Marcin Białowarczuk

Early Neolithic Wall Construction Techniques in the Light of Ethnographical Observations on the Architecture of the Modern syrian Village of Qaramel

Polish Archaeology in the Mediterranean 19, 586-599

2010

EARLY NEOLITHIC WALL CONSTRUCTION TECHNIQUES IN THE LIGHT OF ETHNOGRAPHICAL OBSERVATIONS ON THE ARCHITECTURE OF THE MODERN SYRIAN VILLAGE OF QARAMEL

Marcin Białowarczuk

The so-called "Neolithic Revolution", which began in the Near East about 12,000 BC, led to enormous changes in the everyday life of human communities. Farming and sedentary life were important elements of these changes, but also in architecture a huge development was observed.

Beginning with the Proto-Neolithic Natufian Culture there was growing diversification of architectural forms and techniques in different regions of the Near East. The process appears to have accelerated during the Pre-Pottery Neolithic A and Early Pre-Pottery Neolithic B periods, which are dated between 10,200 and 8000 BC calibrated (Aurenche and Kozłowski 1999). Intensive field research, especially in the past 20 years, has brought to light enormous variation in the architecture of these periods. Younger stages of the Neolithic Period also introduced architectural innovations, although these were mostly modifications of already invented elements. Some architectural techniques from the beginning of the Pre-Pottery Neolithic, especially wall construction, employed technological solutions so efficient that they are still being used unchanged in modern architecture through-out the Near East.

The huge similarities between modern and early Pre-Pottery Neolithic structures stand at the root of the present study. Modern architectural units were observed mainly in the area of the modern village of Qaramel and subjected to comparative analysis during a few seasons of field-work in Tell Qaramel. The data were enriched with information from other areas of northern Syria. The significance of observing modern Arabic architecture is twofold: it pinpoints elements of architecture which have remained unchanged for thousands of years and it facilitates interpretations of prehistoric archaeological finds from the region. Parallels with modern architecture provide explanations for many important features that are not always easy to understand in the archaeological record.

STONE WALL CONSTRUCTION

The most general division of wall construction techniques is by the raw material, which is either stone or mud. Stone construction appears to be both more diverse and more numerous, in Neolithic as well as modern architecture. A classification of these techniques thus seems essential. Similar classifications for historically younger architecture are based traditionally on the way materials are arranged, but this criterion is not valid for early architecture where the arrangement of material is usually accidental, even if the material was prepared beforehand.

Criteria that are, in my opinion, crucial for distinguishing stone wall techniques, other than the array, are wall width and wall surface construction. On this basis three main techniques of wall construction have been identified: single row, double row and double row with internal filling.

SINGLE ROW TECHNIQUE

It is the simplest of the three techniques. The wall is made of a single row of stones arranged in superimposed layers and bonded with mortar [*Fig. 1b*]. The thinness of such walls, usually 0.25–0.30 m, is characteristic. They are founded straight on the ground or on a low foundation made of big, flat stones. The technique is used today for erecting single-storey buildings used as stores for various goods. Structures of this kind do not appear to be resistant to big loads.

One of the earliest archaeological sites to demonstrate the presence of the single row technique is Hallan Çemi in southeastern Anatolia, dated to about 10,000 BC calibrated (Rosenberg 1994). In the Middle Euphrates region, in Mureybet II, the same technique appears slightly later, that is, about 9800–9200 BC calibrated. In Mureybet III, the single row technique is also present, but in a variant that is not represented in modern architecture: "cigar-shaped" blocks of limestone (van Loon 1965). The single row technique was discovered in this region also at the site of Jerf el-Ahmar [*Fig. 1a*], where it appears at the same time as in Mureybet II (Stordeur 2001). The single row technique is also known from PPNA sites in the southern Levant, such as Gilgal (Noy 1989) and Netiv Hagdud (Bar-Yosef, Gopher 1997). At both these sites stones were used as raw material, but they were carefully selected for size. This variant of the single row technique is the youngest of the three methods of construction, as the settlement in Gilgal is dated to c. 9300–9000 BC calibrated and Netiv Hagdud to 9000–8800 BC calibrated (Aurenche, Kozłowski 1999).

DOUBLE ROW TECHNIQUE

A more developed and sophisticated technique involved two rows of stones fitted closely together and forming the two faces of the wall [*Fig. 1d*]. Walls made in this technique are usually 0.30–0.50 m thick. Unlike the walls described above, double row walls are always built on foundations made of big, flat stones. Walls were thus reinforced and could support heavier loads, a characteristic that is evidenced by the functions of buildings raised in this technique. They are usually dwellings or storage buildings, the flat roofs of which are often used as terraces for household activities.

The earliest traces of this technique have been found at Hallan Çemi, where they coexist with walls erected in the single row technique (Rosenberg 1994). Almost simultaneously the technique appears south of the Taurus Mountains, in Tell Qaramel, where it can be found in the lower parts of the so-called "grill house" (Mazurowski

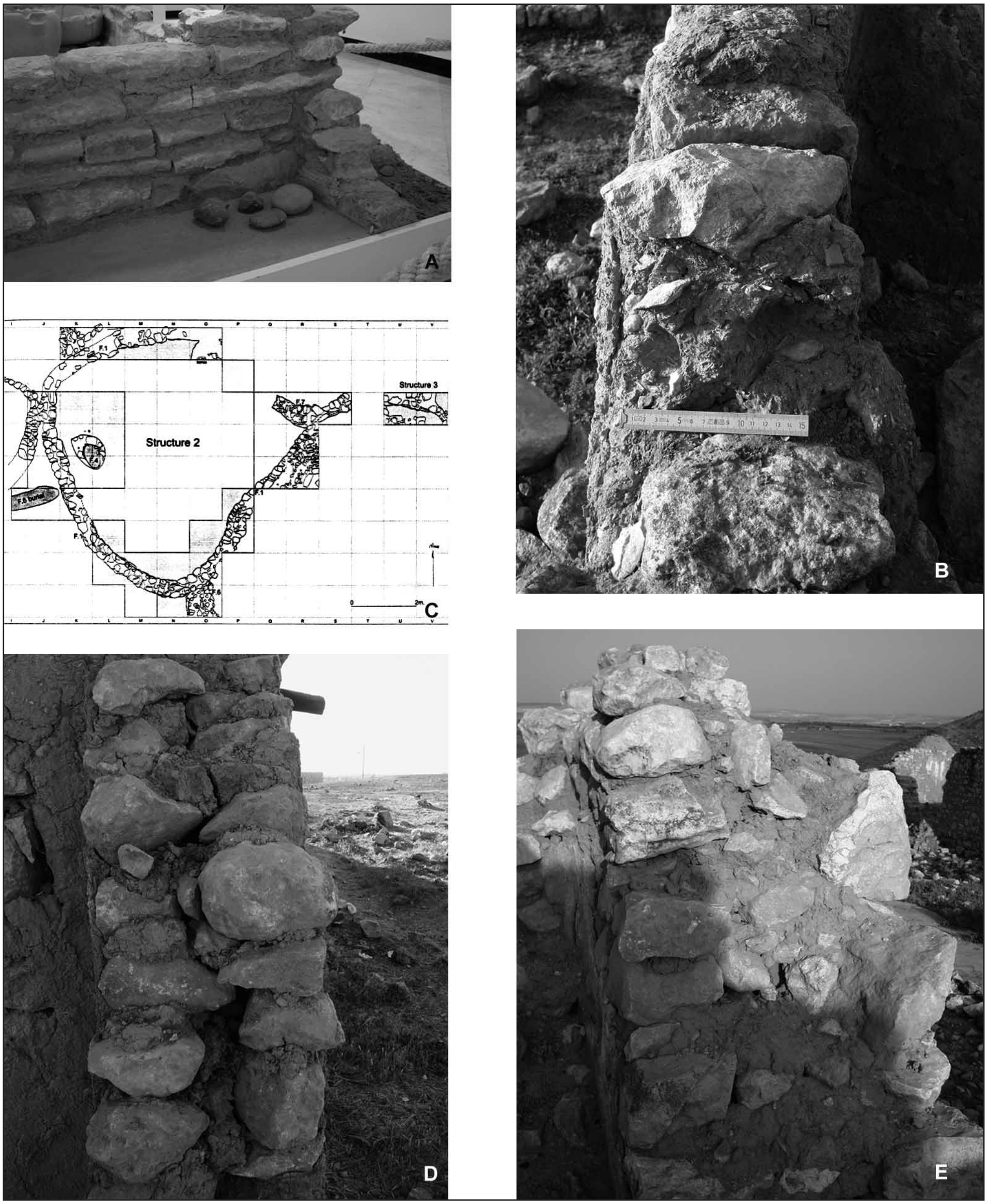

Fig. 1. Examples of stone wall construction: A) Early Neolithic example of single row technique with limestone "bricks". Jerf el-Ahmar (Syria), reconstruction in the National Museum of Damascus B) modern example of single row technique. Qaramel village; C) plan of PPNA house with walls in the double row technique. ZAD 2, Jordan (after Edwards et alii 2004: 27); D, E) modern examples of double row technique, with (E) and without (D) internal fill (Photos M. Białowarczuk)

2003: 323–325). It is latest to arrive in the southern Levant. Between 9150 and 8550 BC calibrated, this technique can be observed first in ZAD 2 (Edwards *et alii* 2004) [*Fig. 1c*] and then in Netiv Hagdud (Bar-Yosef, Gopher 1997). During the Earl PPNB, this technique developed further in the Taurus region, as attested by some dwellings from Nevali Çori (Hauptmann 1988).

DOUBLE ROW TECHNIQUE WITH INTERNAL FILLING

The next stage in the development of stone wall construction is distinguished by two perpendicular single-stone alignments which form the wall faces. The two rows of stones stand at a distance from each other and the space between them is filled with crushed stones and mud [*Fig. 1e*]. The thickness of such walls is 0.50–0.60 m or more. Same as in the double row technique, these walls are built on foundations made of big, flat stones. Buildings constructed in this way have the same functions as those described in the previous group.

The pattern of development of this technique in the early Neolithic is completely different. The earliest examples known so far come from Tell Qaramel; the technique is represented in the lower parts of Towers I and II, the latter one being radiocarbon-dated to 8340+/-85 bc (uncalibrated) (Mazurowski *et alii* forthcoming). Another early Neolithic site is Çayönü Tepesi in southeastern Anatolia, where during the PPNA/PPNB transitional phase the double row technique with internal fill was used for building the foundations of "grill houses". A continuation of this technique appears again in Çayönü Tepesi during the Late PPNB and PPNC stages (Shrimer 1990).

Significantly, the technique is often used side by side with one of the other described techniques in the construction of a single building. The choice of technique is obviously governed by intended wall function. And so, external walls are almost always built using the double row technique or double row technique with internal filling, while internal walls are usually built using the single row technique. This is an optimal solution. External walls are usually thick and strong because their main function is to insulate house interiors from weather conditions and to transfer the load of the roof onto the ground. Internal walls, on the other hand, divide up space inside a house and, if the house is large, support the roof as well. For these tasks, a single-row wall is entirely sufficient.

Such a diversification of construction techniques within a single house is seldom encountered in early Neolithic architecture. Walls were usually built in one technique. Among the rare exceptions are some buildings from PPNB Beidha (Kirkbride 1966).

BUILDING STONE ARRAY

Many variants of these three techniques exist. A common feature is the careful choice and preparation of building material. Even if a wall looks messy, the blocks or stones used in its construction are fitted tightly. When the stone raw material is used without preparation, the gaps between stones are often packed with small pebbles or pieces of rocks. These efforts seem to have served the purpose of strengthening the walls in order to make them higher. Wall strength has always been an issue in the Near East, the region being an earthquake-prone zone since prehistoric times. Building stone array is thus an important criterion for distinguishing wall types, which fall into two principal categories: disordered and ordered arrangements.

The disordered stone arrangement features a chaotic and haphazard array of stones that are all of different shapes and sizes [*Fig. 2a*]. Natural stones and pebbles are frequently used in this kind of wall, together with partly dressed stones and even worn or broken heavy stone tools, such as basalt mortars [*Fig. 2b*]. This stone array is characteristic of most Neolithic structures, especially the oldest ones.

The stones in the ordered arrangement are not dressed as a rule, but they are selected for shape and size [*Fig. 2c*]. They are usually arranged in courses. A number of subtypes can be distinguished: walls made of small regular pebbles; structures made of big or midsize stones; and finally, mixed structures in which courses of big, carefully selected blocks alternate with rows of small pebbles or chunks of rocks [*Fig. 2d*].

The first two subtypes are characteristic of early Neolithic settlements at Gilgal

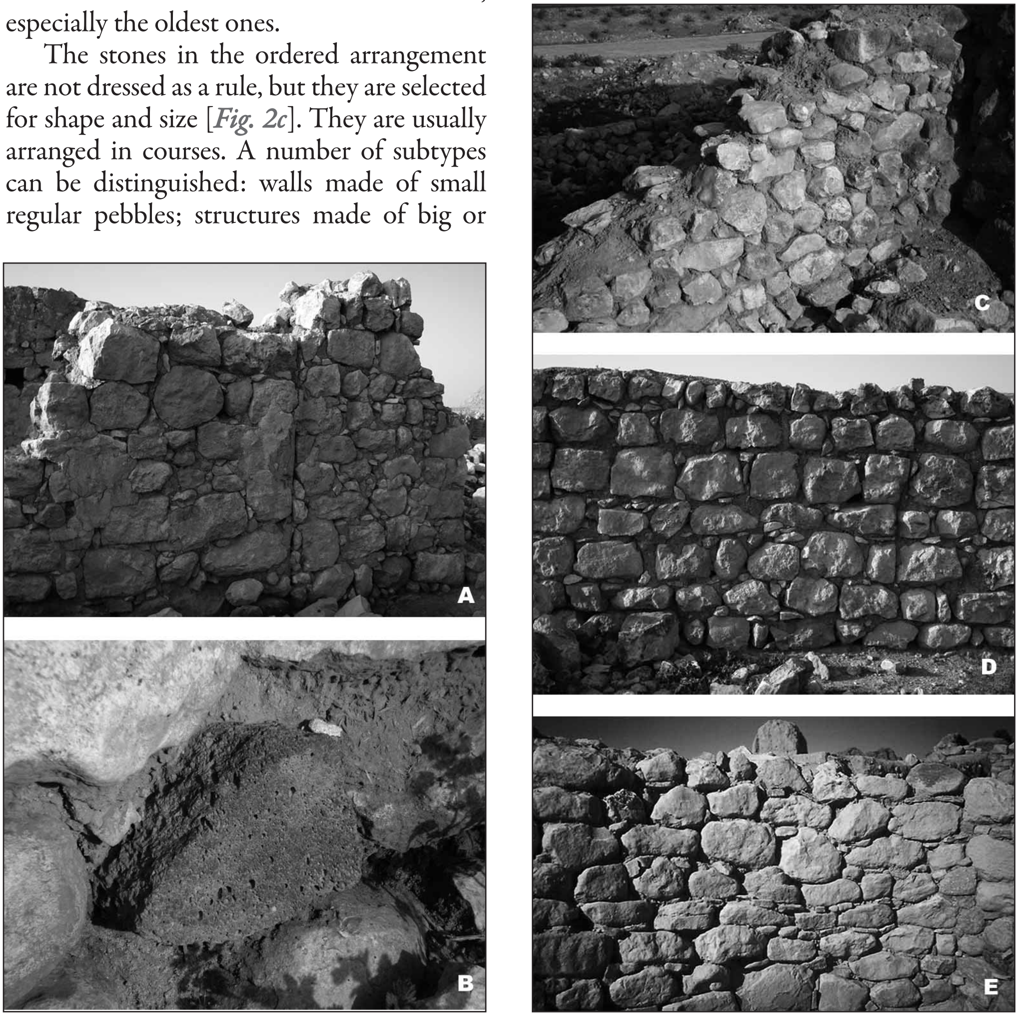

Fig. 2. Building stone array: A) modern example of disordered array, Qaramel village; B) fragment of basalt mortar used in wall construction, Qaramel village; C) modern example of ordered array, Qaramel village; D) modern example of mixed technique with rows of selected big blocks separated by two rows of pebbles, Qaramel village; E) Early Neolithic example of mixed technique: two rows of pebbles separating rows of selected big blocks, Beidha, Jordan (Photos M. Białowarczuk)

(Noy 1989) and Netiv Hagdud (Bar-Yosef, Gopher 1997). Among the younger Neolithic sites connected with the PPNB, one should mention Göbekli (Schmidt 2000). Typical examples of the third subtype are supplied by structures from Beidha in Jordan [*Fig. 2e*], also connected with PPNB levels (Kirkbride 1966).

PISÉ BUILDING TECHNIQUE

Pisé is one of the oldest wall construction techniques and is known throughout the Near East. A monolithic wall is made of mud mixed with water and some organic components (Aurenche, Kozłowski 1999: 138).

Two types of this technique can be distinguished. The first one uses handmade mud blocks of different size and shape, arranged in a row and then smoothed over the face so that the joints are blurred. Next, the row is left to sun-dry for one to three days. During this time the wet mud blocks bond together and form a very strong structure. The next row of blocks is laid on top of the first one. The whole procedure is repeated until the wall reaches the required height (Aurenche 1981: 54–55).

In the other variety of the technique, a wooden form is filled with a muddy mass. Next the mud is beaten with a special beater,

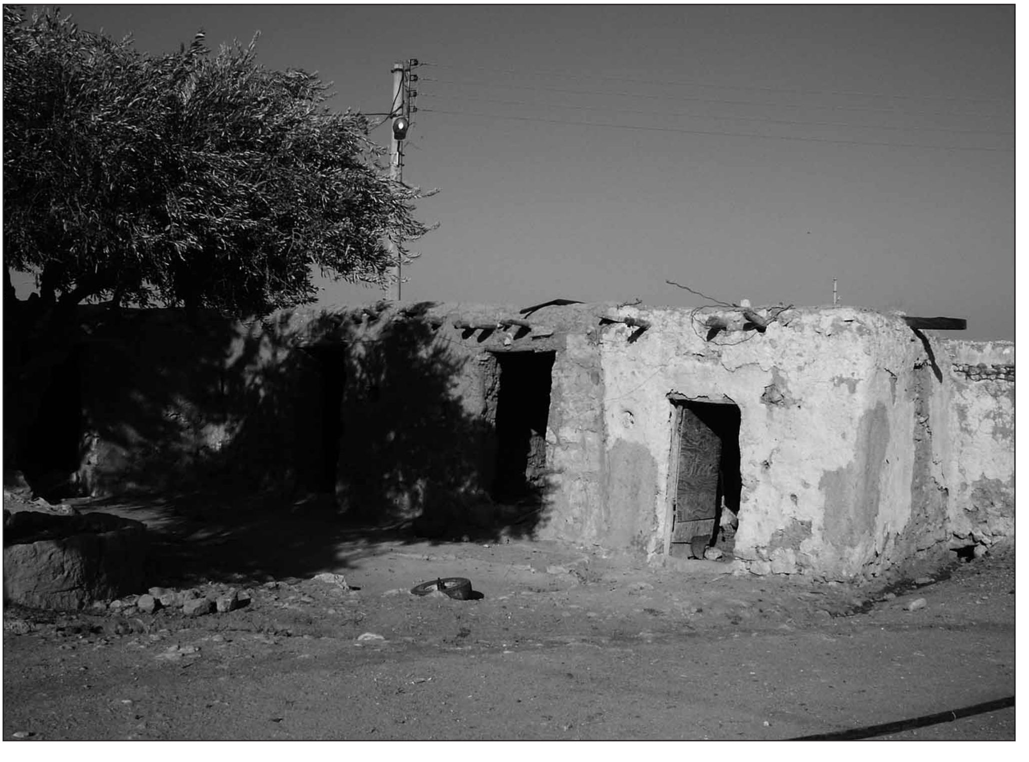

Fig. 3. Storage buidings made of pisé. Qaramel village (Photo M. Białowarczuk)

weighing up to 20 kilograms. Then, the structure is also left to dry for a few days in the sun (Aurenche 1981: 57–58).

In the modern village of Qaramel, the *pisé* technique is becoming increasingly rare. It remains much more common in the Middle Euphrates region. The gradual disappearance of this technique in Qaramel is caused by increased usage of modern building materials, such as limestone blocks and concrete bricks. *Pisé* of the first of the described types can still be observed in small storage buildings [***Fig. 3***] and — sometimes — in the oldest houses [***Fig. 4***]. The second type of the technique is used commonly for rather low and wide walls built as fencing.

The oldest examples of *pisé* are known from the Proto-Neolithic Period but the main period of its development is the PPNA, especially in the Levant and Mesopotamia. From this period on, *pisé* is known from Hatoula in Israel (Lechevalier *et alii* 1989), Dhra' (Kujit, Finlayson 2002: 19), Tell Qaramel (Mazurowski *et alii* forthcoming) and many others. Buildings erected in this technique very often coexist with stone structures at these sites.

Pisé seems to have been most popular, especially during the PPNA, in Northern Mesopotamia. The most interesting examples from this region are known from excavations of Nemrik 9, where they seem to be characteristic of the oldest phase of village occupation, dated to the end of the 9th millennium BC. This technique was used there for building walls of the oldest semi-subterranean houses, as well as the first structures built on the level of the ground, such as house 6 (Kozłowski, Kempisty 1990: 352).

Fig. 4. Traditional Arabic house made of pisé. Qaramel village (Photo R.F. Mazurowski)

MUD BRICK BUILDING TECHNIQUES

Mud bricks used in the architecture of modern Qaramel take on the form of small, regular, cubical mud blocks, cast in forms and sun-dried [*Fig. 5*]. The mud mass contains chunked straw as temper.

Mud brick is a building material used in all types of structures, but the most common use is for building the so-called *qubbas* [*Fig. 6,* top]. These are traditional houses with domed roof [*Fig. 6,* bottom], best known from the northern Levant during the Halaf culture. Mud brick is also used frequently for building the superstructures of some stone walls [*Fig. 7*].

The brick arrangement supports a division into three types of walls: characterized by parallel arrangement, transversal arrangement and mixed arrangement. The first type has the mud bricks arranged in rows with their side faces towards the wall faces. There are subtypes consisting either of a single row of bricks or of a few rows lying parallel to one another. The width of such walls ranges from several to several dozen centimeters, depending on the number of brick rows.

In the second type, bricks are arranged with their end faces towards the wall faces. This type of walls usually consists of a single row of bricks. For this reason, wall thickness does not exceed 20–25 cm.

Finally, walls with mixed arrangement are characterized by rows of mud bricks arranged alternating with their end and side faces

Fig. 5. Modern sun-dried mud bricks in a Syrian village on the Middle Euphrates (Photo M. Białowarczuk)

Fig. 6. Traditional qubba with cupola roof made of mud bricks and covered with plaster (top) and example of mud brick usage in cupola roof construction, both from Qaramel village (Photos R.F. Mazurowski)

towards the wall faces. These walls are the strongest of the described mud brick walls and reach up to 1 m in width.

EXAMPLES OF EARLY MUD BRICK USE

The invention of sun-dried mud bricks during the PPNA was a revolutionary step in the development of architecture in the Near East. Similarly as in the case of the pisé technique, the largest number of examples of mud brick buildings is known from the Levant and northern Mesopotamia. This distribution can be directly connected with the origins of the earliest mud bricks. As O. Aurenche suggested, the invention of the first mud brick was the effect of long term experience with the *pisé* technique (Aurenche 1981: 60–70).

In the Levant, the oldest evidence for the use of this technique comes from the PPNA site of Jericho in Palestine. Walls of houses discovered there were built of sun-dried mud bricks laid mostly in the parallel arrangement, in three rows. The transversal arrangement is very rare there (Kenyon, Holland 1981). Bricks were bonded in clay mortar in the same way as were the stones in the stone walls from Jerf el-Ahmar or Mureybet. Apart from Jericho, mud bricks in the southern Levant were discovered on such PPNA sites as Gesher, Netiv Hagdud (Bar-Yosef, Gopher 1997: 249–253) and Dhra' in the Jordan Valley (Kujit and Mahasneh 1998: 157).

Fig. 7. Example of modern stone wall with superstructure made of mud bricks. Qaramel village (Photo M. Białowarczuk)

In Northern Mesopotamia, the best example of the mud-brick technique is House 1A in Nemrik 9. Its walls were built of mud bricks laid on foundations made of hard rocks and clay. Each layer of mud bricks was laid in the parallel arrangement [*Fig. 8b*]. The brick bonding was rather accidental. In the last phase of the building process, internal faces of walls were covered with approx. 0.50–1.50 cm thick coat of clay plaster (Kozłowski [ed.] 1992: 23–35). The same technique was used in the construction of the wall of the circular House 8 in M'lefaat [*Fig. 8a*], with plaster coat thickness ranging from 1 to 4 cm (Kozłowski [ed.] 1998: 194). The parallel arrangement occurs in just one house in M'lefaat, while it is the most popular technique used in Nemrik. On the latter site, walls with transversal and mixed arrangement appear only occasionally. The best examples are provided by walls nos 2 and 3 discovered inside House 2 (Kozłowski [ed.] 1990: 48–50). Wall 3 is a typical example of the transversal arrangement and wall 2 is a very interesting example of the mixed arrangement [*Fig. 9*].

In all of the mentioned examples, mud bricks were bonded with specially prepared mortar. In M'lefaat it was made of clay mixed with ash (Kozłowski *et alii* 1998: 149). In

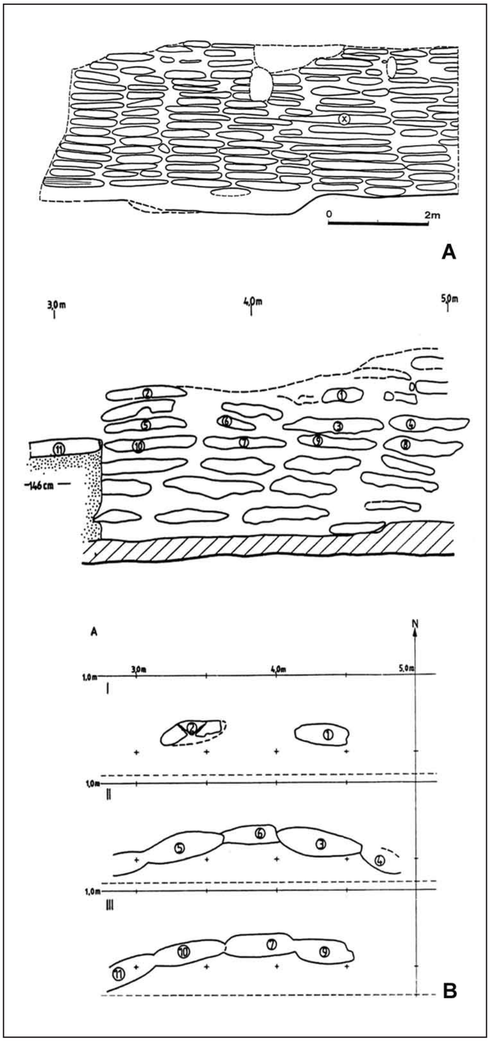

Fig. 8. Examples of parallel arrangement of mud bricks: A) PPNA house, M'lefaat, Iraq (after Kozłowski [ed.] 1998: 250); B) House 1A, Nemrik 9, Iraq (after Kozłowski [ed.] 1992)

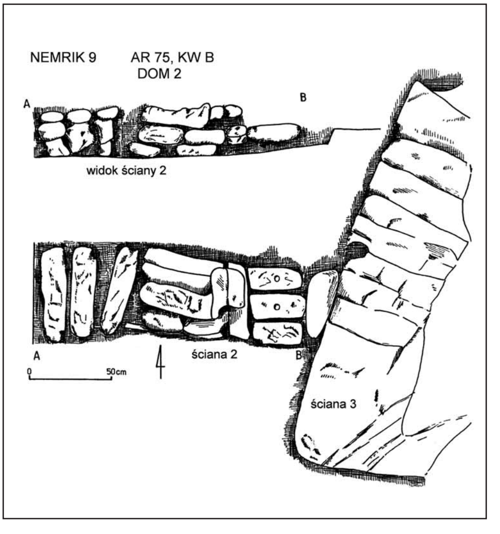

Fig. 9. Transversal arrangement of mud bricks in PPNA House 2, Nemrik 9, Iraq (after Kozłowski [ed.] 1990: Fig. 18)

Nemrik 9, it was a kind of mortar made of clay mixed with humus (Kozłowski [ed.] 1992: 25). Chemical analyses of this mortar suggest also the addition of egg white to the mortar (Kozłowski [ed.] 1990: 176).

BRICK SHAPE AND SIZE

The oldest mud bricks were plano-convex or cigar-shaped and varied in dimensions. Modular forms, cuboids, as we know them now, started to spread through the Near East during the PPNB period. Some of the oldest were discovered in Çafer Höyük in southeastern Anatolia. Cuboid mud bricks of standardized dimensions were used there from the beginning of the PPNB (Cauvin, Aurenche 1982: 124). During the middle and late PPNB, this kind of building material became popular in the other regions of the Near East. A good example can be Tell Buqras in the middle Levant (Akkermans *et alii* 1981: 499).

In light of archaeological data, the process of shape and size standardization took place during the developed Neolithic Period. The best example thereof seems to be Çatal Hüyük, where standardized mud bricks were found in layer VI A. From that time onward, the standard dimensions were 32 x 16 x 8 cm (Mellart 1967: 55). According to some architects, this example clearly indicates another important issue: from this point in architectural development, a simple measurement system was used, measuring length by multiplying smaller units (Tobolczyk 2000: 103). The coordinated dimensions of bricks from Çatal Huyük suggest that the Neolithic builders based them on natural measures, such as a foot and a hand or their multiples. The length of 32 cm is very close to the measure of one foot and it is four times longer than a hand, which is 8 cm (Tobolczyk 2000: 103).

CONCLUSIONS

All the described techniques of modern Qaramel architecture and their comparison with early Neolithic techniques clearly indicate the survival of certain architectural traditions for more than 10,000 years.

Wall construction seems to be much more conservative than any other building element. Roofs, for example, conform to weather conditions and their construction has been modified through the ages. Certain methods of wall construction have survived in unchanged form in spite of civilizational and technological development, testifying thus to people's attachment to tradition.

This phenomenon is especially conspicuous in rural architecture where it seems to be connected with village location. From prehistoric times settlements have been located mostly at the edges of various ecological zones. This border location ensured better use of natural resources to meet needs (Bieliński 1985: 26). In terms of architectural development, the location provides access to certain raw materials which can be used for building. Raw materials in turn dictate specific ways of use (Tobolczyk 2000: 42). For this reason wall construction is ranked among the most conservative building techniques and traditions of wall construc-tion have survived down the ages. It is only now that modern architecture with its array of developed techniques is fast replacing the old architectural traditions. Many ethnographical elements of importance for comparative studies in archaeology are in danger of extinction. It is therefore not just a need, but also an obligation for researchers to document examples still in existence.

REFERENCES

Akkermans, P.A., Fokkens, H., and Waterbolk, H.T.

1981 Stratigraphy, architecture and lay-out of Bouqras, *Préhistorie du Levant* 598, 485–501

Aurenche, O.

1981 *La maison orientale. L'architecture du Proche Orient ancien des origines au milieu du quatrième millénaire*, Paris

Aurenche, O., Kozłowski, S.K.

1999 *La naissance du Neolithique au Proche Orient ou le Paradis Perdu*, Paris

Bar-Yosef, O., Gopher A., (eds)

1997 An Early Neolithic village in the Jordan Valley, Part I: The archaeology of Netiv Hagdud, *American School of Prehistoric Research Bulletin* 43, Harvard

Bieliński, P.

1985 *Starożytny Bliski Wschód. Od początków gospodarki rolniczej do wprowadzenia pisma,* Warszawa: PWN

Cauvin, J., Aurenche, O.

1982 Le Neolitique de Cafer Hoyuk (Malatya, Turquie). Fouilles 1979–1980, *Cahiers de l'Euphrate* 3, 123–138

Edwards, P.C. *et alii*

2004 From the PPNA to the PPNB: new views from the southern Levant after excavations at Zahrat Adh-Dhra' 2 in Jordan, *Paléorient* 30/2, 21–60

Hauptmann, H.

1988 Nevali Çori: Architektur, *Anatolica* 15, 99–110

1999 The Urfa Region, (in:) M. Özdoğan, N. Başgelen (eds), *The Neolithic in Turkey. The cradle of civilization*, Istanbul

Kenyon, K.M., Holland, T.A. (eds)

1981 *Excavations at Jericho. Vol. III. The Architecture and Stratigraphy of the Tell*, London

Kirkbride, D.

1966 Five seasons at the Pre-Pottery Neolithic village of Beidha in Jordan. A summary, *PEQ* 98, 8–72

Kozłowski, S.K., Kempisty, A.

1990 Architecture of Pre-Pottery Neolithic settlement in Nemrik, Iraq, *World Archaeology* 21/3, 348–362

Kozłowski S.K., (ed.)

1990 Nemrik 9, P*re-pottery Neolithic Site in Iraq. General Report — Seasons 1985–1986*, Warsaw

1992 *Nemrik 9, Pre-Pottery Neolithic site in Iraq*. 2: *House No 1/1A/B*, Warsaw

1998 M'lefaat, Early-Neolithic site in Northern Iraq, *Cahiers de l'Euphrate* 8, 179–273

Kujit, I., Mahasneh, H.

1998 Dhra': An Early Neolithic village in Southern Jordan Valley, *Journal of Field Archaeology* 25, 153–161

Kujit, I., Finlayson, B.

2002 The 2002 excavation season at Dhra', Jordan: preliminary results from the Jericho IX and Pre-Pottery Neolithic A period components, N*eo-Lithics. A Newsletter of Southwest Asian Lithics Research* 2, 17–21

Lechevallier, M., *et alii*

1989 Une occupation khiamienne et sultanienne à Hatoula (Israël)?, *Paléorient* 15/1, 323–330

Mazurowski, R.F.

2003 Tell Qaramel. Excavations 2002, *PAM* XIV [=*Reports 2002*], 315–330

Mazurowski, R.F., Białowarczuk, M. and Januszek, K.

forthcoming Architecture of Tell Qaramel, (in): R.F. Mazurowski, Y. Kanjou (eds), Tell Qaramel Protoneolithic and Early Pre-Pottery Neolithic settlement in Northern Syria (Preliminary results of the Syrian-Polish archaeological excavations 1999–2007), *Documents d'archeologie Syrienne*, Damascus

Mellart, J.

1967 *Çatal Hüyük. A Neolithic Town in Anatolia*, London

Noy, T.

1989 Gilgal I — a Pre-Pottery Neolithic site, Israel. The 1985–1987 seasons, *Paléorient* 15/1, 11–17

Rosenberg, M.

1994 Hallan Çemi Tepesi: Some further observations concerning stratigraphy and material culture, *Anatolica* 20, 121–140

Schmidt, K.

2000 "Zuerst kam der Tempel, dann die Stadt". Vorläufiger Bericht zu den Grabungen am Göbekli Tepe und am Gürcütepe 1995–1999, *Istanbuler Mitteilungen* 50, 5–41

Shrimer, W.

1990 Some aspects of building at the Aceramic Neolithic settlement of Çayönu Tepesi, *World Archaeology* 21/3, 363–387

Stordeur, D.

2000 New discoveries in architecture and symbolism at Jerf el Ahmar (Syria) 1997–1999, *Neo-Lithics. A Newsletter of Southwest Asian Lithics Research* 1, 1–4

Tobolczyk, M.

2000 *Narodziny architektury*, Warsaw: PWN

Van Loon, M.

1968 The Oriental Institute excavations at Muraybit, Syria. Preliminary report on the 1965 campaign, *JNES* 27, 265–290