CHAPTER 5 BUILT TO BE BURNT: THE BUILDING AND COMBUSTION OF CHALCOLITHIC DWELLINGS IN THE LOWER DANUBE AND THE EASTERN CARPATHIAN AREAS

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INTRODUCTION

The burning of the Balkan-East Carpathian Chalcolithic buildings is an archaeological subject more and more approached in modern literature (Tringham 1992, 1994; Tringham and Krstiæ1990; Stevanoviæ1997, 2002; Chapman 1999; Gheorghiu 2005b), but despite this rich literature there are not yet credible models created to explain the process of combustion of wattle and daub dwellings. Experimental archaeology was used to explain the process of firing prehistoric houses (see Coles 1973), but not for those made of wattle and daub, except for the partial experiment of firing a peasant house by Bankoff and Winter (1979).

The prehistoric material culture of South-Eastern Europe, particularly the ceramic objects, is characterized by an antagonistic cyclical principle of construction and deconstruction (Gheorghiu 2001), i.e., the *chaines opératoires* of construction incorporated the deconstruction of objects, to cite only the ceramic figurines, which incorporated the method of deconstruction (Gheorghiu 2005a *in press*; Gheorghiu *et al*., *forthcoming*).

In this perspective the current paper tries to demonstrate an existing relationship between the method of construction of wattle and daub houses and their deconstruction by firing. The main goal of my exposition will not be to offer an explanation for the process of deconstruction, but to focus on some problems of pyrotechnology in the process of combustion of houses by means of experimental archaeology. This is the most adequate instrument used to understand the cyclical process of construction-deconstruction, a complex technological process which cannot be understood only by analysing the archaeological record.

THE DIVERSITY OF PREHISTORIC ARCHITECTURE

When analysing the prehistoric architecture of the area discussed, one can notice a similar process of evolution in time from simple semi-subterranean houses to surface houses with wooden and clay platforms. The semi-subterranean houses left round or oval cavities in the soil and no traces of wooden structure; the experiments (2004) of reconstructing them revealed the fact that the roof's beams could be thrust directly into the walls of the cavity without leaving any archaeological trace in the soil, since the oblique voids (that resulted after the firing or the removal of the wooden structure) were pressed by the weight of the soil. The vertical posts could have been positioned on small wooden planks which also leave no traces in the archaeological record.

Since the Early and Middle Neolithic in the Lower Danube area are perceived as having been epochs with a high population dynamic due to the thin layers of occupation (Andreescu *et al*. 2002 : 44 ff), it is possible that the wooden material was easily recuperated, as experiments revealed (2004-5).

The emergence of surface architecture is attested in the Lower Danube area as early as the Boian-Giule°ti phase (Neagu 2001) which can be interpreted as an index of a developing sedentism as well as of social difference, and subsequently of an emerging stratified society.

The of the wattle and daub surface houses still offer subjects for discussion; there is no convincing explanation for the foundation trenches, or for thearchitectural structure above the ground. For instance, the method of fixing the wooden structure into the soil, causes some to believe that only a few houses were two-storied, the shape of the roof was never put into question, and the functioning of the heating system inside houses was not at all imagined. As for the firing of this architectural object, there are many hypotheses which will be discussed later. This is why I decided to study the processes of construction-deconstruction in full scale, to be able to observe relevant details.

One of the experiments I carried out (August 2003) consisted of building a *megaron*-house of 6 X 3.5 meters (House 1), with a wooden platform, an internal pillar sustaining the main longitudinal cross-beam, a clay bench, an oven and a grinding place, using as a main model the plan of a house from Radovanu tell (building E, level II, Com°a 1990: 89) (south of Romania, near the river Arge°, a tributary of the Danube), dated to early Gumelnia (Pandrea 2000).

Figure 1. *The foundation trenches of a Chalcolithic house (Vadastra, 2004)*[1].

Another experiment (August 2005) was to build a long house of 8 X 4 meters (House 4), with a wooden platform, an internal pillar and an oven, using several plans of Cucuteni houses (Ursulescu 2002; 2003; Petrescu-Dîmboviţa and Valeanu 2004: 56; 59; 60; 62; 72; as well as clay models from the Voroshilovka clay model (Gusev 1995).

The archaeological architectural remains accessible in Gumelniţa- Karanovo VI and Cucuteni-Tripolye traditions that were used for the house reconstructions were the following:

1. Rectangular plans of houses, with wood platforms (Todorova 1982; Marinescu-Bîlcu *et al.* 1997; Ursulescu 2003: 9, fig. 1);

2. Foundation trenches with post holes (Todorova 1982: 81, fig. 41; Popovici and Railland 1996: 24; Marinescu-Bîlcu *et al.* 1997: 68; Ursulescu *et al.* 2002:16);

3. Post holes of variable dimensions as evidence for main and secondary posts (Ursulescu *et al.* 2003:7; Ursulescu *et al.*2002:15 ff; Marinescu-Bîlcu *et al.* 1996-1998: 95; Todorova 1982:23-32, figs.13-22); these features are always present in foundation trenches;

4. Evidence for pointed posts (Ursulescu *et al.* 2003: 16; Todorova 1982: 81, fig. 42), inferring the thrusting into the soil by pressure or rotation;

5. Wattle and daub fragments of walls and ceilings as evidence for a building technique with the wood structure hidden in the wall material;

7. Various techniques of construction in the same building (Pandrea *et al.* 1999: 147);

8. Wooden platforms made of split wood (Comºa 1990: 88, fig. 47; Todorova 1982: 153, figs. 96 and 97; for Stoicani-Aldeni regional aspect see Dragomir 1983: 27) or layers of branches and leaves with plaited twigs and reed bunches (Marinescu-Bîlcu 1974: 25);

9. Post holes at a certain distance from the walls (see Comºa 1990: 87, fig. 46; Todorova 1982: 23-32, figs.13-22), as evidence for a wattle and daub building technique with visible plastered and painted wood structure in the form of interior "columns" (Dumitrescu 1986);

10. Imprints of vegetal cords for bonding wooden structures (Comºa 1990: 84, figs. 44a and b);

11. Interior architectural features as fixed pyroinstruments (ovens or fireplaces), concave spaces for grinding andclay benches (Comºa 1990: 86; Todorova 1982: 118, fig. 70);

12. Overlapped layers of fine finishing on walls or ovens (Haita 2003: 82 ff);

13. Paintings on exterior and interior walls with red pigment (Comºa 1990: 81);

14. Architectural clay models representing houses (Todorova 1982: 40, fig. 24; Gusev 1995; Bem 2002:190ff) and group of houses forming settlements (Gheorghiu 2002: 103; Gheorghiu 2005b).

Although the reconstructed houses employed all the features mentioned, the present paper, due to space restrictions, will discuss the experiments of replicating and firing of only a part of the features cited.

All the architectural traces (as post holes, foundation trenches, clay imprints of wattle and cords, etc.) were translated into possible architectural structures (determined by the limits of the materials used and the principle of efficiency), then modeled after the proportions of the prehistoric art representations (i.e., the architectural clay models) and finally transferred into a full scale architectural model.

THE BUILDING PROCESS

The foundation trenches

The first stage in the process of replicating the Chalcolithic house was the digging of "U" shaped foundation trenches (0.40 m deep and 0.40 m wide), (**Figure 1**) architectural features

[1]Dragos Gheorghiu is the author and copyholder of all photos in this article.

Figure 2. *Plaiting the wattle around the posts fixed in the foundation trenches (Vadastra, 2004).*

whose role seems to have been primarily symbolical: to separate the interior space from the exterior, in an analogous way as the perimeter ditch separated the tell settlement from the neighbouring environment (see Bem 2001).

I believe that houses with perimeter foundations were an adaptation to the weak riverine and lacustrine soils, as well as to the weak compressed soils of the tell settlements that resulted from many overlapped demolished buildings, in order to build massive large buildings.

One functional role of the foundation trenches discovered through experimentation could have been the following: the walls of the channel could have acted as a sort of a mould/ shutter to fix the base of the posts and twigs already thrust in the trench with wet pressed soil. Another role would have been to collect water during the course of the building process and in this way to make easy the thrust of the post into the wet soil; a trench filled with water by the builders or by rain facilitates the easy rotational thrust of the posts into the soil, as experiments and ethnographic evidence from the Lower Danube region demonstrate.

Walls

The second stage was to erect the wooden structure of the walls. The basic architectural structure to sustain the roof, made of trunks of 15–20 cm diameter, was positioned at a distance of 1.5 m along the foundation trench perimeter; and a second one, made of trunks of 7–10 cm was added in the intervals left, to support the wattle plaiting.(**Figure 2**) Both kinds of posts, sharpened at one end, were thrust approx. 40 cm into the wet soil using a rhythmical movement of rotation. This technique is mentioned at the end of Boian and beginning of Gumelniţa tradition, as well as in Precucuteni, where it seems to have been a southern import (Ursulescu *et al.* 2003: 6). In the Eastern Carpathian area, in Cucuteni tradition, the use of foundation trenches and individual posts like in the Lower Danube area was recently demonstrated (Ursulescu *et al.* 2003: 7). When voids were not detected, the explanation was the use of wooden beams to support the vertical posts of the walls (Dumitrescu *et al.* 1954; Comºa 1990: 81), a current technique of building in the Carpathian area in historic times.

Wooden posts were used in the Balkans (Nikolov 1992) and Lower Danube areas (Berciu 1956, Comºa 1986) as well as in the Eastern Carpathian area (Ursulescu *et al.* 2002), where one can notice variability in time in the quantity of wood used in the same settlement (Ursulescu *et al.* 2003: 6). Differences in the quantity of wood used are observed between traditions too; so the Cucuteni houses employed more wood for the making of walls (see Ursulescu *et al.* 2002 : 17).

Looking at the plans of the Bulgarian Gumelniţa tells dug exhaustively, and on recent excavations on Cucuteni settlements (see the presence of pits in the centre of houses 7, 8, 9 at Isaiia, Ursulescu *et al.* 2003: 9, fig. 1), one can conclude that a great number of medium and large houses had an internal wooden structure made of posts positioned on the central axis of the dwellings in order to offer a larger aperture for the interior space (see Todorova 1982:13-22, figs. 23-32).

Moreover, a structure which suggests an emergence of the complexity of the spatial organization allowed a flexible design of the dwelt space by means of the partition of the room according to two axes of composition. An inner post of large dimensions (as at Radovanu building E, level II) positioned on the central axis could sustain two transversal beams of large size, expanding the width of the room, as well as two master beams, expanding the length of the same room. Moreover a large post, positioned on the centre of the inner space could

Figure 3. *The central post of a house, plastered with clay (Vadastra, 2005).*

sustain a solid and heavy ceiling and attic made of large pieces of wood, allowing a secondary level of (temporary) dwelling. For experimentation I used a post of 20 cm in diameter and 5 m in length which was thrust on the central axis of the house, at 1.5 m distance from the wall facing the entrance.

A wooden structure positioned near the oven could have been protected against fire by a thick clay coating; in archaeological remains this is to be found as a void in the soil, as the ones found inside a building dated to Gumelnica phase A from Cascioarele island where the painted clay coatings of two large posts were discovered (Dumitrescu 1970). (**Figure 3**)

Ethnological examples (see Coiffier 1992: 53, fig.7) infer that one of the roles of a central or interior post arc could be symbolic and in relationship with social organization (Kus and Raharijaona 2000). It is possible that an analogous symbolism could have been applied in the Gumelnica tradition, in the perspective of Chalcolithic emergent social stratification (see Gheorghiu 2001a: 374 ff.).

Wattle and daub

The third stage was the construction of the wattle and daub walls, a technique specific for the European Neolithic according to Treuil (1983), but mentioned also at an earlier sub-phase at Çayönü (Perlès 2001: 197).

A wattle structure plaited between posts confers to walls an inner resistant core and allows the adherence of daub made of wet clay mixed with straws and chaff. This method required the throwing with force of clay balls of 1.5 – 2 kilograms on the wattle plaiting and wooden posts to fix the clay on the wood structure. (**Figure 4**) By plaiting the twigs around the posts thrust in the foundation trenches and by covering this structure with pressed clay the wall functioned from a mechanical perspective as a monolith structure, its mechanical role being to annihilate the lateral movement of the walls.

Wattle and daub technique demands a high compression of the walls, since the clay balls were thrown with force on the wooden structure for adherence, and the resultant wall surface is beaten to produce a homogeneous material similar to a *pisé* technique.

The main advantages of the composite material resulting from the mix of clay with straws and chaff is a good thermal isolation and a high thermal inertia, due to the empty spaces left in the material fabric by the vegetal fibres.

Water and construction

As experiments demonstrate, daub preparation was a laborious water consuming process involving a large group of individuals. For building and plastering a house of 6 x 3.5 x 2.50 m, a quantity of 5000 litres of water was used to mix 120 cubic meters of clay with 600 kg of straw. Such a large quantity of water created transportation difficulties since the source of water was not near the settlement. The excavated soil used for building the house created a large hole in the ground of 2.5 x 6 x 0.80 m. The clay used for the first level of settling came from the deep perimeter trench that surrounded the tell settlement. Reused clay from the demolished walls was used for the next levels of settling (Gheorghiu 2002).

The role of the trench around the tell-settlements could have functioned as a sort of symbolic separation between the

Figure 4. *Plastering the wattle structure of a wall (Vadastra, 2005).*

dwelt area and the outer world, as a *temenos*-sacred enclosure (Gheorghiu 2003: 42), but definitely not one of defence (Marinescu Bîlcu 1974: 20; Bem 2001); an additional function could have been as a water reservoir (Gheorghiu 2003: 43) to seasonally protect the settlement against fire by using the water collected from rain and melting snow.

Platform

In the Boian tradition surface houses with platforms with wooden structures are recorded in the final phase; they become common in the Gumelniţa tradition (see Todorova 1982: 153, figs. 96-7; Marinescu-Bîlcu *et al*. 1997: 67) all over the Balkans and the Lower Danube. A different technique is to be found in the Stoicani-Aldeni tradition, where platforms were built on a vegetal layer (Dragomir 1983 : 34).

In the Eastern Carpathian area, in Precucuteni tradition, some of the first surface buildings had simple platforms (Marinescu - Bîlcu 1974: 27) which became a current architectural feature as early as Cucuteni phase A (see Petrescu-Dîmboviţa *et al*. 1999 : 31 ff).

A technological trait common to all the mentioned traditions was the building of ovens directly on the ground floor, in order not to ignite the platform through heat transfer.

After the vertical structure of the walls was set up, a wooden platform made of split trunks was fixed within the perimeter delimited by the posts and then plastered with clay, creating a waterproof and fire protected structure. (**Figure 5**) A further role of the platform was the creation of a firm surface for dwelling, especially at the upper levels of the tell, to cover the numerous perforations produced by the posts of the lower levels of dwelling (for example at Ovcharovo, house no. 6 at level 3, which overlaps the foundation trenches of levels 1 and 2, had a wood platform to cover the perforated, and therefore weakened soil surface; see Todorova 1982: 194, figs.135; 137 and 196, fig. 139).

Roof

After finishing the platform, the next operation was the positioning of the beams forming the attic. All this architectural structure, as well as the cross-beam, was inspired from a clay model of a house from Ovcharovo, Bulgaria (see Todorova 1982: 41, fig. 25/1).

The wooden structure of the roof consisted of a main crossbeam made of two joined trunks which supported a number of rafters on each side of the roof.

Making the cross-beam from two joined pieces was the architectural structural solution inferred by the presence of the inner large post and also by the length of the house.

To affix a structure made of a large number of wood pieces, the carpenter joints were fastened with wooden nails. Unless absent from the archaeological record, the wooden nails, as shown by historical examples from the Carpathian-Danube area, were used as the simplest efficient technique to fix separate wood pieces.

An additional method of fastening the roof's structure was to bind the carpenter joints with the help of hemp cords (for the use of vegetal cords in ethnological examples see Coudart 1998: 62 ff).

The ceilings of the houses were made of plastered middle size trunks, as clay imprints from Bulgarian settlements

Figure 5. *Plastering the wood structure of a platform (Vadastra, 2005).*

demonstrate (A. Chohkadzhiev, *personal communication*) positioned on three transversal beams and therefore forming a solid structure that could support heavy loads, allowing the attic to be inhabited during the warm season. (**Figure 6**) In this perspec the few special "two-storey buildings" discovered in Gumelniţa and Cucuteni traditions could, in fact, be simple houses with inhabited attics. If the thin trunks were plastered completely, the crossbeams would have been visible, and probably were also plastered with a thin layer of clay to prevent an easy ignition.

Experiments demonstrated that a second role for the attic, after that of temporal residence, could have been that of food smoking during the cold season, since the thatched roof's permeability would produce an air draught which would evacuate the oven's smoke through the ceiling aperture/ opening, but would not allow the rain to go through the bunches of reeds. The smoking of the wooden structure produces in time a fireproofed material with similar properties as the clay coated one.

Finishing

In the end, the complete wooden structure of House 1, fastened by wood joints, wood nails and rope bonds, worked as a very flexible as well as robust structure. House 4 was affixed only with the help of wooden nails. When covered with clay, this flexible structure became rigid (**Figure 7**) and after the shrinking process the tensions in clay and ligneous material produced cracks along the main posts and beams, without weakening the robustness of the building.

Architectural structures needed periodical coatings because they were made up of two materials with different degrees of shrinkage that generated deep cracks between the vegetal structures and the mass of clay. The coating with clay mixed with dung and water would cover only the exterior surface of the fissures like a protective slip made of fine clay, fine chopped straws and organic matter.

Finally the overlapped coatings were covered with a thin red slip layer.

Similar to the walls, ovens and floors suffered repeated operations of coating, since they suffered from the erosion of daily use. Cyclical coating was a ritual action that was probably performed within renewal ceremonies.

Ovens

The system of heating consisted of a fixed oven and a multitude of movable pyro-objects, such as braziers and amber-protectors. Generally, the shape of the oven copies that of the building, being built in the form of a small house (see the model from Izvoarele, Gumelniţa A2, in Done 1997:250, fig. 3/6), whose lateral window aperture serves for up-draught and smoke evacuation. There is a functional relationship between the oven and the ceiling aperture for visiting the attic, the later having the role of aspiring the hot air and smoke produced by the oven, when the window is closed.

As archaeological evidence and clay models illustrate (see Todorova 1982: 40, ill. 24), the oven was customarily situated on the eastern wall, when the house was positioned on a North-South axis. Therefore, the oven (and the round window for smoke evacuation) was in a symbolic relationship with the light and heat of the sun, similar to the house.

Façades

The reconstruction of the façades of the houses was a difficult

Figure 6. *Plastering the wood structure of the ceiling (Vadastra, 2005).*

task. As one could see from the archaeological evidence mentioned before, solid archaeological data come from the plan, although there is little information about elevation. So I was compelled to make use of art representations from the same context and to put shape and proportion in relationship with the logic of wooden architecture.

The main source was the clay model from Cãscioarele island (Dumitrescu 1968) which I interpreted as representing a row of megarons (a representation of a settlement surrounded by a palisade) (Gheorghiu 2003 b: 41, fig 5.), followed by several architectural clay models from Sultana, Gumelniþa eponymous site, Spanþov, and Vladiceasca (see Done 1997: 248-251, figs. 1-4).

THE FIRING PROCESS

The intentional or accidental setting on fire of a house was definitely a rite of passage for the owners and the community, whose symbolism could be put in relationship with the cycles of the vegetation, or purification. Firing objects was a ritual for Neolithic populations; clay objects such as vases and figurines, household objects such as braziers, lamps, models of buildings, to cite a few categories, were the result of a technical ritual of the transformation of matter. Could the firing of the house be perceived as a similar ritual process?

Many hypotheses have been offered to explain the intentional destruction of houses. Dr. John Chapman (1999: 116 ff) identified nine criteria for defining a deliberate burning:

1. Selective firing of perimeter walls (Marinescu-Bîlcu *et al*. 1997: 66 ff);

2. Presence of "ignition points" which infer the origin of the generated fire (Stevanoviæ1997: 373);

3. The absence of burned areas between houses infers a separate firing for each house (Tringham *et al.* 1992: 382) ;

4. Temperatures reached at some points are too high for accidental fires (Tringham *et al.* 1992: 382; Stevanoviæ1997: 364 ff);

5. The different temperatures reached in different houses infer the setting on fire of each house in turn and not of the entire settlement (Russell 1997: 77; Stevanoviæ 1997: 364 ff);

6. The use of extra fuel to reach high temperatures (as supported by Bankoff and Winter's (1979) experiments);

7. Formalization of house interior layout prior to destruction;

8. The presence of ritual deposits in houses, i.e., the funerary ritual performed in houses (Raczky 1982-83), which could have had a symbolic significance like the burial of corpses. Examples from Gumelniþa–Karanovo VI– Kodzadermen: at Gumelniþa tell (Dumitrescu 1925: 38), Hotnitsa (Angelov 1961), Junatsite (Mazanova 1992: 258) or Dolnoslav tell (Raduncheva 1996) support this assertion;

9. The large amount of objects burnt infers a special accumulation of goods (Horvath 1987; Raduncheva 1996).

I agree with the hypothesis of deliberate destruction for symbolic reasons (Tringham and Krstiæ 1990; Tringham et al. 1992, Stevanoviæ 1997; Stevanoviæ 2002), which seems to be the closest to the Neolithic mentality, but not with all of the above-mentioned criteria.

Since South Eastern European Neolithic material culture is characterized by rites of construction-deconstruction (Gheorghiu 2001), such behaviour could explain the cyclical destruction of wattle and daub houses. A significant data in favour of this interpretation is the fired final layer of occupation on all the tell-settlements from the Lower Danube area,

Figure 7. *Fixing two beams with a wooden nail (Vadastra, 2005).*

belonging to the last phase of Gumelniţa tradition, which I interpret as being a collective symbolic decision after the abandonment of the area. At the same time I don't reject the hypothesis of the existence of accidental fires too, a reality in traditional societies (see Pyne 2001: 106). Some of the combustions generated by strong air turbulences could explain the very high temperatures that sometimes reached over 1000°C.

DESTRUCTION BY FIRE - A REVERSE PROCESS OF CONSTRUCTION

Experiments infer the idea that destruction by fire could have been an anthropic controlled phenomenon, as Bankoff and Winter's experiment (1979) tried to demonstrate, since the architectural object was fire protected by layers of fireproof clay. A recent catastrophe (May 2002) in the Village Museum of Bucharest offers additional arguments in favour of the above-mentioned hypothesis: during the burning of the museum, the traditional timber houses coated with clay were very well preserved, loosing only (part of) the roof structure. To conclude, to set a wattle and daub macro-object on fire a large quantity of fuel with high heat content is needed because the wood furniture and the textile and vegetal objects that equipped the interior would be insufficient for such a process.

Recent full scale experiments with replicas of Chalcolithic architecture showed the difficulty of firing wattle and daub objects (dwellings or palisades) unless a fuel with heat content (see Rehder 2000: 30) is introduced to increase the temperature and to start the ignition of the vegetal structure of the walls and ceiling, at the same time supported by a strong air-draught.

A prehistoric wattle and daub house could be perceived as a combustion box, with lateral (door and window(s)) and upper (the hole in the ceiling to visit the attic) apertures, where the air draught of the wind through the vegetal roof (covered with reed or thatched straws) creates an up-draught air current to feed the fire and carry the flames. Currently, due to the openings in the walls and ceiling, a moderate air-draught should have existed in each prehistoric house to eliminate the smoke of all the pyroinstruments in use. In order to enhance the firing process, some experimentalists have broken holes in the walls and roof (Tringham *et al.* 1992; Stevanoviæ 1997: 373) to improve the air-draught of the object.

Experiments demonstrate that the firing process could be accelerated when the coating protection of the walls is (partly) damaged.

The series of deep cracks along the main wooden structure and the series of superficial and profound cracks on the walls (which separated the clay balls used to build the walls), even coated with layers of clay mixed with dung, would have permitted the penetration of a high temperature fire up to the wooden structure and allow its ignition. Through heat transfer, during the first stage, the wattle and wood structure would begin to develop a process of anaerobic firing, acting as a pyro-frame inside the walls, and after consuming part of the resulting charcoal, a process of aerobic firing would take place. In case the combustion of the house was stopped at the first stage, the house should have been demolished for security reasons and the unburned wooden material recuperated.

The initiation of fire inside the walls could also have been produced from the ignition of coatings containing a high quantity of vegetal content and organic substances resulting from repeated coatings with dung mixed with clay. This

Figure 8. *The ceramic imprint of a post inside a fired wall (Vadastra, 2006).*

material can develop constant, relatively high combustion temperatures - over 700°C in small spaces (see Gheorghiu 2002a: 86). When the chopped vegetal material from dung, and the twigs used to fix the clay between the wooden posts are heated at a temperature of approx. 225°C without contact with air, a process of pyrolisis can develop which produces charcoal (Rehder 2000: 28).

After the partial ignition of the cellulose material of the wooden posts, a series of vertical and horizontal canals were generated inside the material of the walls. In case of a strong air-draught, the temperatures reached in these clay canals could go over 1000°C, changing the colour and the properties of the clay and producing a layer of (vitreous) slag on the inner surface of the clay tube. (**Figure 8**) Since the hardness of such fragments is higher than of the rest of the wall, they were better preserved in the archaeological record, and sometimes identified as "ignition points". Generally such objects break along the tube's length, which is their weakest line, resulting from their construction.

To neutralize the combustion of the main post, which could generate the weakening of the mechanical of the building followed by the collapse of the ceiling and roof, the wood was coated with a layer of clay, which, after the firing of the house, was preserved as a crust in the archaeological record (for example the "clay column" from Cãscioarele, see Dumitrescu 1970). The collapse of the main post would have had a special social symbolism.

The combustion of the wooden and vegetal components of the walls and the ceiling is therefore the second stage of the process of ignition of a wattle and daub house, a process which is possible only due to a fuel with high heat content and a good air-draught.

A third stage of the firing would have been the partial or total combustion of the roof, depending on the intensity of the fire and the degree of fireproofing of the beams (as demonstrated by the Museum of the Village fire in 2002). After the consumption of the roof, the mechanism of the walls would suffer major damage, since the walls would then be fixed only by the foundation trenches.

It seems that the starting of of fire inside the house was frequently (Marinescu-Bîlcu 1974: 29) followed by an action of implosion, with the walls being crashed inside the built perimeter, (**Figure 9**) over the platform, probably quenching the combustion. Another explanation for the quenching process would be the collapse of the ceiling and roof, which could pull down the walls or at least slope them over the bed of ambers, which would tend to protect the settlement against arson.

If the wooden material of the roof was retrieved (to be recycled) before the firing, the combustion process would become a low risk procedure in a very dense settlement (for the density in tells see Chapman 1989; 1990) with a high risk of arson.

After quenching, one can notice a slow rate of temperature rise over the platform due to the beginning of the combustion of the wooden material, which slowly turns to charcoal. During an interval of 5 hours, I measured a rise from 15°C up to 700°C between the clay surface of a platform and a wall that had tumbled down onto carbonized beams (Cucuteni 2004). The platforms seem to have been the best preserved parts of the buildings since they were not very disturbed while the walls were transformed into ceramics by the anaerobic combustion of the wooden planks or vegetal matter, (**Figure 10**) and by the quenched ambers.

Figure 9. *A collapsed wall inside the built perimeter (Vadastra, 2006).*

The fallen walls could not have been very well fired since their material changes into ceramics slowly after the quenching process by employing the heat emanated from the fire source. Experiments with surface kilns (2000) and small buildings fired (diameter 3 m, h = 2,30 m) (2004) demonstrate that clay walls in indirect contact with fire could change colour to look like ceramics in a couple of weeks. At the same time part of the material of the walls which was not in contact with fire or heat was left untransformed and could be washed by weathering or left in place to become invisible to the archaeo-logist.

Extinguishing the fire by quenching the walls on the platform produced a fracturing of the material, an action that created an informal mass of fragments when the material was not strongly leveled to form a strong base for another house. This operation of covering the ambers with clay fragments left a lot of space for air-draught, so if the operation took place during air turbulences, the temperature could rise very high, i.e., over 1000°C in several places, different from the "points of initial ignition". This fact was observed in several experiments. In the archaeological record, I have identified these small firing chambers at different houses at Radovanu, Hâr°ova and Cucuteni-Cetatuie. (**Figure 11**)

DISCUSSION OF THE CURRENT THEORIES

In the perspective of these full scale experiments, some of the current theories on the firing of wattle-and-daub shall be put into question:

- The perimeter walls could not be fired without a very large expense of energy (by placing the fuel outside the house's walls), so the example cited from Bordusani-Popina (Marinescu-Bîlcu *et al.* 1997: 66, cited in Chapman 1999: 117) is a special example of a house without platform used after being set on fire as a refuse deposit before the walls tumbled down;

- The "ignition points" are actually mini firing chambers where temperature rises due to a strong air-draught;

- The quenching of the walls on the platform protects the space between houses from fire;

- The high temperatures result from the intensity of the air draught, which cannot be controlled;

- The differences between temperatures in different houses are due to their positioning in the tell and the differences in the intensity of the air flow (see also Chapman 1999 : 117);

- For reaching very high temperatures a strong air flow in a narrow firing chamber is needed more than extra fuel.

FIRE, HOUSE AND RITUALITY: THE MESSAGE OF THE CERAMIC MODELS

A special relationship of the house with the fire could be discovered indirectly when studying the objects like braziers in connection with fire. In the Gumelnica tradition the symbols of the house or the tell are linked to the phenomenon of combustion (Gheorghiu 2005b); for instance at Cãscioarele tell a large ceramic brazier in the shape of a palisaded tell (Gheorghiu 2002: 103), whose air-draught perforations could correspond to the number of the houses of the settlement, offers for the viewer an image of the settlement with flames and smoke, which could have been the representation of a habitual reality.

At Sultana tell a house model with whose air-draught perforations, which could correspond also to the number of the houses of the settlement, displays the image of a house consumed by flames. (**Figure 12**)

A last argument in favour of a symbolism of combustion

Figure 10. *The excavated fired platform showing the wooden structure partly transformed into charcoal (Vadastra, 2007). The excavation was conducted by Dr. Fabio Cavulli, University of Trento.*

and dwellings are the clay models of ovens in the shape of houses from both the Gumelniţa and Cucuteni traditions.

All of the mentioned examples where the symbols of fire consumption of houses or tell are related to the rituality (and sacredness?) of the food making and daily heating infers the existence of a special attitude towards the firing of the house, perceived as sacrifice and therefore as a sacred action.

CONCLUSION: PYRO-POTLATCH AND ARCHITECTURE

One main conclusion of an experimental study of the houses set on fire was to validate the social changes occurring in the Lower Danube Chalcolithic societies through the study of the energy consumed to build a wattle and daub house. The large dimensions of the Chalcolithic surface houses compared with the Middle Neolithic semi-subterranean ones (the strength of the walls due to the foundation trenches, the thick posts and the plaited core of the walls made of twigs and poles, the waterproof wood platforms characteristic for surface buildings, the central pole that allowed a large opening of the interior space) were not possible without the joined effort of a relatively large group of people. This could be interpreted as evidence of an emergent social control and represent possible data in favour of an emergent social stratification (see Webster 1990) and the competitive spirit that characterizes the Danube-Balkan Chalcolithic.

The houses resulting from the experiments were quite robust structures which, without the occurrence of an external dramatic event such as an earthquake or flooding could have had a long lifespan without major repairs, which contradicts the archaeological reality, since the small number of re-plastering of floors, walls or ovens infer a relatively short utilization of the architectural objects. An explanation for this contradiction could have a social source. A short period of utilization of a robust building could be explained by means of social control, the surface Chalcolithic house being in this perspective not the result of a collective work of an egalitarian society, but of a controlled one, with emergent social stratification. Furthermore, in this perspective one can perceive the controlled destruction of buildings as a type of social competition (potlatch-like?), that included the intentional firing of houses followed by reconstruction on the same surface with a change of place in time for some buildings to have a firm soil for foundation (Gheorghiu 2002). Experiments demonstrate that the controlled deconstruction of the dwelling was included in its technology of construction.

An analysis of the fired material found in the archaeological record compared with the post-firing results from experiments brings into evidence the small quantity of material left in many cases. There are two alternatives to explain this: 1) part of the fired material fallen over the platform was taken away after the combustion, or 2) the material of the walls was not deeply transformed into ceramics, so it was not considered to belong to the house by excavators. The first hypothesis could lead to two interpretations: the material was taken to be recycled, or to be utilized in a ritual purpose (as the deposition in pits).

A fired wooden platform with or without compressed walls created a very firm waterproofed surface. Sometimes these overlapped ceramic deposits which represented a sort of imprint of the image of the house could include objects or even cremated human bodies, emphasizing the role of fixing memories through the firing process. After the collapse of the walls and their compression over the platform, the house lost its volume and became a two dimensional object, a layer of

Figure 11. *Fragment of a fired wall in situ (Radovanu tell, Boian tradition). One can see how the empty spaces of the fired wattle structure increased the air-draught and consequently the temperature producing slag (2008).*

memory, which contributed to the rise of the tell-settlement. Firing the house was a ritual analogous to the production of ceramic objects or the production of cooked food, as well as a sacred action to preserve and create identity.

I perceive the consuming of the house by fire followed by its transformation into a ceramic object used as a support for new dwellings as a symbolic process of construction of ancestors, the sacrificed house becoming an "ancestor" itself.

As the technology of building and the shape and function of some of the ceramic objects suggest, Chalcolithic societies developed a special relationship between dwelling and fire materialized in technologies and the shape and use of pyro-objects. If the combustion of the house would have had a negative connotation, it is improbable that such symbol would have been accepted as a quotidian object.

The high variety of symbolic-functional objects in relationship with fire as the braziers and models of ovens infer the possibility of the practice of a cult of fire in the Balkans-Lower Danube and the Eastern Carpathian area, which included the sacrifice of the house. In this perspective the phenomenon of the emergence of a stratified society in the area could be perceived in a relationship with that of the sacrifice of houses by fire, whose role could have been of social control in the manner of potlatches, with the additional role of creating a group history and a physical contribution to the development of the settlement.

A special case of combustion representing the burning of all the settlements from the Lower Danube area is recorded in the final phase of Gumelniþa tradition, an action followed by the migration of the entire population of the tells. The action of burning the network of settlements in a very large territory and the transfer of the inhabitants to other regions indicates an efficient social control as well as the symbolic uses of fire for social purposes as the sacrifice of the tells. At this final level of Gumelniþa tradition we have the absolute certitude of an intentional combustion of dwellings.

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***Figure 12**. A model of a fired house, probably functioning as a brazier (Sultana tell, Oltenita Museum).*

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