

# FROM CIRCLE TO RECTANGLE. EVOLUTION OF THE ARCHITECTURAL PLAN IN THE EARLY NEOLITHIC IN THE NEAR EAST

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**Abstract:** Transformation of the plan seems to be one of the most fundamental characteristics of architectural evolution during the PPNA stage. It starts with simple round monocellular structures and ends with the invention of modular subrectangular ones, divided into many rooms. However, the evolution of some types of buildings in different regions of the Fertile Crescent was varied in pace. A major question are the main factors causing such regional differences. This paper presents a basic typology of early Neolithic structures and their regional diversification, which could result from individual dynamics of the development of original types stimulated by regionally invented practical and technical solutions. Two variants of the process were distinguished. The first is the evolution from a primitive shelter to open, free-standing durable forms of round houses. The other variant was the development from shelters to large round subterranean houses. Different regions of the Near East adopted one of these two variants. Each featured specific traits and determined further regional development of plan.

**Keywords:** architecture, plan evolution, PPNA, Fertile Crescent, Neolithic

The term “Neolithic” defies simple definition. Most scholars concur that this was a time of economic transformation involving domestication of wild food resources and establishment of permanent settlements (Simmons 2010: 4). One of the fundamental elements defining the Neolithic is also the evolution of architecture, which began during the Kebaran and Natufian, and developed through the early Neolithic age. The early Neolithic should be understood here as a period of

the most intensive architectural experiments, including the invention of a modular, rectangular plan and its distribution in the Near East. In chronological terms, this can be dated to the period between about 10,200 and 8500 BC, corresponding with the PPNA and EPPNB (Aurenche and Kozłowski 1999: 255).

A round or oval, monocellular subterranean house was the only type of dwelling known initially in the area in question. In some regions of the Near East, to judge

from the archaeological record, an intensive modification of the basic round plan took place as early as the PPNA, leading in the end to the development of a rectangular multi-roomed house. It was a long-term process, in the course of which many interesting intermediate forms were invented.

The invention of the rectangular plan as well as the dynamics of its diversification in the Near East seem to be the central issues. Questions about factors leading to the earlier development of the rectangular plan in the Northern Levant, and later in other regions, are of importance as well.

## BASIC TYPOLOGY OF EARLY NEOLITHIC STRUCTURES

The typology of buildings in the Near East during the Neolithic has only once been brought up in the scholarly debate so far (Aurenche 1981: 183–212). Intensified archaeological investigations over the past thirty years have supplied a great deal of new data, putting the evolution of architecture in new light. Excavations at North Levantine sites such as Tell Qaramel (Mazurowski and Kanjou 2012) or Jerf el-Ahmar (Stordeur 2015) appear as one of the most important sources of information. For this reason, the typology of buildings proposed previously by Olivier Aurenche, despite the topicality of many elements, requires modification as regards the oldest structure types. Data from Tell Qaramel and Jerf el-Ahmar, as well as parallels with architecture of other PPNA settlements suggest that almost all types

of houses known in the Neolithic Near East (see Aurenche 1981: 183–212) appeared there at the time, namely between 10,300 and 8800 BC. The process of invention and dispersion of successive plan types did not happen simultaneously in all regions [Table 1]. However, five basic types of houses can be distinguished during the said period.

### ROUND STRUCTURE

It is the oldest and the most basic type of structure [Fig. 1:a]. This form originated directly from the Geometric Kebaran and Early Natufian (Aurenche 1981: 185). During the PPNA, a round plan became the most frequent in the Near East. It is known from almost all PPNA sites [see Table 1]. Progressive decline in this type of buildings took place between 8800 and 7600 BC,

*References to Table 1 (opposite):* || 1. Aurenche and Kozłowski 1999 || 2. Ibáñez 2008 || 3. Stordeur and Abbès 2002 || 4. Cauvin 1978 || 5. Mazurowski et al. 2009 || 6. Mazurowski, Białowarczuk, and Januszek 2012 || 7. Stordeur 2003 || 8. Kenyon 1981 || 9. Bar-Yosef and Gopher 1997 || 10. Stekelis and Yizraely 1963 || 11. Kuijt, Mabry, and Palumbo 1991 || 12. Edwards et al. 2004 || 13. Kuijt and Mahasneh 1998 || 14. Kuijt and Finlayson 2001 || 15. Kuijt and Finlayson 2002 || 16. Finlayson et al. 2003 || 17. Noy, Schuldenrein, and Tchernov 1980 || 18. Noy 1989 || 19. Gopher 1995 || 20. Lechevallier et al. 1989 || 21. Lechevallier and Ronen 1989 || 22. Rosenberg et al. 1998 || 23. Rosenberg 1999 || 24. Özdoğan 1999 || 25. Schirmer 1990 || 26. Kozłowski 2002 || 27. Kozłowski 1998 || 28. Watkins 1995 || 29. Yartah 2004 || 30. Yartah 2005 || 31. Hauptmann 1999 || 32. Özkaya and Coşkun 2011 || 33. Schmidt 2009 || 34. Abbès 2008 || 35. Schmidt 2010 || 36. Solecki 1980 || 37. Bar-Yosef, Goring-Morris, and Gopher 2010

Table 1. Occurrence of various architectural plans on the main PPNA sites in the Fertile Crescent

Site name [numbers in brackets refer to bibliographic references listed on the opposite page]	Chronology	Type of structure				
		Round and oval [full plan]	Round and oval [semi-opened plan]	Agglutinative	Subrectangular	Rectangular
Mureybet [1, 2]	10,400–8600 BC (IA–IIIB)		+			+
Jerf el-Ahmar [1, 3]	9200–8800 BC	+		+	+	+
Tell 'Abr 3 [29, 30]	9200–8800 BC	+				
Cheikh Hassan [1, 4]	9000–8600 BC					+
Qaramel [5, 6]	10,900–8800 BC (H1–H4)	+		+	+	+
Wadi Tumbaq 1 [34]	10,000 BC		+			
Tell Aswad [7]	9600–8600 BC	+				
Jericho [1, 8]	9000–8200 BC (PPNA)	+		+		
Netiv Hagdud [9]	9000–8800 BC	+			+	
Nahal Oren [1, 10]	? (w. IV–II PPNA)	+	+			
Iraq ed-Dubb [1, 11]	9100 BC	+				
ZAD 2 [12]	9200–8300 BC	+				
Dhra' [13, 14, 15, 16]	11,600–10,500 BP	+				
Gilgal I [1, 17, 18, 37]	9300–9000 BC	+			+	
Ain Darat [19]	? EPPNA	+				
Hatoula [20, 21]	8300–7500 BC	+				
Abu Salem [1]	10,400–9400 BC (PPNA)	+				
Hallan Çemi [1, 22, 23]	10,700 BC	+				
Çayönü Tepeşi [24, 25]	10,200–9400 BP (PPNA) 9400–9200 BP (PPNA “grill house”)	+				+
Körtik Tepe [32]	10,400–9300 BC	+				
Göbekli [33, 35]	9600–8800 BC (PPNA encl. A–D)	+				
Nevalı Çori [31]	8400–8100 BC (Level I/II – PPNA?)					+
Zawi Chemi [36]	Second half of 11th millennium BC	+	+			
Nemrik 9 [1, 26]	10,000–8000 BC (Phases I–III)	+			+	
M'lefaat [1, 27]	9000–8600 BC	+				
Qermez Dere [1, 28]	9000–8600 BC	+			+	

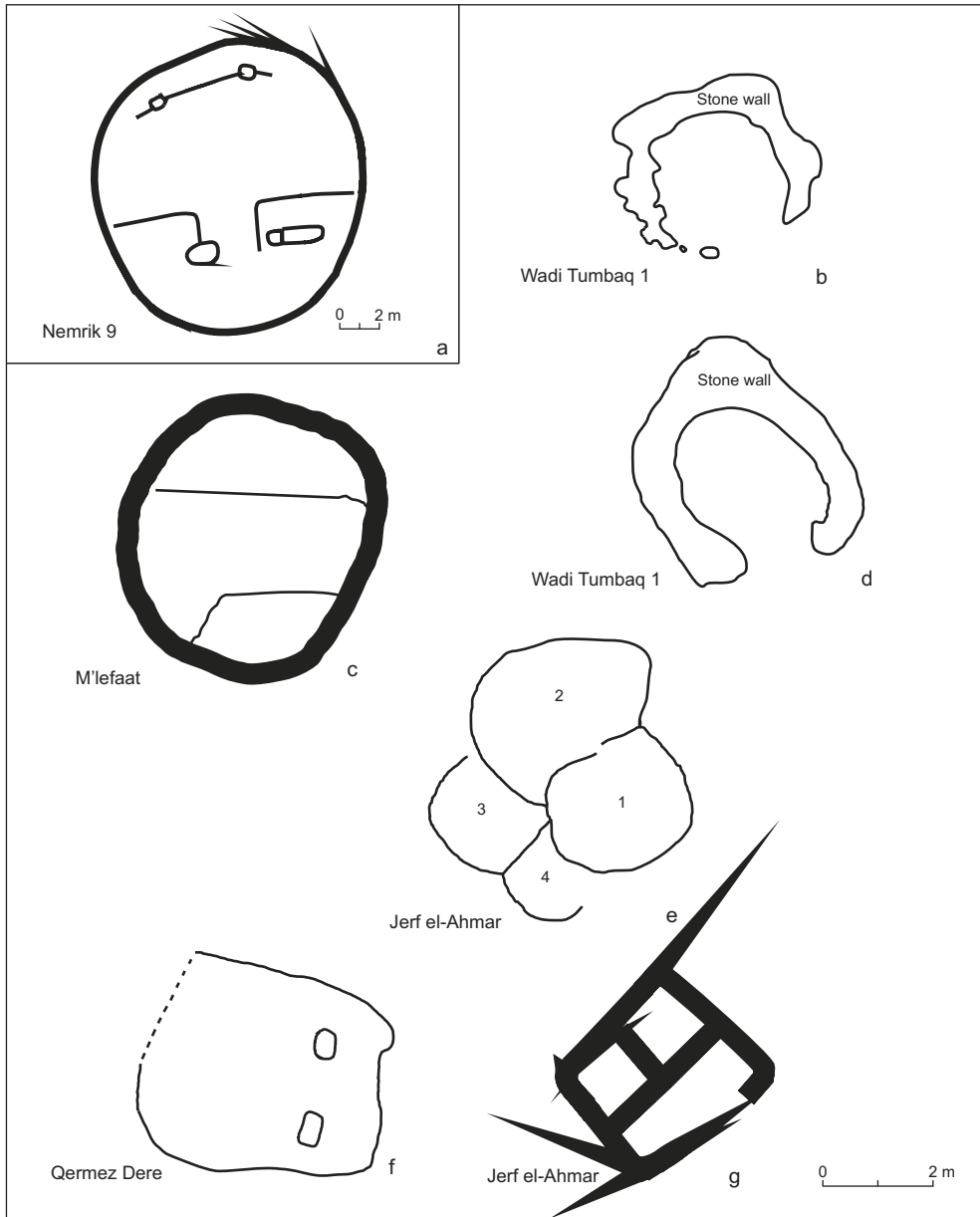


Fig. 1. Examples of plans: a – round full; note the different scale (After Kozłowski 2002: House 1A); b – round semi-opened (After Abbès 2008); c – oval full (After Kozłowski 1998); d – oval semi-opened (After Abbès 2008); e – typical agglutinative (After Stordeur 1999); f – subrectangular (After Watkins 1995: house RAF); g – rectangular (After Stordeur 1999: house from level 0/E)

which corresponds with the EPPNB and MPPNB (Hours et al. 1994: 18). However, some examples of the prolonged existence of such structures are known as well, as in the case of Tell Rihan III (Tusa 1985) and Munhata (Lechevallier 1974).

The diameter of these buildings is regionally diversified and reaches 3–5 m on average. The smallest structures range from about 1.20–2.00 m in diameter, as at Çayönü Tepeşi (Schirmer 1990; Özdoğan 1999), while the largest reach 6.00–7.50 m, as at Nemrik 9 (Kozłowski 2002), Tell Aswad (Stordeur 2003) and ZAD 2 (Edwards et al. 2004). Moreover, there are some examples of larger structures, from the Northern Levant, with diameters of about 10–12 m. These are the so-called public houses known from Qaramel (Mazurowski and Yartah 2002; Mazurowski 2004; 2005; 2007; 2008; 2010; Mazurowski et al. 2009; Mazurowski, Białowarczuk, and Januszek 2012), Jerf el-Ahmar (Stordeur, Brenet, and Yarta 2000; Stordeur 2015) and Tell ‘Abr 3 (Yartah 2004; 2005). Recent discoveries at Tell Qaramel indicate that structures of this kind emerged in the 11th millennium BC. Progressive growth in diameter of round buildings can be observed in the case of some settlements permanently inhabited for a few hundred or even thousand years. At Mureybet, for example, the diameter of the houses expanded from 3–4 m in phase II to 6 m in phase III (Ibáñez 2008). A similar process was recorded at Tell Qaramel. In the early PPNA horizon H1, the average diameter of houses was 2–3 m, expanding to 5–6 m in horizons H2 and H3 (Mazurowski and Yartah 2002; Mazurowski 2004; 2005; 2007; 2008; 2010; Mazurowski et al. 2009; Mazurowski, Białowarczuk, and

Januszek 2012). Diameter growth at Nemrik 9 ranged from 4.50–5.00 m in the oldest occupation phase to 7.50 m or more in the younger phases (Kozłowski 2002). In the Near East, apart from northern Mesopotamia, growth in size was usually paralleled by the internal division of houses into multi-roomed structures (Białowarczuk 2013: 126–138). Most of the examined houses are characterized by a full round plan, where the external wall of the dwelling closes its internal space completely [see *Fig. 1:a*]. Nevertheless, semi-open round-plan structures appear as well, although rarely. In this variant of a round house, the external wall has a gap in the circumference ensuring easy access inside [*Fig. 1:b*]. One of the oldest houses of this type was discovered at Zawi Chemi (Solecki 1980: 53). Other interesting examples include “house 3” from Wadi Tumbaq 1 (Abbès 2008: 5) or some of the oldest houses at Çayönü Tepeşi (Schirmer 1990; Özdoğan 1999).

### OVAL STRUCTURE

It is also the oldest and most simple type of structure [*Fig. 1:c*]. Its origin and development in the region was parallel to that of round structures and both forms appeared throughout the PPNA [see *Table 1*] and slightly beyond it.

Oval buildings differed regionally in size. The smallest ones are typical of settlements of the northern and central Levant, such as Tell Qaramel (Mazurowski 2004; 2005; 2007; 2008; 2010; Mazurowski et al. 2009; Mazurowski, Białowarczuk, and Januszek 2012), Jerf el-Ahmar (Stordeur 2000a; Stordeur and Abbès 2002), and Tell Aswad (Stordeur 2003). The average size of oval buildings reaches 2.80 m by 3.00 m. The largest

diversification in size characterizes the southern Levant and northern Mesopotamia. In the former region, oval structures ranged from 3 m by 4 m to 5–6 m by 10 m. Netiv Hagdud is a good example, where such large buildings were discovered (Bar-Yosef and Gopher 1997). Large houses are also known from Jericho (Kenyon 1981) and Hatoula (Lechevallier and Ronen 1989). A similar situation was recorded in northern Mesopotamia, where the size of oval structures was from 3.50 m by 2.70 m to 8 m by 7 m. Many interesting examples from this region come from M'lefaat (Kozłowski 1998). Just like the round houses, some oval ones were sometimes divided into multi-roomed units (Białowarczuk 2013: 126–138). However, oval structures from northern Mesopotamia remained consistently monocellular during the PPNA, in spite of their large size (Kozłowski 1998). In the case of oval structures, full and semi-open plan variants are typical as well [Fig. 1:d].

#### AGGLUTINATIVE STRUCTURE

This new type of structure merits special attention in the light of discoveries made at Jerf el-Ahmar (Stordeur, Helmer, and Willcox 1997; Stordeur, Brenet, and Yarta 2000; Stordeur et al. 2000; Stordeur and Abbès 2002; Stordeur 1999; 2000a; 2000b; 2015). Agglutinative houses are marked by an irregular plan consisting of two or more separate annexes connected into one multi-roomed unit [Fig. 1:e]. The irregularity of the plan is a basic feature, which distinguished this type of building from other multi-roomed forms. The most common conglomerate comprises one monocellular house, either round or oval in plan, furnished with one to three smaller extra annexes, which might be

round, semi-round, oval or semi-oval in plan. The total number of annexes led to size diversification among structures of this type, which could be from 3 m across to 5 m by 7 m.

Houses of this type apparently developed on a micro-regional scale. The presence of agglutinative houses is limited to a few sites in the Levant [see Table 1]. The most impressive ones were discovered at Tell Qaramel (Mazurowski 2004; 2005; 2007; 2008; 2010; Mazurowski et al. 2009; Mazurowski, Białowarczuk, and Januszek 2012) and Jerf el-Ahmar (Stordeur 1999; 2015; Stordeur and Abbès 2002). Some examples are known from Jericho as well (Kenyon 1981). Moreover, the chronology of these sites attests to a local development of this kind of buildings through the end of the PPNA, and their coexistence with other types of houses. Even so, there is no evidence so far of the idea circulating to neighboring sites. The archaeological data clearly suggest that this type of building was invented by connecting round and oval monocellular houses into different configurations. The process appears to stem from a specific spatial organization of the two settlements. At Jerf el-Ahmar small houses were concentrated around a central open space of limited size used for daily activities (Stordeur 1999). It is likely that during subsequent stages of development single small round structures started to be connected and finally evolved into agglutinative forms. A situation of this kind was observed at Tell Qaramel (Mazurowski, Białowarczuk, and Januszek 2012). Agglutinative structures on sites in the northern Levant can be referred to as intermediate forms between round and subrectangular houses. This process of evolution of the plan is especially well

evidenced in the architecture of Jerf el-Ahmar (Stordeur and Abbès 2002; Stordeur 2015).

#### SUBRECTANGULAR STRUCTURE

Another intermediate type of building, between round and rectangular structures, subrectangular structures are characterized by straight external walls with rounded corners [*Fig. 1:f*]. Unlike the previously described types, subrectangular forms appeared in the middle phase of the PPNA. The oldest examples come from horizon H3 at Tell Qaramel, dated to 9820–8710 BC (Mazurowski et al. 2009: 779). In the final phase of the PPNA, this type appeared at some other Levantine sites like Jerf el-Ahmar (Stordeur 1999; 2000a; 2015; Stordeur and Abbès 2002), Netiv Hagdud (Bar-Yosef and Gopher 1997) and Gilgal I (Noy 1989). These settlements existed simultaneously between 9300 and 8800 BC. In northern Mesopotamia the oldest known subrectangular house, dated to 9200–8600 BC, was discovered at Qermez Dere (Watkins 1995: 3 and *Fig. 2.3*). The development of such buildings is observed in this area much later, at the end of phase III at Nemrik 9, which is dated to about 8000 BC (Kozłowski and Kempisty 1990: 350, 358–359).

The size of subrectangular buildings is regionally diversified. The smallest are characteristic of the northern Levant and measure approximately 2.50 m by 3.00 m. The largest come from northern Mesopotamia, the dimensions there reaching 6 m by 7 m. More diversified dimensions are characteristic of the architecture in the southern Levant. The subrectangular houses discovered at Netiv Hagdud were approximately 2.50 m by

2.50 m (Bar-Yosef and Gopher 1997), which is close to the sizes of those from Jerf el-Ahmar, while at Gilgal I (Noy 1989: 13) they reach 5 m by 6 m, which nears the structures from northern Mesopotamia.

#### RECTANGULAR STRUCTURE

The plan of buildings of this type is perfectly rectangular with right-angled corners [*Fig. 1:g*]. From a chronological point of view, it is the youngest type of structure. Archaeological data points to its development between 9000 and 8600 BC, corresponding with the final PPNA and the transition phase to the EPPNB. Except for Çayönü Tepeşi in Southeast Anatolia, where the first “grill houses” (a specific kind of large multi-roomed rectangular houses with part of the stone foundation in the form of parallel walls) appeared about 8800 BC (Schirmer 1990; Özdoğan 1999), the rectangular plan at the time was limited territorially to the northern Levant [see *Table 1*]. The Middle Euphrates region is the best investigated in terms of the evolution of the rectangular plan. A parallel development of this type has been observed at Jerf el-Ahmar (Stordeur and Abbès 2002), Mureybet (Stordeur and Ibáñez 2008), and Cheikh Hassan (Cauvin 1978). Fragments of two, badly damaged, buildings of the same type are known from horizon H4 at Tell Qaramel, contemporary with the beginnings of settlement activity at Jerf el-Ahmar, and phases IIIA and IIIB at Mureybet (Mazurowski et al. 2009: 779).

In other regions of the Near East, rectangular houses appeared in the second half of the 9th and at the beginning of the 8th millennium BC. One of the



earliest examples is the plan of a sanctuary discovered in levels I and II at Nevalı Çori, which corresponds to the final PPNA in the Taurus region (Hauptmann 1999: 74–78). It is also contemporary with the development of “grill houses” at Çayönü Tepeşi (Schirmer 1990; Özdoğan 1999).

Rectangular structures are strongly diversified in terms of dimensions, due to internal division that formed multi-roomed units. Depending on the total number of rooms, the dimensions of rectangular houses ranged from 3.50 m by 3.50 m to 7 m by 12 m or even more.

## REGIONAL DIVERSIFICATION OF PLAN EVOLUTION IN THE EARLY NEOLITHIC

Developments of construction techniques progressed continually, but the evolution of some types of buildings in different regions of the Fertile Crescent proceeded at varying pace. The architecture of the Levant seems to be the most advanced in this case, especially in its northern part [see *Table 1*]. It was there that round monocellular structures started to be compounded into the two to four cells of agglutinative units.

Intensive modification of already existing architectural solutions led to the invention of the modular subrectangular plan in the second half of the 9th millennium BC. The first signs of this process could be observed at Tell Qaramel a few hundred years earlier. Numerous radiocarbon dates indicated permanent occupation of this settlement for about 3000 years, starting from the beginning of the 11th millennium BC (Mazurowski et al. 2009: Table 2). The best researched horizons H1–H4 reflect a comprehensive transformation of a new archaeological culture which had gone unrecognized in the area earlier and which could have been according to Ryszard F. Mazurowski one of the original centers of neolithization (Mazurowski et al. 2009: 779). The evolution of plan observed there shows a shift from basic round structures, typical

of the oldest occupational levels, through multi-roomed oval, agglutinative and subrectangular forms in the middle levels, to the rectangular plan in the youngest levels of occupation. The oldest example of a rectangular building is one of the sanctuaries, dated to 9820–8710 BC (horizon H3), with a large rectangular annex of “grill” type (Mazurowski 2004: 364–366; Mazurowski et al. 2009: 779). This discovery indicates that the introduction of the rectangular plan in early Neolithic architecture took place at Tell Qaramel much earlier than in the Middle Euphrates, where the oldest rectangular houses appeared at Mureybet and Cheikh Hassan at the end of phase IIIA, dated to 9500–8700 BC (Cauvin 1978: 36–44; Évin and Stordeur 2008: 24–32). Plan evolution was noted at both these sites at this time.

A new kind of round multi-roomed subterranean structure appeared at the same time as the older monocellular one, that is, at the beginning of this phase of occupation at Mureybet. Further development led to the appearance of the first multi-roomed rectangular houses at the turn of phase IIIA (Stordeur and Ibáñez 2008: 62–89).

The Neolithic village of Jerf el-Ahmar is the best example of the evolution of the



rectangular plan in the Middle Euphrates region. About 60 houses discovered there belong to successive levels of occupation, representing all types of structures known at that time in the Levant. The time span of this settlement is contemporary with phase IIIA at Mureybet. It was located on two natural hills. The eastern hill was inhabited first and is more interesting because of this. Nine levels of occupation were discovered there. The four oldest levels consisted of round houses only. Levels III and II featured irregular multi-roomed structures demonstrating the first efforts made to straighten the walls. Rectangular houses appeared, and coexisted with all older types of structures, in the youngest levels (Stordeur 1999; 2000a; 2015).

The architecture of central and southern Levantine sites is not so strongly diversified. Basic round and oval, mostly monocellular, structures are the most popular there. Rare examples of subrectangular houses were discovered at Gilgal and Netiv Hagdud. The former was inhabited about 9300–9000 BC (Noy, Schuldenrein, and Tchernov 1980: 68). Two houses discovered there featured an irregular plan. House 10 was irregularly oval, while house 11 subrectangular (Noy 1989: 12–13). Both seem to represent an intermediate phase of plan evolution. In the case of Netiv Hagdud, which is slightly younger, only two of

the round and oval houses may suggest some attempts at straightening the curved walls. In locus 8, the two longer external walls were roughly straight, while the others were still curved. The second one, locus 40, was irregularly oval with one rectilinear wall (Bar-Yosef and Gopher 1997: 55–60).

A different pattern of architectural evolution characterizes the Taurus region. Until the end of the PPNA, only round and oval monocellular houses were built. About 8800 BC, at the end of the PPNA and the beginning of the EPPNB, the first “grill houses” appeared in Çayönü Tepeşi. This particular variant of rectangular structure is interpreted as an architectural adjustment to a humid climate (Özdoğan 1999: 43).

Northern Mesopotamia looks conservative in comparison with the other discussed regions of the Near East. Traditional round and oval houses, mostly subterranean or semi-subterranean, were constructed throughout the described period and survived, in some villages, to the end of the PPN. The first subrectangular houses started to appear at the end of phase III at Nemrik 9 (Kozłowski and Kempisty 1990: 350, 358). A strong tradition of constructing round houses survived locally until the end of the PPNC, with Tell Rihan III as an example (Tusa 1985).

## DISCUSSION

Morphological structure diversification from the beginning of the PPNA is proof of an incredibly high level of development of prehistoric architecture. However, the intensity of this development is clearly different across the Near East, raising

questions about the evolutionary process itself. The evolution is best visible in the northern Levant. Monocellular round houses evolved step by step into oval, then agglutinative and subrectangular multi-roomed, and finally modular rectangular

forms. This pattern of evolution has not been observed in the Taurus region and northern Mesopotamia. In the Taurus, a traditional type of round house, which functioned until the end of the PPNA, was followed directly by large rectangular, and technologically advanced, buildings of the "grill" kind without any intermediary types. The same can be said of northern Mesopotamia. Therefore, the issue looming large here is what factors determined such a regional differentiation. Individual dynamics constitute one possibility, with original structure development being initiated by regionally invented practical-technical solutions.

For the plan to be able to evolve, it was necessary first for the original round monocellular subterranean house to be invented. The oldest permanent structures of this type are characteristic of the Natufian period, during which the transition from nomadic to settled lifestyle began (Bar-Yosef and Valla 1991). The main factor influencing shape and dimensions of the oldest round houses was no doubt the experience of living in caves and primitive shelters, that were the only kind of dwellings known to the Paleolithic and Mesolithic hunter-gatherer societies.

Examples of Epipaleolithic caves indicate that the best living conditions were provided in areas characterized by soluble rocks subject to weathering, such as limestone, dolomite, chalk and gypsum. Water is responsible for carving numerous channels and chambers inside such rock, often multi-leveled and interconnected by passages. The entrance is usually from the top or side. Mountain slopes where karstification took place were a natural habitat for most hunter-gatherer communities. The adaptation

of caves for dwelling purposes was one of the most important factors of architecture development. Caves, as closed spaces, constituted an archetype of internal space at this time in prehistory. Living in them formed particular habits and patterns of space use. To the prehistoric mind, a dwelling should have been round and should have provided shelter from cold, rain and invaders; it did not need to be full of light or easily accessible (Tobolczyk 2000: 42–45). This archetype may have served as a prototype for the original subterranean dwellings.

In turn, shelters can be treated as 'laboratories' for testing various building materials and structures. The use and adaptation of natural resources available for housing purposes became a basic skill, acquired in the process of building primitive dwellings. Therefore, building shelters would have been of great importance for the development and technical advancement of PPNA. Each kind of material used for building stimulated experimenting in search of an optimal manner of exploitation. This led to the invention of more and more efficient construction techniques. As a result, the ergonomics of building materials were sufficient for people of the early Neolithic age to construct huge structures, and to deal with problems of span, insulation, durability, etc. Archaeological data confirm that many technical solutions, invented over the course of hundreds of thousands of years of shelter construction, were used in the first permanent houses built in the Near East at the beginning of the Neolithic. A shelter was quite likely a starting point for the oldest Neolithic houses (Tobolczyk 2000).

The first to develop were the original round houses. Two variants of the process

of architectural plan evolution in the given regions of the Near East have been identified in the course of an analysis of the archaeological evidence. The first one is a simple transformation from primitive shelters into open, free-standing durable forms. The other one involves the conversion of shelters into large round

subterranean houses. In both cases, efforts to enlarge the living space inside the shelter hindered by limitations arising from size and durability of construction materials, seem to have been the main driving force of the evolution (Białowarczuk 2013).

Six stages of round house development can be distinguished in the first variant [Fig. 2]. Stage I is a direct imitation of Epipaleolithic shelters. Light roofing is placed on a wooden frame. In this type of dwelling, the diameter length is limited by the span of wooden beams used for frame construction. For this reason, the oldest PPNA houses are characterized by small dimensions. Moreover, the slope of the conical roof further constricted the area where easy movement was possible [see Fig. 3:A].

Stage II is connected with the appearance of a more permanent variant of semi-subterranean round house roofed in the same way as above. Lowering the floor level by a few dozen centimeters extended the space of easy movement within the same diameter as well as same

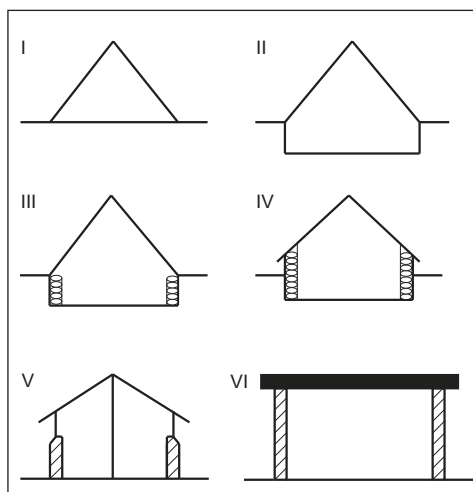


Fig. 2. Variant I of round-house plan development (After Białowarczuk 2013)

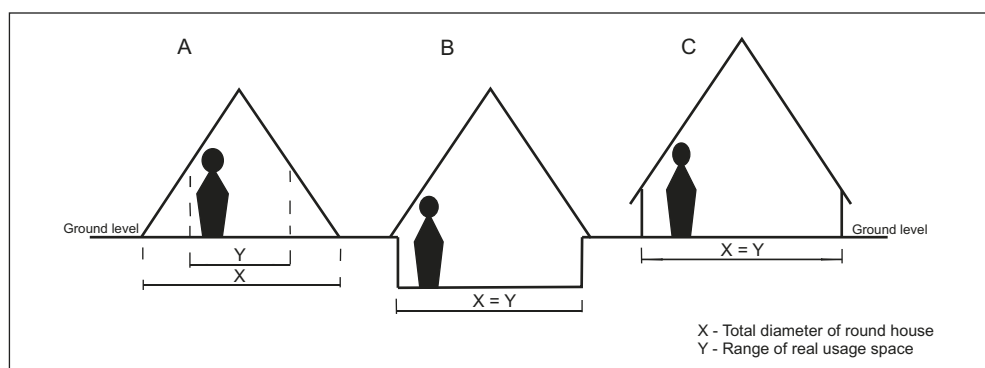


Fig. 3. Stages of the original type of round-house plan development and dependence between type of structure and internal usage space: A – shelters (usage space less than diameter of structure); B – semi-subterranean house (usage space same as dwelling diameter); C – free-standing house (usage space same as dwelling diameter) (Processing M. Białowarczuk)

size and roof construction [see *Fig. 3:B*]. The subterranean variant was inspired by an archetypal pattern of internal space. A sound geological base in many regions of the Near East, consisting mostly of alluvial deposits, made the building of such structures possible even without the need to construct stone revetment along the edges of dwelling pits. This kind of structure appeared for a short time and only episodically at the oldest levels of occupation, e.g., at Nemrik 9 (Kozłowski 2002) and Tell Qaramel (Mazurowski, Białowarczuk, and Januszek 2012).

Stage III is connected with modification of the semi-subterranean structures of stage II. It involved introduction of resistant walls inside dwelling pits. This solution could have been necessitated by seasonal rains damaging the edges of the pits. The technique of supporting walls with mud plaster, as attested at Qermez Dere (Watkins 1995), or more often with a drystone wall, was used to protect them against water erosion. The effects of this minor architectural modification were surely more durable and comfortable, which explains the short existence of structures belonging to stage II.

In stage IV, further improvements were introduced, mostly connected with the construction of higher walls. Depending on the needs, it could have been done either to enlarge the height of a house or to reduce the depth of the pit [see *Fig. 3:C*]. Development of such structures is observed from the beginning of the PPNA and is contemporary with the modification of construction techniques, especially the introduction of mortar.

Stage V is connected with the development of the first free-standing houses built on ground level. The most characteristic

elements of these structures are durable walls made by means of advanced techniques, such as stone or *pisé*, and a superstructure made of wattle-and-daub or light organic materials. Due to the early chronology of these houses, spanning from the end of the 11th to the beginning of the 10th millennium BC, their forms seem to be strictly connected with the evolution of construction techniques. It may have been around that time that a technical problem emerged, that is, matching wall durability to the weight and span of a roof supported on these walls. Pressure, exerted especially by sloped roofs could damage the upper parts of mud or stone walls. Thus, any modification of *pisé*, such as, for example, the framework or lime-mass technique, known from Tell Qaramel (Mazurowski, Białowarczuk, and Januszek 2012: 36–38), can be in fact seen as an attempt at increasing the durability of the walls. The use of joint techniques, with lightweight materials and superstructures, seems to be another solution to this problem. Archaeological data suggest, in most cases, that such superstructures were supported on solid wooden poles fitted into the construction of the lower parts of the walls, which simultaneously functioned as a roof-support system and frame for the wall superstructure. There are many examples of such a technical solution in the EPPNA architecture in the Near East. At Nahal Oren, for example, all houses discovered in level II had the lower parts of their walls made of stones to a height of about 0.80 m, while their superstructures were built of lightweight organic materials supported on wooden poles (Stekelis and Yizraely 1963: 4–6). Locus 40/K7 at Tell Qaramel is a classic example. The lower parts of its walls were made of *pisé* and

preserved to a height of 0.40 m. Seven, regularly spaced, postholes were discovered along its external face. Some of them left impressions in the external face of the wall, which indicates that they were fitted into the construction of the *pisé* wall, and probably beyond it, constituting the frame of the superstructure and the roof-support system (Mazurowski 2005: 501–502; Mazurowski, Białowarczuk, and Januszek 2012).

Stage VI is characterized by the appearance of free-standing houses built on ground level, with walls made by means of uniform techniques. The development of these houses is also connected with further evolution of construction techniques. Enlargement of *pisé* walls as well as the introduction of modified stone walls, such as the double-row or core techniques (Białowarczuk 2010: 587–589), increased wall durability, and solved the technical problem described above.

The second variant includes five stages of evolution of the round monocellular houses [Fig. 4]. It starts from the same type of simple shelter as in the first variant. The subsequent forms, up to stage IV, are also the same. The main difference in this variant of evolution comes at stage V. Houses were still semi-subterranean [see Fig. 4:Va] or subterranean [see Fig. 4:Vb] but their construction was strengthened and covered with a flat or slightly sloped roof. The increased diameter of these houses created the same problems with roof span and weight as in the first variant (see Kozłowski and Kempisty 1990: 355). The problem was solved by introducing internal divisions and exploiting inner walls for support as, for example, in the multifunctional public buildings from Jerf el-Ahmar (Stordeur et al. 2000). Roof-

-support systems consisting of 2–4 or more pillars or poles, arranged in a particular geometric pattern, were another way to meet these challenges. This solution seems to be dominant in northern Mesopotamia, where it is known from almost all houses at Nemrik 9 (Kozłowski 2002) and other major villages, such as M'lefaat (Kozłowski 1998) and Qermez Dere (Watkins 1990; 1995). It is also present in the Levant and some of the oldest PPNA villages of the Taurus region. Certain of the special public buildings from Jerf el-Ahmar (Stordeur et al. 2000) and Tell 'Abr 3 (Yartah 2005) can be cited as examples.

The first variant characterizes the northern Levant, whereas the second one is associated with northern Mesopotamia, the Taurus Mountains and the southern Levant. Both feature specific traits and determine further development of the plan. From this point of view, the first variant seems to have carried more weight, being

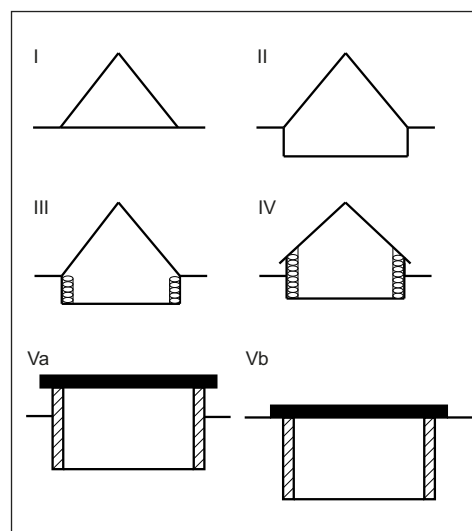


Fig. 4. Variant II of round-house plan development (After Białowarczuk 2013)

in fact the most direct route to inventing a rectangular plan. As a result of enlarging internal space in subterranean houses, freestanding structures soon emerged, quickly generating further consequences because this kind of building favors the development of intermediate forms, such as agglutinative houses. As said above, enlargement of a round house required new technical solutions to deal with the significant technical difficulty of roof weight and span. Agglutinative buildings enabled the expansion of usable floor area, exploiting the same construction techniques and technical solutions as applied in monocellular round houses. In other words, combining two or more small monocellular freestanding buildings into one agglutinative architectural unit led to the enlargement of households without the necessity of modifying building materials and construction techniques. In addition, this introduced a very important new element of architecture diversification, that is, functional division of internal space, which might have been the main reason for agglutinative houses to have developed in the first place.

The next step in the evolution of the plan was the straightening of curving walls and the appearance of subrectangular and finally rectangular houses. This gradual transformation to regular modular geometric forms seems to have been the final stage of intensive efforts to enlarge usable floor area and to exploit it in the most effective way. This pattern of evolution is typical of northern Levant architecture, starting from the oldest architecture of Tell Qaramel and continuing into the Middle Euphrates.

Evolution of the plan in northern Mesopotamia emerges as an entirely

different picture. The second variant is present here. Nemrik 9 is one of the oldest settlements where the process could be observed (Kozłowski and Kempisty 1990; Kozłowski 2002). After a short phase of primitive round semi-subterranean huts, roofed with lightweight organic materials, subterranean flat-roofed structures became dominant. Freestanding buildings were extremely rare and their small sizes excluded their dwelling function. This variant is observed to have continued until the end of the 9th millennium BC. Unlike variant I, the high representation of subterranean structures was not favorable for the development of agglutinative forms and, as a consequence, for multi-roomed rectangular ones, too. Nevertheless, the enlargement of monocellular building and well-planned multifunctional use of internal space characterized the area (see Kozłowski 2002). In most cases, the same principle is applied: four massive pillars in symmetrical arrangement, dividing a single room into a number of functional zones.

The same tradition of round subterranean houses is also observed in the Taurus region. Such forms are evidenced in the archaeological record from the 10th and the first half of the 9th millennium BC. Examples from Hallan Çemi and Körtek Tepe show that such structures continued to be built in these villages for a few hundred years (Rosenberg and Davis 1992; Rosenberg 1994; 1999; Rosenberg et al. 1995; 1998; Özkaya 2009; Özkaya and Coşkun 2011; Benz et al. 2011). The first forms, with vestibules, appeared at Hallan Çemi during the youngest occupation phase (Rosenberg et al. 1998: 28). Round and oval monocellular subterranean structures are characteristic of the oldest levels at Çayönü Tepesi (Özdoğan 1999).



The round-house horizon there is dated to the end of the 11th and the beginning of the 10th millennium BP, which corresponds to the end of the 10th and the first half of the 9th millennium BC calibrated (see Stordeur and Abbès 2002: Table 3). The oldest rectangular “grill houses” at this site are dated to the period between 9400 and 9200 BP and correspond to the final PPNA in Anatolia (Özdoğan 1999: 41). All these facts indicate that round subterranean houses

dominated in this area until the middle 9th millennium BC or even slightly later.

Central and southern Levantine sites do not display a huge diversification of architectural plan. Traditional round and oval monocellular subterranean structures are dominant there. As said above, rare attempts at straightening the walls were observed in a few houses at Gilgal I (Noy 1989: 12–13) and Netiv Hagdud (Bar-Yosef and Gopher 1997: 55–60).

## SUMMARY

The first variant of original round structure development, as exemplified by the archaeological evidence, seems to have been especially favorable for the evolution of the plan and typological diversification of the architecture. The archaeological record points to the northern Levant as a cradle of architecture. The process of evolution of the architectural plan took place there earlier than elsewhere and was the most intensive. Development of the rectangular plan in other regions of the Near East was much more recent and took place during the second half of the 9th and the first half of the 8th millennium BC. Rare examples of agglutinative and subrectangular forms at some southern Levantine and northern Mesopotamian sites could be the outcome of modifications of the traditional round dwellings or of cultural contacts and diffusion of some new technological ideas along the Euphrates river or the

“Levantine Corridor”, linking the northern and southern Levant (Simmons 2010: 33–34). Therefore, the appearance of some subrectangular forms at the end of the PPNA at Gilgal I (Noy, Schuldenrein, and Tchernov 1980; Noy 1989) and Netiv Hagdud (Bar-Yosef and Gopher 1997) in the southern Levant is hardly accidental. The situation is similar at Qermez Dere (Watkins 1995), the westernmost PPNA village of northern Mesopotamia. In the Taurus, however, it is different, the oldest rectangular houses appearing in the final phase of the PPNA dated to the second half of the 9th millennium BC, corresponding with the EPPNB in the northern Levant (see Stordeur and Abbès 2002: Table 1). Its late chronology and specific form (“grill houses”) indicate that diffusion of new ideas involved solely the rectangular plan, construction being subject to local environmental conditions.

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