of 4,85 m, and the archaeologists describe a light batter in order to build a corbelled vault (DZHAPARIDZE & DZHAVAKHISHVILI, 1971, p. 110): this technique involves a mud-bricks stretcher bond with a progressive offset inside (batter) to close the vault (HOUBEN *et al.*, 2006, p. 290, CRATERRE *et al.*, 1979, p. 235: fig. 323).

However, the use of another type of roofing is also possible, as shown by the discovery of postholes inside several buildings. At Imiris Gora, a central posthole has been identified inside building n° 9-10 (inner diameter: 3 m and span without support: 3,40 m) (DZHAVAKHISHVILI & DZHAPARIDZE, 1975, fig. 1, pl. XV), and, therefore, a “flat” roof has been proposed. Since then, several other examples have attested the existence of this type of roof: it is the case at Khramis Didi Gora in building n° 6 (inner diameter: 1,80 m and

span without support: 2,20 m) and recently at Mentesh Tepe, in building n° 293 (inner diameter: 4,15m and span without support: 4,45m)(Figure 14). In the last case, the walls are preserved to a height of 50 cm at best and are built with plano-convex mud-bricks, with no visible batter inside. On the west side, inside the building, at least three postholes (Ph 1108, 1113, 1115) ca. 20 cm in diameter were found at an equal distance from each other (27 cm). These postholes were filled with compact clay and pebbles to secure the wooden post. Another posthole filled with very compact sediment has been found in the central part of the building, close to a structure made of mud-bricks put on their edge (St 346). On the eastern part of the building, postholes may have also existed but unfortunately have been partly obliterated by hearths dug into them. For this building, which is also the largest of all those excavated at Mentesh Tepe for this period, we can thus restore a system of supporting posts deleting the first function of the mud-brick wall which was used only as a “curtain wall” (PÉROUSE DE MONTCLOS, 2004, p. 174, col. 83).

To sum up, two main covering systems have been proposed for the buildings of the Shulaveri-Shomu culture: the beehive roof (Shulaveris Gora, Imiris Gora, Shomu Tepe...) and the flat roof (Imiris Gora, Khramis Didi Gora, Mentesh Tepe...). There does not seem to be a correlation between the building size and its way of covering (Figure 13). Recent discoveries at Khirokitia (Cyprus) have demonstrated that the buildings were not covered with a beehive roof as initially proposed (DIKAIOS, 1953, p. 196-231), but rather with a

Region	Site	Building	Phase	Level	Datation (B.C.)	Width of walls (in m)	Height of preservation (in m)	Inner diameter of the building (in m)	Unsupported span (width of wall x 2) + diam. build.)	Internal arrangement	Covering supposed by authors	Bibliography
Southern Caucasus	Shulaveris Gora	11	Shulaveri-Shomu	/	5700-?	0,2	/	4,45	4,85	∅	corbelled vault	Kiguradze 1986: fig. 3, 16
	Imiris Gora	n°9-10		I	5700-5300	0,2	/	3	3,4	buttresses and central posthole in room n°10	flat roof	Dzhavakishvili <i>et al.</i> 1975: fig. 1; pl. XV
	Khramis Didi Gora	6		IV-III	5500-5400	0,2	/	1,8	2,2	∅		Kiguradze 1986: fig. 63, 76
	Mentesh Tepe	293		Néolithique	5900-5600	0,15	0,5	4,15	4,45	peripherics and central postholes	Lyonnet <i>et al.</i> 2016: p. 174	

Figure 13: Summary table with size of buildings, walls and internal arrangements to interpret roofing in the Shulaveri-Shomu culture.

flat roof (DAUNE-LE BRUN & LE BRUN, 1996, p. 21-24). The batter inward is considered by the last authors as due to several external causes like the weight of the roofing, the lack of foundations, or an oblique thrust on het-

erogeneous material (DAUNE-LE BRUN, 2003, p. 154). Recent discoveries at Mentesh Tepe would rather support this hypothesis, and the difficulty in identifying postholes encourages us to revise the old publications.

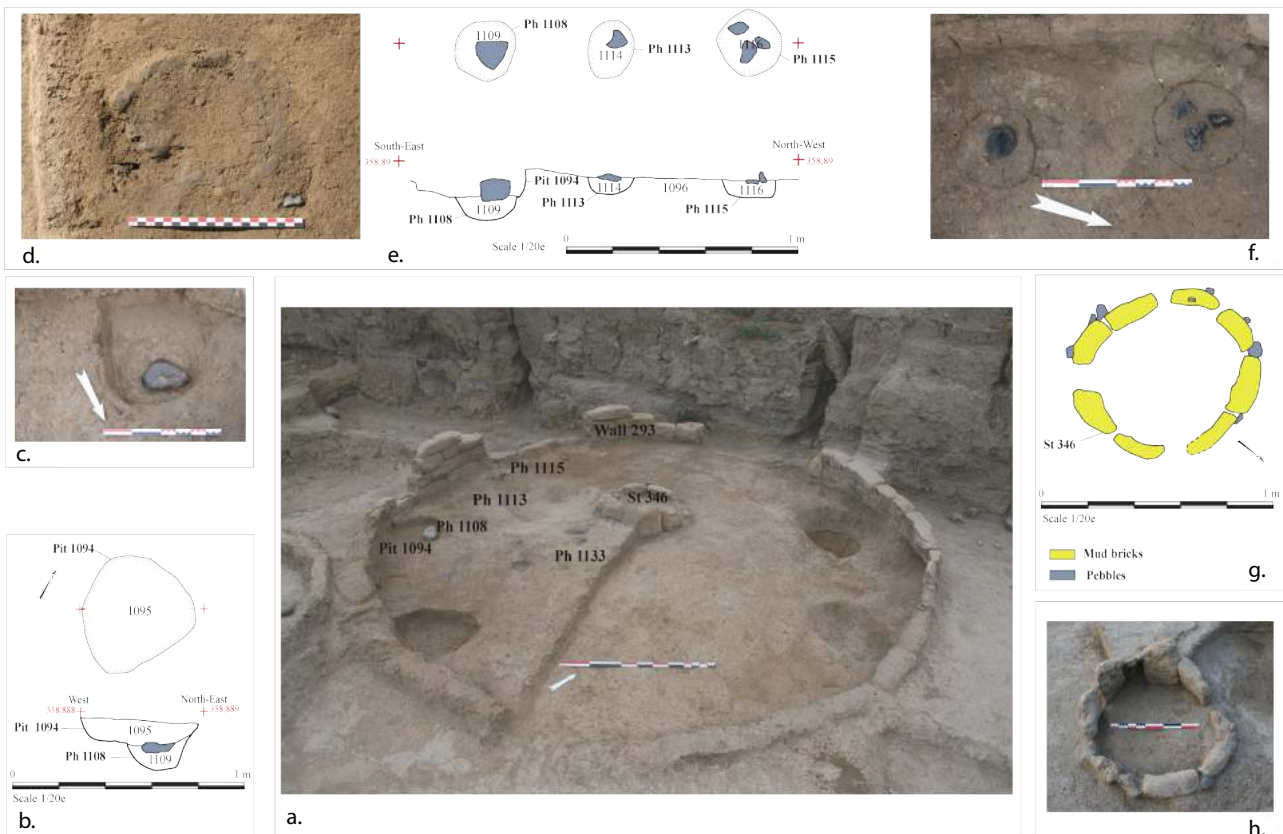


Figure 14: Mentesh Tepe, building n° 293. **a.:** General view of the building and localisation of postholes and structures; **b.:** Plan and section of pit 1094 and posthole 1108; **c.:** Detail of posthole 1108 – View from the North-East; **d.:** Detail of posthole 1133 – View from the East; **e.:** Plan and section of postholes 1108, 1113, 1115; **f.:** Detail of postholes 1113 and 1115 – View from the East; **g.:** Drawing plan of structure 346; **h.:** Detail of structure 346 made of mud-bricks put on their edge – View from the North (photo: Mission Mentesh Tepe).

2. The Halaf culture

2.1. Geography and chronology

In Northern Mesopotamia, the Halaf culture is settled in a similar geographical context, at the foothill of the mountains (Figure 15): with the exception of a few sites like Tilki Tepe, located in the Anatolian mountains or Tell es-Sawwan, situated low in the alluvial plain (HOURS *et al.*, 1994, maps 14, 16, 22a, 22c, 23b and 23c, NIEUWENHUYSE, 2000, p. 181: fig. 69). Most sites are located where rainfall is around 200-400 mm/year (HOURS *et al.*, 1994, map 4).

In this study several major sites will be analyzed for comparisons, like in the Irakian Jezirah, Yarim Tepe (YOFFEE & CLARK, 1993) or Tell Arpachiyah (MALLOWAN & CRUIKSHANK, 1935; HIJARA, 1980) or, for their good stratigraphic sequences and chronological contexts, in the Syrian Jezirah, Tell Halula (MOLIST *et al.*, 2007, 2013) and Tell Sabi Abyad.

There is no doubt that, contrary to the sudden birth of the Shulaveri-Shomu culture, a long period of gestation during the whole of the seventh millennium B.C. led to the



Figure 15: General map of the Near East (based on Geoatlas.com).

development of the Halaf culture in northern Mesopotamia. Various cultures have been identified in different areas like Proto-Hassuna (LE MIÈRE, 2000) and Hassuna and, with confusing terminology¹¹, Proto-Halaf or Pre-halaf (CAMPBELL, 2007, p. 105). At Sabi Abyad itself, the earliest levels are named Early Pottery Neolithic until the last quarter of the seventh millennium B.C. At that time starts a period labelled as Pre-Halaf, followed, around 6100 B.C., by a Transitional period when the first occurrence of some sherds in the Samarra and Halaf style are noticed, and finally by the Early Halaf around 5900 B.C. (BERNBECK & NIEUWENHUYSE, 2013). To classify halafian settlements (Figure 2), we will nevertheless use Stuart Campbell's periodization (CAMPBELL, 1992, 2007) which distinguishes three main periods: Halaf IA (6000-5800 B.C.), Halaf II (5800-5400 B.C.) and Transition Halaf/Obeid (5400-5250 B.C.)¹². We will focus on the first two periods to keep a chronological consistency with sites studied previously in the Shulaveri-Shomu culture.

2.2. Architectural techniques

Unlike the Shulaveri-Shomu architecture, the Halaf one mixes quadrangular¹³ and circular plans.

However, only a few sites with a long stratigraphic sequence, like Yarim Tepe (YOFFEE & CLARK, 1993) or Tell Sabi Abyad (AKKERMANS, 1989, 1996; AKKERMANS *et al.*, 2014), testify of changes from the Halaf IA onwards.

In the Halaf IA at Yarim Tepe II in level 9 (MERPERT & MUNCHAEV, 1993, p. 167: pl. 45) or at Tell Sabi Abyad in level 8B-7A (Operation I) (on the eve of the Transitional Period)¹⁴, both rectangular buildings (often grill-planned or cellular plan) and circular buildings are attested but not coupled. It is only during the Halaf II that *tholoi* (circular room) associated with a rectangular antechamber occur (see below). It is the case at Tell Arpachiyah in levels TT10-7 (MALLOWAN & CRUIKSHANK, 1935, p. 25), Çavi Tarlası (MELLINK, 1985, p. 556: fig. 2), Tell Yunus in the "Middle Halaf" levels (WOOLLEY, 1934, p. 148: fig. 1) or Tell Halaf, in the

11. For the « Halaf » terminology, see CAMPBELL, 2007, p. 105 and recently BERNBECK & NIEUWENHUYSE, 2013, p. 20-27.

12. Differences exist in the absolute dates given in the different publications from one and same author and between authors. They, of course, follow the advance in radiocarbon dates.

13. The transition between circular and rectangular plan during PPNB period coincide with the invention of the coin bonding (bonding between orthogonal walls). At Jerf el-Ahmar (STORDEUR, 1999, p/ 136), this technical innovation (to reinforce the solidity of the buildings) seems to be linked with a technical evolution answering a need (J.-Cl. Margueron, pers. com.). Later, during the sixth millennium B.C., the bonding of walls is used for rectangular architecture, like at Djaffarabad in Iran (DOLLFUS, 1975, p. 15), or at Hacilar in Turkey (MELLAART, 1970, p. 25), but is not systematic in all the buildings (AURENCHE, 1981, p. 119). In the current state of our knowledge, it is difficult to know if this technical innovation was essential to explain the transition between circular and rectangular architecture.

14. Level 8B (AKKERMANS *et al.*, 2014, p. 35: fig. 2.2); level 8A (AKKERMANS *et al.*, 2014, p. 41: fig. 2.10); level 7B (AKKERMANS *et al.*, 2014, p. 50: fig. 2.13); level 7A (AKKERMANS *et al.*, 2014, p. 56: fig. 2.21).

Halaf II levels (BECKER, 2013, p. 54-55: fig. 3). This typical type of building still occurs during the Transition Halaf-Obeid, but then alongside rectangular buildings, with long rooms and devoted to dwelling purposes.

2.2.1. Foundations

The implementation techniques for the foundation of buildings as observed in the Shulaveri-Shomu culture are also attested in the Halaf culture (fig. 9) except for the third one:

- 1 The existence of stone footings¹⁵ is mentioned and is often the only remains of the architecture, like at Tell Arpachiyah in levels TT10-7 during the Halaf II (MALLOWAN & CRUIKSHANK, 1935, p. 25) or at Tell Turlu (BRENIQUET, 1991, p. 26: pl. VII). Other examples are known at Tell Halula in Syria (MOLIST *et al.*, 2007, p. 19: fig. 12) or at Çavi Tarlası in Turkey (MELLINK, 1985, p. 556: fig. 2), where two facing walls of large pebbles have been raised to support the mud walls. At Tell Sabi Abyad, in Op. I, building I, level 3B (5940-5905 cal. B.C), a stone foundation has been noticed only under its external walls (AKKERMANS, 1996, p. 87: fig. 2.25) probably to protect them from humidity and to avoid a premature wear of the base of the wall;
- 2 Recent researches at Tell Sabi Abyad (Op .I) have much improved our knowledge about foundations practices. None have been observed in level 8 (6125-6075

cal. B.C.), but a special installation under several buildings have been found in level 7 (6020-5995 cal. B.C.) consisting of a layer of compact clay about 10-15 cm thick discovered under the floor of building 7.10 (AKKERMANS *et al.*, 2014, p. 60). The same installation made of a compact greyish clay about 40 cm thick mixed with mud-bricks fragments has been found under the walls of building 7.11 (AKKERMANS *et al.*, 2014, p. 61). In level 6 (6010 cal. B.C), a new foundation implementation is attested for the rectangular architecture: areas between the mud-bricks foundations of the cellular building 6.14 are filled with a compact grey clay layer up to 30 cm thick (AKKERMANS *et al.*, 2014, p. 75);

Foundation under the walls (our point 1) seems to have been used often in the Halafian architecture during the Halaf IA and the Halaf II, while point 2 has been observed only during the Halaf II at Tell Sabi Abyad. No foundation layers to prevent moisture infiltration (our point 3) have been described in publications.

2.2.2. Building techniques

The use of shaped plano-convex mud-bricks in Northern Mesopotamia seems to be a minor technique but is nonetheless known in the Halaf culture, as shown by the description of a building at Tell Arpachiyah (MALLOWAN & CRUIKSHANK, 1935, p. 16).

15. The term “Foundation” used here is the buried part under the floor utilization of the building (AURENCHÉ, 1977, p. 88) while the term “footing” is the base of the wall (AURENCHÉ, 1977, p. 160-161).

The *pisé* technique is described at Tell Yunus (WOOLLEY, 1934, p. 147) or Tell Arpachiyah (MALLOWAN & CRUIKSHANK, 1935, p. 16, 25). A similar technique is mentioned for buildings 44A and 44B at Yarim Tepe II: “The walls were made, in a conventional manner, of clay layers, held together by a stratum of grey-greenish loamy clay” (MERPERT *et al.*, 1977, p. 89). The same term is used describing this architectural technique at Tell Sabi Abyad: “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 layers of various colors and, most likely, various consistency. 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” (VERHOVEN & KRANENDONK, 1996, p. 44). Obviously, these building techniques can be considered to be cob ones (Figure 11).

Yarim Tepe II is one of the sites where material techniques have been best analysed. Besides *pisé* techniques, the excavators describe “cakes of clay” in *tholos* 42 (MERPERT *et al.*, 1976, p. 45), level VI (Halaf II). They also mention mud-bricks not shaped individually by hands since period Halaf IA in *tholos* 55, level VIII (MERPERT *et al.*, 1978, p. 37). Catherine Breniquet supposed the appearance of moulded mud-bricks¹⁶ during the Halaf II

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 16: Summary table of the evolution of mud-bricks sizes at Tell Sabi Abyad (Syria) (Op .I) between levels 8 and 3B (6125-5905 B.C.) – based on AKKERMANS *et al.*, 2014.

16. The first moulded mud-brick in the Near Eastern are said to occur during the ninth millennium B.C. in Anatolia: “On remarque également que les briques de Çafér Höyük ou de Gritille ont pu avoir été moulées, ce qui pourrait avoir également été le cas de celles de Çatal Höyük” (SAUVAGE, 1998, p. 100). On this issue, read also SAUVAGE, 2009, p. 195 and SAUVAGE, 2001, p. 418.

period (around 5800-5400 B.C.) at Yarim Tepe II, in level VI (BRENIQUET, 1996, p. 84)¹⁷. We know others examples of this technique at Tepe Gawra in a circular building of level XX where mud-bricks are standardized (TOBLER, 1950, p. 47-48), but the stratigraphic context needs to be verified.

At Tell Sabi Abyad, cob and mud-bricks are used. A study of the use of these techniques in connection with stratigraphy shows a constant decrease in the size of the mud-bricks between levels 8 and 3 (6125-5905 cal. B.C.) and the gradual disappearance of the cob technique to the benefit of the mud-brick one (Figure 16 and Figure 17). Cob nearly totally disappeared around 6 000 B.C. (see discussion).

2.2.3. Covering and roofing

When Max Mallowan discovered the first circular buildings at Tell Arpachiyah in the 1930's, he called them *tholoi*, referring to the funeral architecture of the Aegean

world during the Bronze Age (MALLOWAN & CRUIKSHANK, 1935, p. 30). This term was also used to determine the dome covering, again in reference to the circular Greek temples with a domed-roof (PÉROUSE DE MONTCLOS, 2004, p. 402, col. 194). Unfortunately, this terminology is twice inappropriate to determine the circular architecture of the Neolithic period, on the one hand because it never had a funeral or a sacred function and, on the other hand, because the archaeological data do not lead necessarily to a domed roof.

At Yarim Tepe II, a "cupola-shaped" roof (Figure 18) has been advanced for *tholos* 63 in level VIII, period Halaf IA (MERPERT *et al.*, 1978, p. 38), and for *tholos* 42 (inner diameter: 3,90 m and span without support: 5,30 m), level VI, Halaf II (MERPERT *et al.*, 1976, p. 45). The same technique is mentioned at Tell Arpachiyah, in building Fd V2 (inner diameter: 4 m and span without support: 4,60 m) (MALLOWAN & CRUIKSHANK, 1935,

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 mud-bricks (round building in orange) – based on AKKERMANS *et al.*, 2014.

17. Before this period, mud-bricks were apparently shaped by hands (BRENIQUET, 1996, p. 83). However, published reports are not always clear about the exact fabrication (MUNCHAEV & MERPERT, 1973, p. 10-11, MERPERT *et al.*, 1977, p. 85-87).

p. 27). At Tell Sabi Abyad, some buildings have a lightbatter like building 8.1 (Op .I) (with an inner diameter of 3,10 m and an unsupported span of 3,90 m), level 8A (6125-6075 cal. B.C.): “The walls seems to curve inwards gradually, suggesting a domed superstructure” (AKKERMANS *et al.*, 2014, p. 36). This is also the case for building 8.4 (AKKERMANS *et al.*, 2014, p. 40) and building 7.5 (AKKERMANS *et al.*, 2014, p. 52) in level 7B (6020-6005 cal. B.C.). However, the example of Khirokitia discussed above, encourages us to be careful about the hypothesis of dome-roofs.

At Tell Sabi Abyad, in Op .I, *tholos* IX (with an inner diameter of 3,50 m, and span without support: 4,40 m), level 6 (6010-5995 cal. B.C.), the thickness of the wall, together with the discovery of reed-impressions and of circular wooden poles, allowed the interpretation of a terrace covering for this circular building. Another example confirms this interpretation: in *tholos* P (Op .I) (inner diameter: 3 m) (stratum 6B) inside the building, archaeologists have found three postholes (with a diameter of 12 cm and a depth of 6 cm) and in

the centre a “stone platform” (AKKERMANS, 1989, p. 33: fig. III.10) interpreted first as a support for a room partition (AKKERMANS, 1989, p. 32), but later reconsidered as a support for a terrace roof (AKKERMANS, 2010, p. 26).

The emergence of internal or external buttresses seems to have appeared later (Halaf II, around 5800-5400 B.C.), and to be linked with the growing size of the circular buildings, like at Yarim Tepe II, in *tholos* 23b (inner diameter: 4,50 m and span without support: 5 m), level III and at Yarim Tepe III, in *tholos* 3/1 (inner diameter: 6 m, and span without support: 7-8 m). At Tepe Gawra, Arthur J. Tobler described three buttresses preserved to a height of one meter inside the *tholos* of level XX (inner diameter: 5,25 m and span without support: 5,85 m) (TOBLER, 1950, p. 47 and pl. XLV). A similar implementation has been observed inside two *tholoi* in level XVII (inner diameter: 4,50 m and span without support: 5,10 m) (TOBLER, 1950, pl. XVIII and

Region	Site	Building	Phase	Level	Datation (B.C.)	Width of walls (in m)	Hight of preservation (in m)	Inner diameter of the building (in m)	Unsupported span ((width of wall x 2) + diam. build.)	Internal arrangement	Covering supposed by authors	Bibliography	
Northern Mesopotamia	Yarim Tepe II	63	Halaf IA	VIII	5900-5700 ?	/	/	/	/	Ø	cupola-shaped	Merpert <i>et al.</i> 1978: 38	
		8.1		8A	6125-6075	0,4	1	3,1	3,9	Ø	domed superstructure	Akkermans <i>et al.</i> 2014: 36; fig. 2.2, 35	
	8.4	8A		6125-6075	0,35	/	2,8	3,5	Ø	Akkermans <i>et al.</i> 2014:40; fig. 2.2, 35			
	Tell Sabi Abyad	7.5		7B	6020-6005	0,4	/	4,6	5,4	Ø	reed-impressions : circular wooden poles	Akkermans <i>et al.</i> 2014: 52; fig. 2.13, 50	
		IX		6	6010-5995	0,45	/	3,5	4,4	terrace roof		Akkermans <i>et al.</i> 1996: 40; fig. 2.7, 43	
		P		6B	6010-5995	/	/	3	/			three postholes and a central "platform"	Akkermans 1989: 33; fig. III.10; Akkermans 1989: 32; Akkermans 2010: 26
	Yarim Tepe II	23-b	Halaf II	III	5700-5400 ?	0,25	0,8	4,5	5	buttresses	flat roof ?	Merpert <i>et al.</i> 1976: 44	
		42		VI	5700-5400 ?	0,7	0,4 à 0,75	3,9	5,3	Ø	cupola-shaped	Merpert <i>et al.</i> 1976: 45	
	Yarim Tepe III	3/1				0,5 à 1	1,25	6	7 to 8	buttresses	flat roof ?	Yoffee, Clark 1993: 175	
	Tell Arpachiyah	Fd V2				6050-5550 ?	0,3	/	4	4,6	Ø	cupola-shaped	Mallowan & Cruikshank 1935: 27; fig. 14
	Tepe Gawra	/					0,3 ?	/	5,25	5,85 ?	buttresses	flat roof ?	Tobler 1950: 47; pl. XLV
		room 36				/	0,3	/	4,5	5,1	buttresses		Tobler 1950: 42; pl. XVIII
		room 21					0,3	/	4,25	4,85	buttresses		Tobler 1950:43; pl. XVIII

Figure 18: Summary table with size of buildings, walls and internal arrangements to interpret roofing in the Halaf culture.

XLII)¹⁸. It is clear that these buttresses built and that they reduced the span of the wooden inside the buildings prevented a too high pressure on the walls due to a massive covering beams.

18. Due to the lack of precise stratigraphy, we have to be careful about the chronology of the Tepe Gawra buildings.

3. Discussion

These different observations testify of an architectural complexity during the Late Neolithic period in southern Caucasus and northern Mesopotamia, and of the great knowledge the inhabitants already had of the properties of building materials.

Summing up what was presented above, we have seen that the foundation techniques used in these two regions were the following (Figure 19):

- 1 Pebble foundations to protect the base of the walls are used in the Shulaveri-Shomu culture at Mentesh Tepe (wall

718) and are described for footings at Kültepe in Nakhichevan, while in the Halaf culture this technique is used extensively at Tell Arpachiyah (TT10-TT7), Tell Halula, Tell Turlu, Çavi Tarlası or at Tell Sabi Abyad (Op .I, building I, level 3B);

- 2 Pebble layers to level the earth, around and under the building are observed in the Shulaveri-Shomu culture only at Mentesh Tepe (under walls 782 and 783) up until now. This practice is well-known in the Halaf culture at Tell Sabi

Implementation	Shulaveri-Shomu culture	Halaf culture	
1 To protect from the humidity	Mentesh Tepe (wall 718, 5900-5700 B.C.) Kültepe	Halaf IA (6000-5800 B.C.) Tell Halula (Ph. III, 6300-6050 B.C.) Tell Sabi Abyad (build. I, level 3B 5940-5905) Çavi Tarlası	Halaf II (5800-5400 B.C.) Tell Arpachiyah (TT10-7) Tell Turlu
	Mentesh Tepe (walls 782, 783, 5900-5700 B.C.)	Tell Sabi Abyad (build. 7.10, 7.11 6020-5995 B.C.)	/
2 To level the earth	Mentesh Tepe (wall 785, around 5900-5700 B.C.) Imiris Gora (around 5650-5300 B.C.) Khramis Didi Gora (5550-5300 B.C.)	/	/
3 To prevent moisture infiltration			

Figure 19: Foundations practices. Summary table with examples studied in this paper chronologically classified.

Implementation	Shulaveri-Shomu culture	Halaf culture	
		Halaf I (6000-5800 B.C.)	Halaf II (5800-5400 B.C.)
Domed roof	Shulaveris Gora (5700-? B.C.)	Yarim Tepe II level VIII Tell Sabi Abyad (level 8A: 6125-6075 B.C.) (level 7B: 6020-5995 B.C.)	Yarim Tepe II level VI
Terrace roof	Imiris Gora (5700-5300 B.C.) Khramis Didi Gora (5500-5400 B.C.) Mentesh Tepe (5900-5600 B.C.)	Tell Sabi Abyad (level 6: 6010-5995 B.C.)	Yarim Tepe II (level III) Tepe Gawra (level XX)

Figure 20: Summary table about covering implementation studied in this paper with examples chronologically classified.

Abyad (Op .I, buildings 7.10, 7.11) since the end of the seventh millennium B.C.;

3 Pebble foundations inside the building to purify the soils before the installation of floors, in the the Shulaveri-Shomu culture are recognized at Mentesh Tepe (under wall 785), Imiris Gora and Khramis-Didi-Gora. We have not found any parallels in the Halaf culture. We must seek in the Cyprus world, at Khirokitia, around the end of the seventh and the beginning of the sixth millennium B.C., to observe a similar implementation (MORETTI & BRUNET, 1990, p. 955: fig. 77 and p. 956).

The use of foundations is not a systematic practice, either in Southern Caucasus, or in Northern Mesopotamia, and the lack of archaeological data in the publications (Aurenche 1981: 104) does not allow a clear overview about it. However, we observed a great similarity of implementation in the Halaf and in the Shulaveri-Shomu culture.

We have also seen that two different techniques of covering are usually proposed: a domed roof and a flat roof (Figure 20). While in the first one the roof is built with mud-bricks, with a progressive offset inside, in the last one it needs wooden poles when the beams are not long enough to cover the span between the walls. In the Halaf culture, Catherine Breniquet has proposed that terrace-roofs had replaced the domed-roof during the Halaf II, around 5800-5400 B.C. (BRENIQUET, 1996, p. 85). Archaeological data about the roof-coverings are unfortunately too scarce.

We think possible to restore a domed roof at Tell Arpachiyah (building FdV2), and it is taken for granted during the Halaf IA period – at Yarim Tepe II (level VIII: *tholos* 63) and at Tell Sabi Abyad (Op .I, levels 8A-7B: buildings 8.1, 8.4, 7.5), and during the Halaf II period – at Yarim Tepe II (level VI: *tholos* 42) and at Tepe Gawra (level XX). In the Caucasus region, the dome covering is proposed at Shulaveris Gora (building 11: possibly dated to the beginning of the Shulaveri-Shomu culture).

As for flat roofs, at least two buildings at test of the use of this covering technique in the Halaf culture at Tell Sabi Abyad (Op .I, level 6, Halaf IA: *tholos* P, *tholos* IX). In a few cases, we can restore a flat roof in the Shulaveri-Shomu culture, at Imiris Gora (building 9-10), Khramis Didi Gora and at Mentesh Tepe (building 293). In the last one, recent researches prove that, already during the first quarter of the sixth millennium B.C., the population had an advanced knowledge about the technique of architectural thrust by the use of a posts system and the application of the "curtain wall" principle. This invites us to revise the previous archaeological descriptions since it is probable that building 293 at Mentesh

Tepe is not an *hapax* in the Shulaveri-Shomu culture.

As was the case for the foundations, the actual archaeological data about the different types of covering do not allow an interpretation linked with chronological or regional choices: the domed roof is used alongside the flat roof during all the chronological sequence we studied, both in the Halaf culture and in the Shulaveri-Shomu culture.

Finally, we have seen that terminology needs to be revised as far as the building material is concerned. In the Halaf culture, the stacked-mud technique (*cob* or *bauge*) has been identified at Tell Yunus, Tell Arpachiyah, and in the Halaf IA period at both Yarim Tepe II (buildings 44A and 44B) and Tell Sabi

Implementation	Shulaveri-Shomu culture		Halaf culture	
			Halaf I (6000-5800 B.C.)	Halaf II (5800-5400 B.C.)
Stacked mud <i>bauge</i> <i>cob</i> <i>cinch</i> ...	Aknashen-Katunarkh (6000-5800 B.C. ?) Gadachrili Gora (Horizon I: 5900-5300 B.C.) Masis Blur (6000-5750 B.C. ?)		Tell Yunus Tell Arpachiyah Tell Sabi Abyad up to 6000 B.C. Yarim Tepe II (build. 44A, 44B)	
Plano-convex mud-bricks	Aruchlo (5900-5300 B.C.) Imiris Gora (5650-5300 B.C.) Shulaveris Gora (5700-4900 B.C. ?) Göy Tepe (5600-5500 B.C.) Shomu Tepe « Terre massive » Gadachrili Gora (Horizon II: 5900-5300 B.C.) Mentesh Tepe (walls 293, 285: 5900-5600 B.C.)		Tell Arpachiyah	
Flat mud-bricks	Shulaveris Gora (5700-4900 B.C. ?) Gadachrili Gora (Horizon II: 5900-5300 B.C.)		Tell Sabi Abyad (levels 8A-3: since 6125 B.C.) Yarim Tepe II (tholos 55)	

Figure 21: Material and implementation techniques. Summary table with examples studied in this paper chronologically classified.

Abyad (Op .I, levels 8 to 3B) where cob is used in combination with the mud-brick technique (Figure 21). On this last site, we observed the gradual disappearance of the cob technique around 6000 B.C., linked with a trend of changes taking place at the time. Is this phenomenon only local, the result of an autonomous evolution on this site, or can it be generalized on all the sites within the Halafian culture? In the Caucasus region the stacked-mud technique is also used on the earliest sites of the Shulaveri-Shomu culture: at Aknashen-Katunarkh architectural techniques using "cob" and/or prefabricated components coexist (BADALYAN *et al.*, 2010, p. 191). This is also the case at Gadachrili Gora (horizon I) and Masis Blur (MARTIROSYAN-OLSHANSKY *et al.*, 2013, p. 145). Later, the (moulded?) plano-convex mud-brick technique will expand widely. We still lack data and precise chronological information to dismiss either a local evolution of the techniques in the Caucasus itself, or the possibility that relations between northern Mesopotamia and southern Caucasus, clearly attested at the appearance of the Shomu-Shulaveri culture as mentioned in the Introduction, were maintained during the whole of the sixth millennium B.C.

However, the comparison between the size of the mud-bricks among the Shulaveri-Shomu and the Halaf cultures shows major differences, testifying of their own cultural particularity: while the length/width ratio is around 2:1 in the Shulaveri-Shomu culture which means that the bricks are clearly rectangular, mud-bricks

are nearly square and taller with a ratio around 1:1 in the Halaf sites (Figure 22)¹⁹. There are some exceptions, like at Yarim Tepe II (MUNCHAEV & MERPERT, 1973, p. 11) and Tepe Gawra (TOBLER, 1950, p. 48) in Northern Mesopotamia, where the bricks have sizes close to those of the Shulaveri-Shomu ones during the Halaf II (around 5800-5400 B.C.)²⁰. We can nevertheless consider that a kind of regionalization for the shapes and manufacturing techniques existed between the Shulaveri-Shomu and the Halaf cultures.

Furthermore, the regular dimensions and shape of the plano-convex mud-bricks in the Shulaveri-Shomu culture allow the hypothesis that they were moulded. If this technical evolution can be proven from the very beginning of this culture, it will then be anterior to its apparition in the Halaf culture, actually dated to around 5800-5400 B.C.

Finally, the enigmatic implantations observed at Gadachrili Gora and Shulaveris Gora, with mud-bricks laid in a regular stretcher bond on three surviving courses (see above), do not have analogies in the Halaf culture as far as we know. Nonetheless, this technique is well known during the sixth and the seventh millennium B.C., for instance in Central Mesopotamia at Choga Mami (OATES, 1969, pl. XXII), and in Iran at Choga Banut (KANTOR, 1978, pl. IIa). This observation points towards comparisons with other areas, particularly with the foothills of the Zagros, or towards other cultures, like the Hassuna and Samarra cultures.

19. See figure for bibliographic references.

20. Unfortunately, stratigraphic imprecisions and the lack of clear radiocarbon dates for these two sites do not allow more precision for this point.

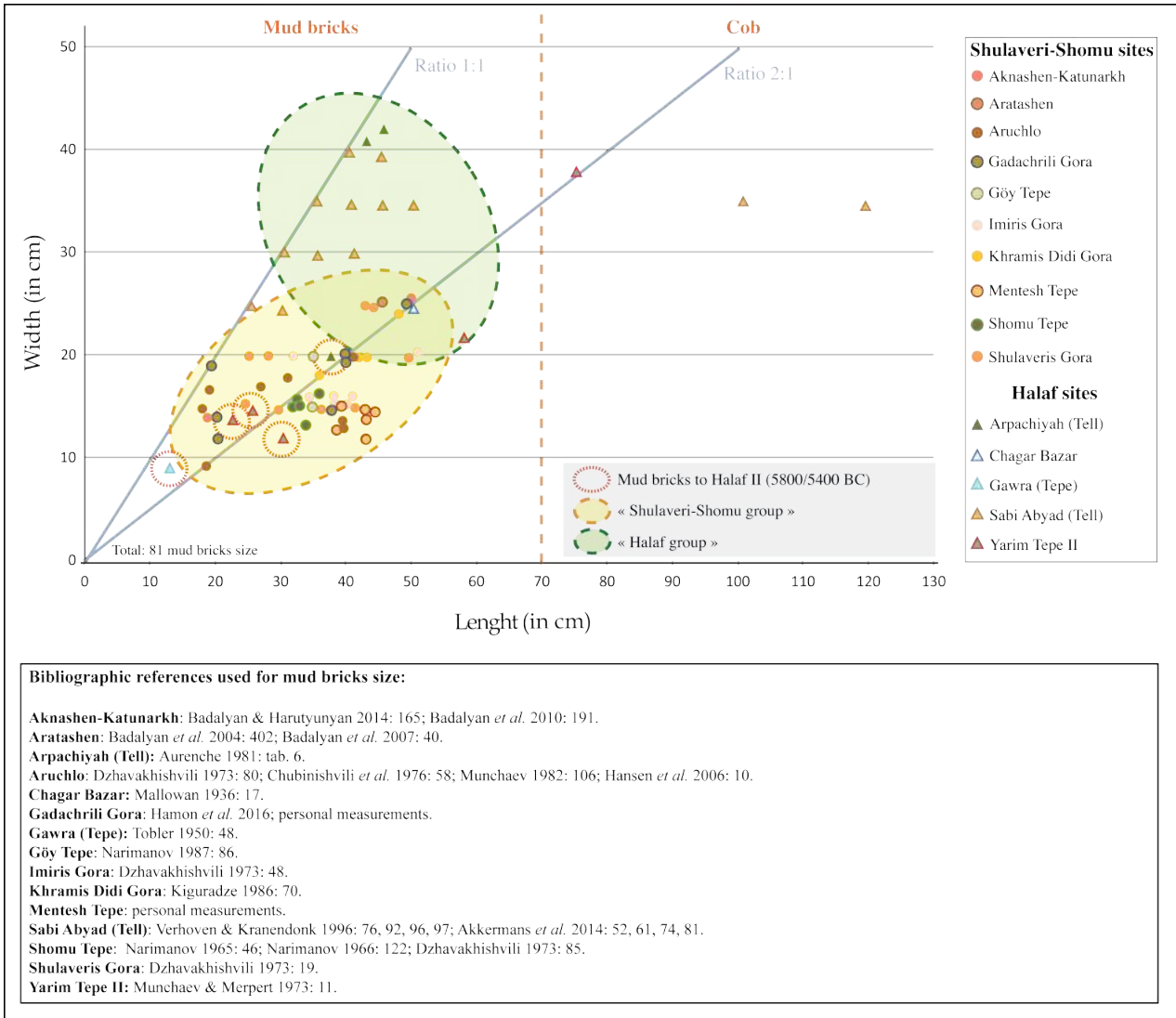


Figure 22: Graph with a regional repartition of the modules of mud-bricks in the Halaf and the Shulaveri-Shomu cultures (author).

Conclusion

This brief overview of the architectural techniques during the first half of the sixth millennium B.C. confirms the know-how of the Late Neolithic populations in architectural building techniques. Even if this field of research is often poorly described, in particular the foundations of walls or the covering techniques, these new arguments advanced here support the hypothesis of relationships between the Halaf and the first populations of the Shulaveri-Shomu cultures. This could testify of movements of population and/or of exchanges of materials between the two areas at that time, though we certainly need more data, based upon other types of evidence (pottery, obsidians, DNA, etc.) to assert this as a statement. Indeed, morphology and similarities in the foundation techniques between the Halaf and the Shulaveri-Shomu culture are not enough to explain relationship, as these "universal" features seem to be distinctive for any community in a settling process (AURENCHE, 1981, p. 185-186). A more valuable proof is the similarity in the evolution of the building techniques within these two areas, with the gradual disappearance of the cob technique to the benefit of the mud-brick in northern Mesopotamia at the outset of the sixth millennium B.C. matching with the appearance of the Shulaveri-Shomu culture in the Caucasus region where both techniques are used concurrently at its beginning, for example at Aknashen-Katunarkh, at Gadachrili Gora and at Masis Blur. But, even if these facts are contemporaneous in the two areas, it is difficult in

our current state of knowledge to quantify the level in the exchanges of techniques that was reached.

Nevertheless, it seems that, later on, the Shulaveri-Shomu culture developed its own architectural features, especially in the size and shape of the mud-bricks. Further research with more precise data should help us solve these important questions.

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