# BŘEZNO: EXPERIMENTS WITH BUILDING OLD SLAVIC HOUSES AND LIVING IN THEM

## BŘEZNO: POKUSY SE STAVBOU A OBÝVÁNÍM STAROSLOVANSKÝCH DOMŮ

## БРЖЕЗНО: ОПЫТЫ ПОСТРОЙКИ СТАРОСЛАВЯНСКИХ ДОМОВ И ПРОЖИВАНИЯ В НИХ

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*The Březno experiment is based on the results of long-term systematic excavations which laid bare house plans well-suited for further interpretation. It is conceived as a complex undertaking the backbone of which is represented by experimental erection of two Old Slavic dwelling structures. Building materials for which there is evidence from the Slavic period were employed and the whole task has been carried out by means of replicas of Old Slavic tools. The ultimate aims were to investigate the technical demands of building, the optimal number of labour hands, the period of time required, and the consumption of material. The building experiment was followed by the investigation of problems of heating the houses in winter conditions. Another experiment involved living in an Old Slavic house. This was done in order to see how the space of the building could have been exploited for work and rest of a small family the existence of which is assumed for the Slavic period (that is c. 6th—9th century A. D.). This involved the imitation of ancient activities carried out in the house that would be as close as possible to the original behaviour patterns. The fundamental component of these was represented by food preparation, including making of fire, corn-grinding, cooking, and baking. The evidence gathered during the experiment permits us to envisage the daily routine of peasants living in Old Slavic villages and some parts of it are applicable to the prehistoric period in general. It may also be helpful for explanations of certain find contexts observed during archaeological investigations.*

The last decades have seen a marked increase of archaeological interest in investigations of village settlements. A number of large-scale investigations which brought to light substantial segments of villages or, in some cases, even complete settlement plans are available for a number of prehistoric and early historic periods. Evaluation of the results obtained frequently focus on mobile objects — mostly pottery —, while questions pertaining to the settlement proper, such as the function of individual features, their life periods, or the structure of settlement receive a rather marginal attention. The causes of this are inherent to the character of archaeological sources the information value of which is limited both generally and locally (in some regions, no wooden building components are preserved, even on the foundation level;) furthermore, the recent trend of the research to multiply constantly our source base in an extensive fashion leaves little time for a more profound analysis of the general situation and for studies of the structures of sites. In addition to this, details connected closely with questions of importance for studying prehistoric villages and their life are not treated with sufficient attention. I am now thinking of reconstructions of structures which may throw light on their function, their life periods, and so on. Some excavations have yielded evidence allowing not only the usual reconstructions which may be best termed static — may this represent a description drawing, model, or a life-size imitation — but even dynamic reconstruction including the whole building sequence. Such cases represent building experiments aiming at the evidence given both by the work procedures and by practical properties of the structure in question. This is, in my opinion, one of the possible methods of approach to fundamental questions of settlement in prehistoric and early historic conditions.

Conditions for putting these projects into practice were offered by long-term systematic excavations at the site of Březno by Louny which revealed several settlements — or fragments thereoff — datable to various prehistoric and early historic periods. There is no difficulty in identification of features and construction traces at the site of Březno, in consequence of which the investigations registered a number of house plans suitable for theoretical reconstructions of their construction and appearance. There was also a practical advantage at hand as we could choose a suitable building spot at Březno. The management of the State farm at Březno and the Cultural Section of the District National Committee at Louny were very helpful to us in this matter. In 1981, the Institute of Archaeology of the Czechoslovak Academy of Sciences at Prague initiated a building experiment for which an Early Slavic hut No. 5, excavated at Březno, was chosen; in the next two years, experimental building of another Slavic house No. 69 (of the 9th century A.D.) took place. In both cases the structures were of the same type as those the foundations of which had previously been laid bare at the site of Březno. Both of them belong to a characteristic type of Slavic dwellings with floors sunk below the ground level (*Pleinerová 1975*).

Before discussion of the experiment proper, a few words are necessary concerning its aim. The reconstructions were not undertaken with the sole purpose of providing an idea of how the shelters might once have looked like. Though having a cardinal importance, they were meaningful only in connection with other questions the solution of which represented the ultimate purpose of the experiment. Crucial issues followed were those of the technical skill required for erection of the ancient buildings, of the building time, optimal number of working hands, and material consumption. If these were to be investigated sensibly, we were obliged to use the same building materials, the same tools, and, if possible, the same work procedures as the builders of yore.

The foundation of the building experiment was a concrete ground plan with all its details and gaps. I emphasize this point as we could choose from two alternatives — either to build on a particular, excavated plan, or to depart from a plan corresponding to finds of Old Slavic dwelling structures and incorporating elements documented on various houses or even on various sites so that it would represent a generalized comprehensive type. Though the other alternative might seem more advantageous from the viewpoint of the completeness of the plan, we have not resorted to it as there is no guarantee that the individual elements could really turn up precisely in this combination.

The building experiment grew into a wider-range and long-term activity including: 1. the building phase, 2. the phase of heating the hut interior, and 3. the phase in which practical and dwelling properties of the house were tested.

## Building of houses

The building phase constituted a base for all our undertakings. It required a rather laborious preparatory stage both theoretical and practical. We had to evaluate the preserved remains and derive a most probable construction from these. In this direction, we benefited from the collaboration of Ing. Arch. J. Škabrada, CSc., of the SURPMO (State Institute for the Reconstruction of Ancient Towns and Structures), and, in the case of the first structure, of Dr. J. Vařeka, CSc., of the Ústav pro etnografii a folkloristiku (Institute for Ethnography and Folklore, Czechoslovak Academy of Sciences, Prague). According to the interpretation of building remains that won a common consent, Ing. Škabrada produced a drawn project for each of the reconstructions at the scale of 1 : 20. Though the reconstruction project represented our basic guideline, some adjustments took place in the course of its practical application. The extent of these was larger in the case of the second building, house No. 69. This may be observed in comparison of the drawn proposed reconstruction with photographic and drawn documentation of the structures actually erected and in the description of reconstruction and progress of the building. It was necessary to procure working tools that may have been used by the peasants of Old Slavic times. Out of a whole range of equipment, basic types of woodworking tools were selected. First and foremost, these included iron axes; we chose the narrower type most usual in the earlier period. In addition to this, adzes — i.e.

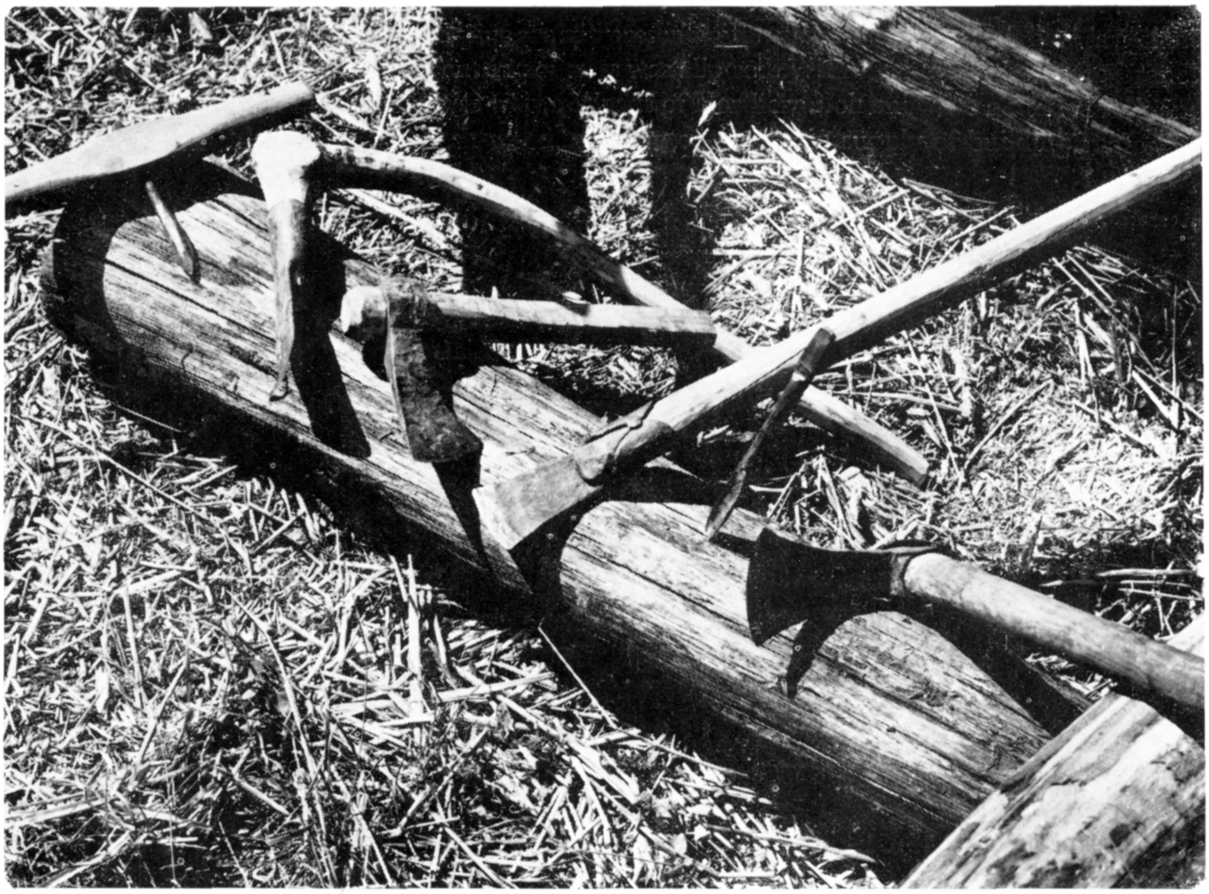

*Fig. 1.* Replicas of Slavic woodworking tools employed in building the Březno experimental houses.

axes with transversally placed cutting edges —, iron chisels, current in Europe since Hallstatt times, spoonshaped augers known since the La Tène period, and, finally, tools with lobes in their hind parts were employed. We decided not to use a saw as only small knife-shaped saws for bone-working are known from the Slavic period and there is no evidence for large wood-cutting saws. A series of the above-mentioned basic tools copying the original pieces in shapes, sizes, and weights (Fig. 1), not in production technology of the tools (that would have been outside the scope of the present undertaking) were manufactured for the purpose of the experiment. The usual steel used for the manufacture of present-day hoes and pickaxes was resorted to. Associate Professor R. Pleiner, DrSc., of the Institute of Archaeology (Czechoslovak Academy of Sciences, Prague) lent us a hand in the selection and design of working tools.

The other task of the preparatory stage was the procuring of the necessary building materials. For the earliest Slavic period, botanical identifications of wood remains (*Opravil 1975*, 15—17), both from other huts and from hut No. 5 itself, were at hand. The presence of maple, oak, pine, ash, and fir was ascertained. The features of the subsequent phase of Slavic settlement contained, in addition to the above-mentioned species, remains of beech, hornbeam, hazel, willow and poplar, rarely also of elm. While all of these trees m'ght have grown in close proximity of the site in the Early Slavic period, the fir represents an intrusive element. Its origins may be sought in higher-lying areas, most probably in the Krušné Hory (Ore Mountains), from where it might have migrated down along the Ohře (Eger) river as far as the present Březno region. Of the species suitable for building, only ash, willow, hazel and pine are still present in the vicinity of Březno. There is a small pine wood on the Březno hill but no cutting of trees was allowed. With the help of the Žatec branch of the Severočeské státní lesy enterprise (State Woods of Northern Bohemia) we obtained oak and beech trunks which, together with ash wood, constituted our main supply of building materials.

## Building of house No. 5 (6th century A. D.)

### 1. The situation as found

The plan of the hut constituted an irregular oblong with rounded corners (4.40—4.60 times 4.20 m) with the longer axis running W—E and sunk some 80 cm below the original surface. Within the sunken part, pits for large posts (43 and 47 cm deep) were observed at the centres of both end sides; another trace of a large post was found in the NW corner of the building. In some spots, small pits for pegs were observed close by the walls. A rectangular hearth paved with pebbles was situated in the NW corner (Fig. 2).

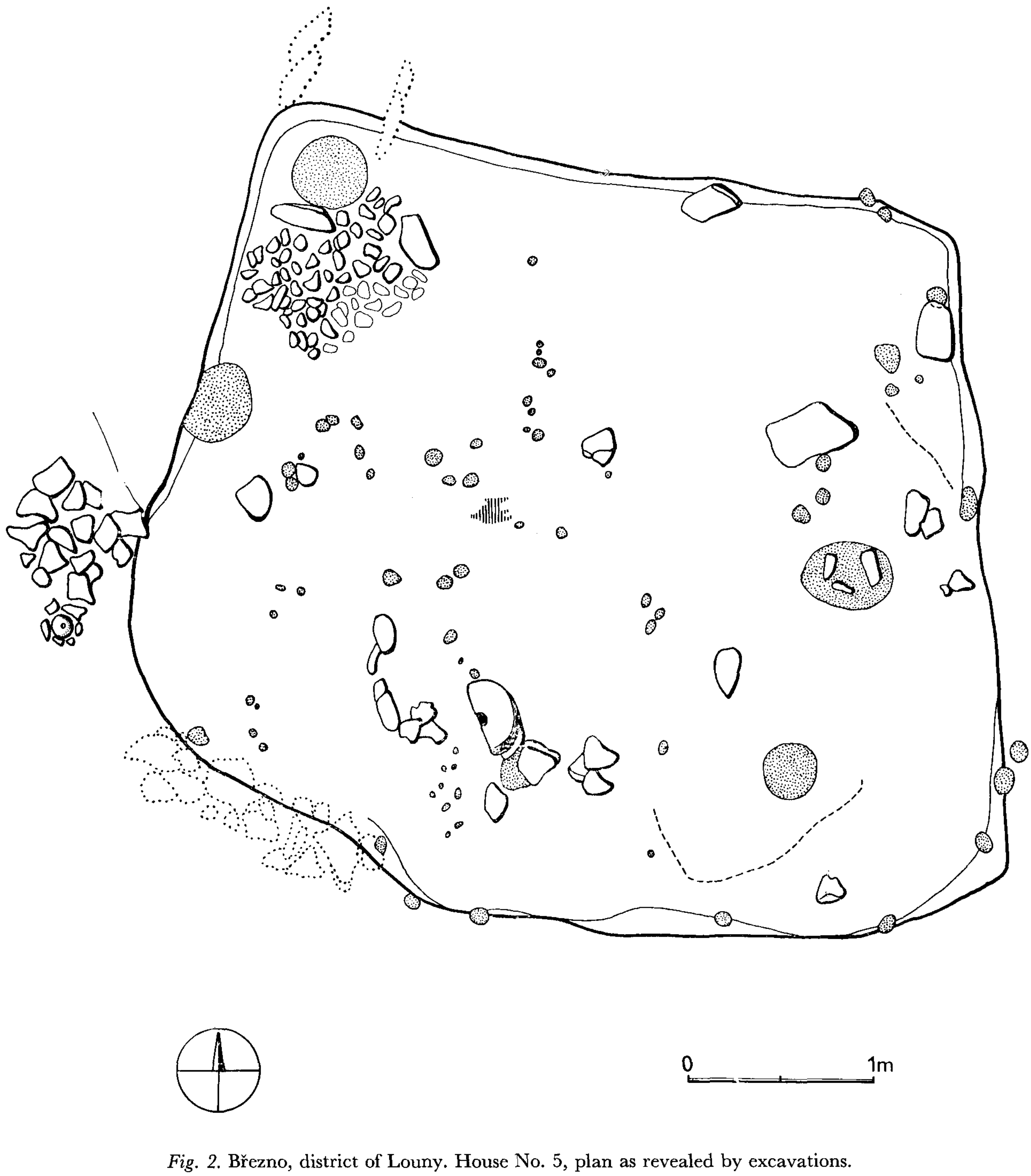


*Fig. 2.* Březno, district of Louny. House No. 5, plan as revealed by excavations.

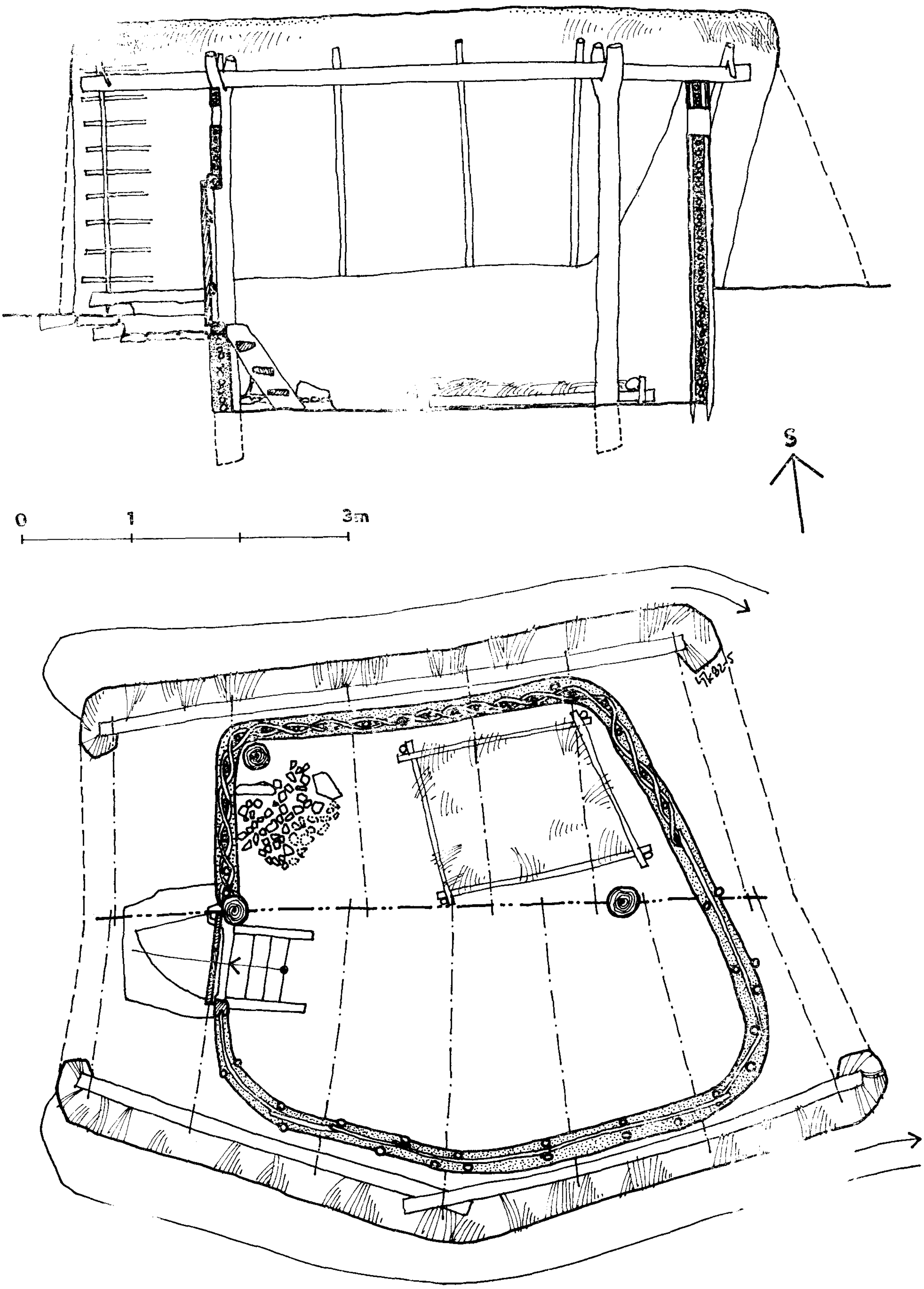


*Fig. 3.* Reconstruction project of house No. 5 before the experiment. Drawn by J. Škabrada.

## 2. Reconstruction

Two facts represented departure points for theories concerning construction. Both large posts along the oblong axis of the structure bear out the truss construction. Both supporting posts carried the ridge pole from which pairs of rafters were suspended giving thus birth to a double-slope gabled roof. In a preliminary outline we suggested a combination of gabled roof and hip-roof with a hip on the eastern side. The reason for this was the location of the eastern post at a distance of 70 cm from the wall, unlike the western ridge post which was leaning on the dug-out wall. Finally, however, we decided that due to the general irregularity of the ground-plan, this could have been an accidental and unintentional feature. *A. Pitterová* (*1970*, 135) quotes the ground plan of the Březno hut No. 5 as a typical example for a reconstruction with a gabled roof carried by suporting posts with a ridge pole. The other fact was represented by peg holes along the dug-out walls which might be interpreted as traces of anchor ng the wattle revetments of walls indicated also by slightly curving corners of the ground plan. Light walls of this kind were surely unable to support the weight of the roof the rafters of which had, in consequence of this, to lean on the earth (Fig. 3). A slight modification of the project in which the corbel beams closely followed the irregular outline of the dug-out southern wall of the feature resulted naturally from its practical application; this would have brought about curving of roof. In actual size, we kept a straight line of both the corbel beams and the southern slope of the roof. The irregularity of the foundation is an accidental factor which did not necessarily command an adaptation of the building construction. In fact, the Slavic builders found an Únětice-culture grave (Early Bronze age) in a stone cist at this spot. The height of the hut could have been estimated fairly safely on the base of the width of the dug-out foundations and the roof-slope angle of c. 40—45°, usual in our climatic conditions. Height from floor to the roof ridge could have amounted to 3 m, wall heights might have equalled some 1.45 m.

Of unclear purpose for the reconstruction was the large post in the NW corner behind the hearth which we were unable to interpret. A post for hanging up a kettle does not seem likely in view of its stoutness; it might have supported the roof as a part of a smoke-evacuation arrangement but its pratical solution seems to be rather problematic. Neither does it seem probable — in view of the archaeological situation — that this might have been an additional support. At this spot, another Únětice-culture grave in a stone cist was hit upon by builders of the hut; the frontal slab of the cist, protruding above the hut floor level, was left in position, obviously with the intention to separate the post from the fire.

Entrance to the house was at the centre of the W end wall. This is borne out by a slight hollow at that spot which indicated that the door could have been opening outside. On the outer side, the entrance was provided with a pavement of flat slabs of stone. All this was duly respected in the reconstruction.

## 3. Sequence of building activities

### *a) Preparation of wood, digging the foundations, tool kit employed and the time schedule*

Tree trunks transported to the building site had to be shortened to a manoeuvrable length oı 4—5 m (Fig. 4 : 1). Bark was peeled off the trunks as we assumed that a part of the material would not be put to immediate use but be left lying on the spot for some time instead. It fact, it was no necessary to skin the trunks systematically[1], as foliate trees are less prone to be attacked by insects than coniferous ones, but they may be endangered in this way after some time. We felled some ash trees on the spot, treating them in a similar manner. The next step was represented by excavation of the foundation, representing some 15 cubic metres of earth, and by sinking holes for posts exactly duplicating the original archaeological findings.

Narrow Slavic axes were used to fell and cut trees and to chop off the branches. A lobed tool with a straight handle (Fig. 4 : 2) did good service in peeling the bark off the trunks. It is reminis-

1. As pointed out by Mr. V. Štajnochr, Department of Ethnography, National Museum, Prague.

*Fig. 4.* 1 — trunks brought to the site, mostly oak and beech wood; 2 — peeling off the bark with a tool with lobes on the hind part.

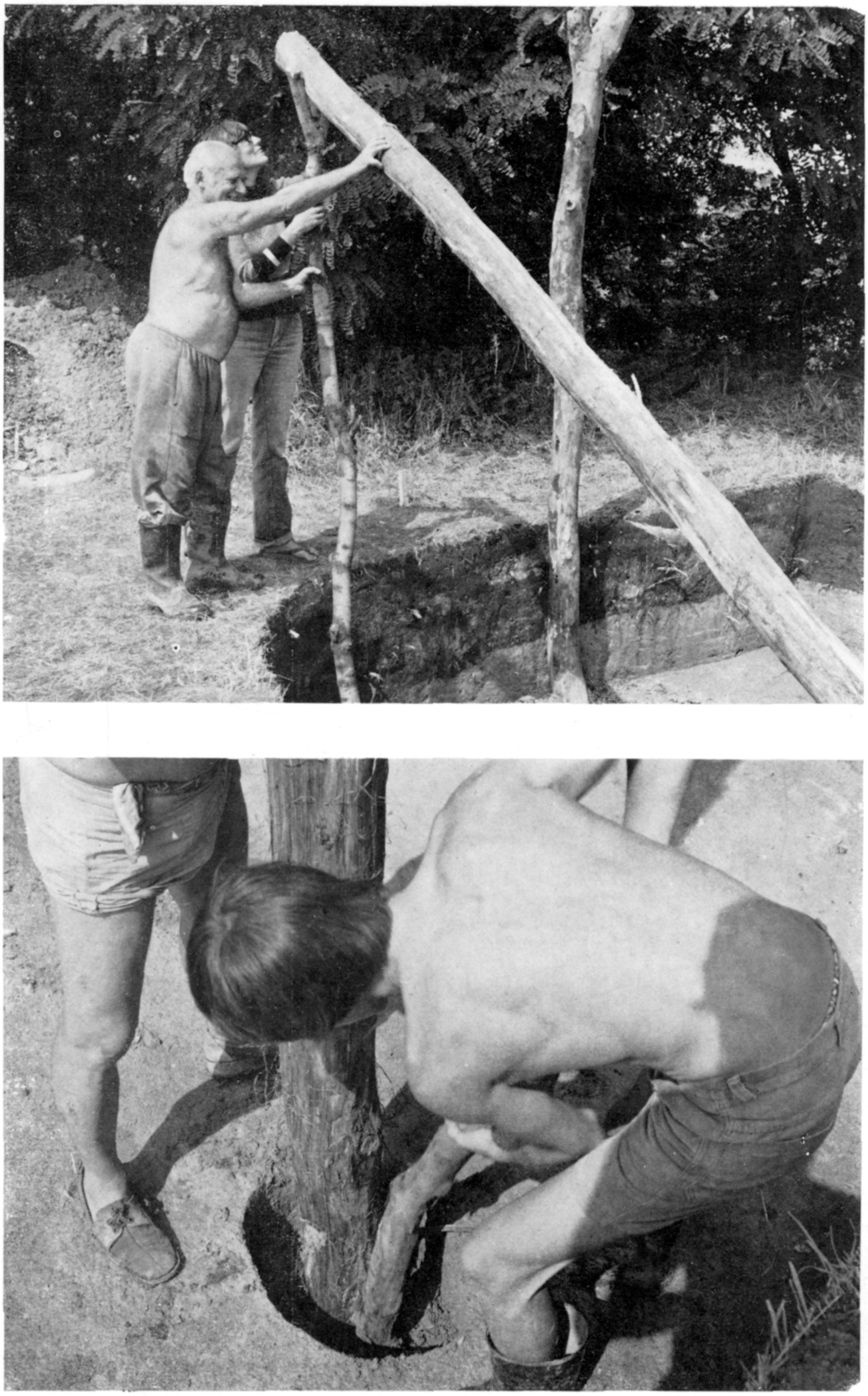

*Fig. 5.* House No. 5. 1 — positioning and erection of supporting posts; 2 — trampling earth around the E supporting post.

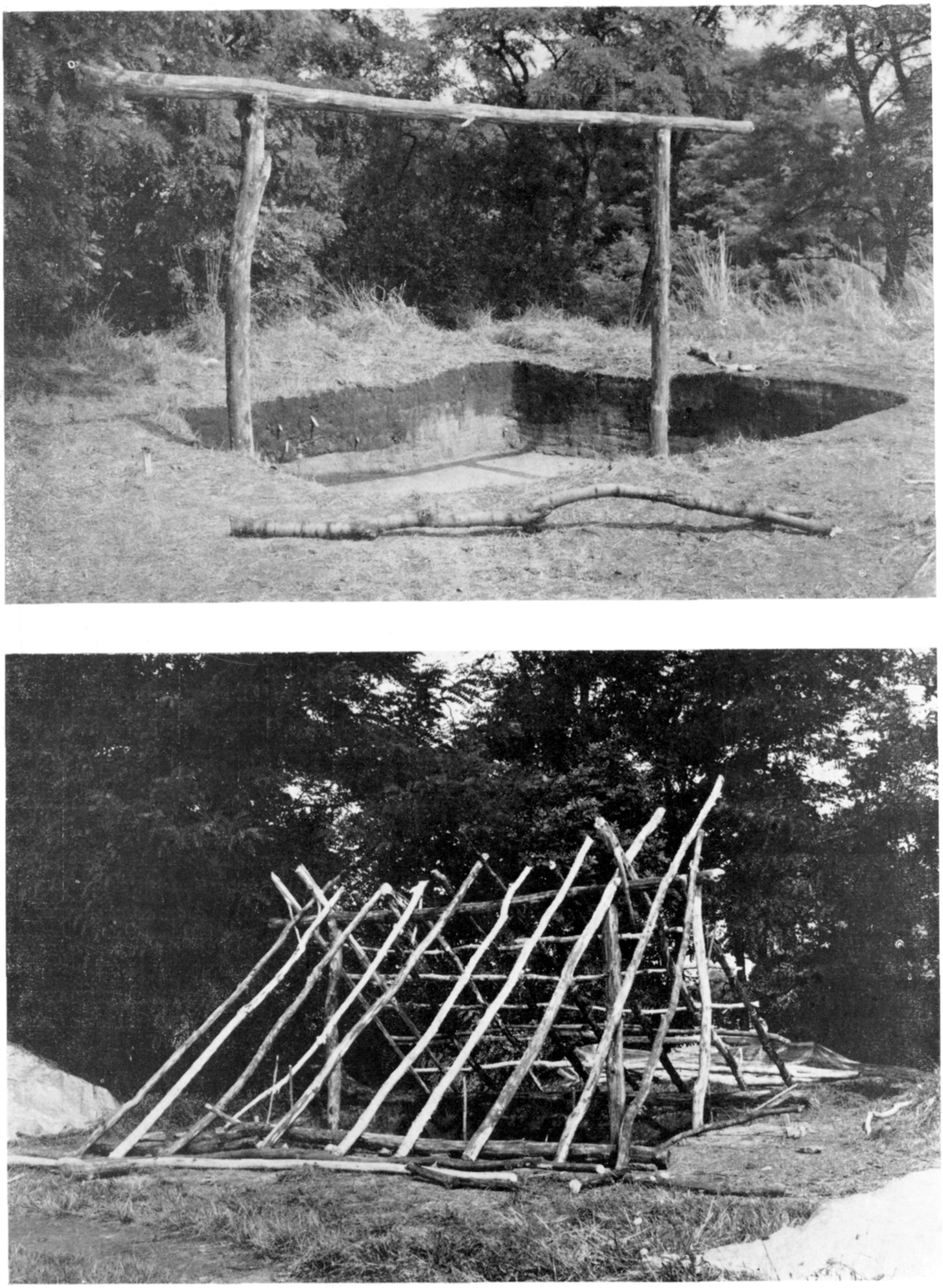

*Fig. 6.* House No. 5. 1 — supporting posts with ridge pole; 2 — construction of roof.

*Fig. 7.* House No. 5. Covering of the roof. 1 — thrusting a reed thatch onto a wooden sword; 2 — binding of thatch to horizontal sticks; 3 — S side of roof with wattle. Building of walls. 4 — wattling.

cent of present-day lumbermen's tools for peeling off the bark, which, however, are much wider. Adzes which were assumed to have been employed — among others — for skinning tree trunks proved unsuitable for work on trunks in horizontal position. Chisels and spoon-shaped augers were also used in the building. The excavation was done by modern tools; only in a certain section was a tool with lobes in the hind part and with a knee-joint handle resorted to. Periods of time required for carrying out individual tasks were noted down. The following schedule is given only for the sake of crude estimates, as its value may be considered problematic. Workers whose performance is being tested try subconsciously to maximalize their outputs; the main thing is, however, that the sum of time periods needed for works assessed individually does not lead to an average performance over a longer period of time which is decisive for comparisons. Comparing the work of a master carpenter and of lay amateurs during the next building experiment led me to the conclusion that the substantial difference does not lie in performing a certain act but in the overall approach to the problem – a series of preparatory procedures, manipulations with materials, and the like.

Continuous measuring of mutually overlapping work procedures was not possible in our case. A certain idea might, then, be formed according to overall time measurements which I give here among the results of the building experiment.

The time of c. 2—2.5 minutes was needed to cut an oak trunk 13 centimetres thick by a narrow axe of iron; this increased to 7 minutes with oak trunks 20 centimetres thick and to 12 minutes with beech trunks 20 centimetres thick. An oak trunk 4.5 metres long and 20 centimetres thick was skinned in 5 minutes; beech trunks were not so easy to clean — a trunk 4—5 metres long and 20—25 centimetres thick took 8—12 minutes. The comparison of excavation speeds by means of a pickaxe and of a lobed tool showed that work with a pickaxe went on almost by one-half quicker.

### *b) The building*

Except the sunk part, the basic construction of the hut consisted, in practice, of assembling the roof. At first, we positioned the supporting posts into their respective holes and fixed them in by trampling (Fig. 5). One of these was of beechwood with a naturally grown fork; the other one was of oak and slightly hollowed out in the top part as noted by *J. Mjartán* (*1963*, 98) in the cases of some recent houses with posts supporting the ridge pole. This was followed by suspension of rafters, mostly of ash wood and of oak; we tried to use pieces with branches forming natural hooks (Fig. 6 : 2). The sunken — floored structure and the roof leaning on earth assured the desired stability of the ridge pole construction. The choice of material was limited and we had to use even substantially warped trunks which slowed the speed of work. We had to re-arrange the rafters several times and some items with hooked ends that were most crooked had to be replaced in order to achieve at least a satisfactory level of straightness of the roof slopes which would permit the fixing of horizontal sticks.

As neither iron nails nor any building fittings of metal were found in any Slavic buildings, the joints were carried out by means of tying with twines or by fixing with pegs. In the case of this first building, production of suitable twines was something of a problem to us. Again, there was not enough suitable material and we had no precise knowledge of the possible variants of application and of the details of technological procedures. At first, we used raft twines, that is, young spruce trees soaked in water for some time, after their tissue had been beaten soft; these could be wound into ropes. Though no suitable material was available — there was a lot of knots — the tied joints held well both the construction and the weight of people ascending the roof during the covering works. A twine tied in position tightens after drying and is very firm. We realized that no spruce twines could have been used originally as there were no spruces in the vicinity, but it was especially spruce twines on which we had at least some information. In less exposed spots we used strips of bark freshly peeled off, and willow twigs. All these ways and means proved to be suitable.

The lower ends of rafters were laid on oak lodging beams resting on earth and joined to them by means of wooden pegs; holes were bored by replicas of augers. Rainwater trenches sloping slightly eastwards were excavated along both sides of the roof. Pegs were also used in assembling the door frame. Even before covering of the roof, stout branches were sunk into earth along the walls inside the house as a base for wattle wall revetments. A slender post with a forked top reaching up to the ridge pole was added to the centre of the E wall. It rested on stones as there was no posthole in the original ground-plan. Its purpose was to fortify the structure of the end wall. The walls were covered with wattling of willow- and ash-tree branches; at the tops of both gables, two ventilation apertures were left free (Fig. 8). The wattling was carried out at the same time as the covering of the roof (Fig. 7 : 4).

No concrete evidence for roof-covering was at hand. We decided to use reed thatch as reeds were likely to occur throught the ancient riverside area in sufficient quantities. At the time being, however, reeds are not available in the vicinity of Březno. The closest site was that of Divice (20 kilometres distance), from which we brought the required quantity of reeds to Březno. Tying on of thatch and covering of roof were done in the traditional way by Mr. J. Křivan, an old-age pensioner from the village of Telce. Bundles of reeds were run by their central parts against a wooden sword and wound around it (Fig. 7 : 1). Finished in this manner, they were tied on horizontal sticks

*Fig. 8.* House No. 5. Ventilation aperture in the E gable; daubing of walls.

from the lower parts gradually upwards to the ridge by means of reed bands (Fig. 7 : 2). In this fashion, the N side of the roof was finished. The S side was assembled in a different way — not with horizontal sticks but by means of wattling (Fig. 7 : 3). This, however, was not well suited to the fashion of covering used by Mr. Křivan. Densely spaced branches prevented fixing of thatch. This led us to the re-arrangement of the branches of the wattling into densely spaced bands of branches between which intervals were left free; these branch bands were then tied to the rafters and the thatch was, in its turn, tied to these bands. The ancient way of roof-covering might have been even simpler; however, no evidence thereon is available. The roof ridge has been covered with daub in order to achieve a suitable isolation of the most vulnerable component.

One of the last tasks to accomplish was the daubing of walls. We used yellow clay of our excavation of the experimental house. This was poured over with water and mixed with chaff and bits of reed. The admixtures amounted to c. one-fifth to one-sixth of the total. The yellow clay, well-trodden by feet, was left to season for a day or two. The walls were daubed gradually as the wattle-work was capable of bearing only a layer of a certain strength while next layers had to be added after the first one was slightly dry. The thickness of the end walls which we could daub above the earth from both sides amounts to some 15 centimetres (Fig. 8). The long walls, daubed from the inside only, are thinner. In those areas, however, the parts of walls protruding 65 centimetres above ground are protected from outside by the eaves of the roof resting on earth. Finally, the door, made of thin ash stakes set into a grooved frame, was assembled. This is a "flag-type door" set by its lower end into a stone with a hollow. The door was fastened to the W supporting post by means of leather straps (Fig. 9). No archeological evidence was available as to the entry into the sunk part of the building. We put in a short oak ladder similar to the one found at the Early Roman

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*Fig. 9.* House No. 5. 1 — W end wall with door; 2 — detail of hinging the door by means of leather straps.

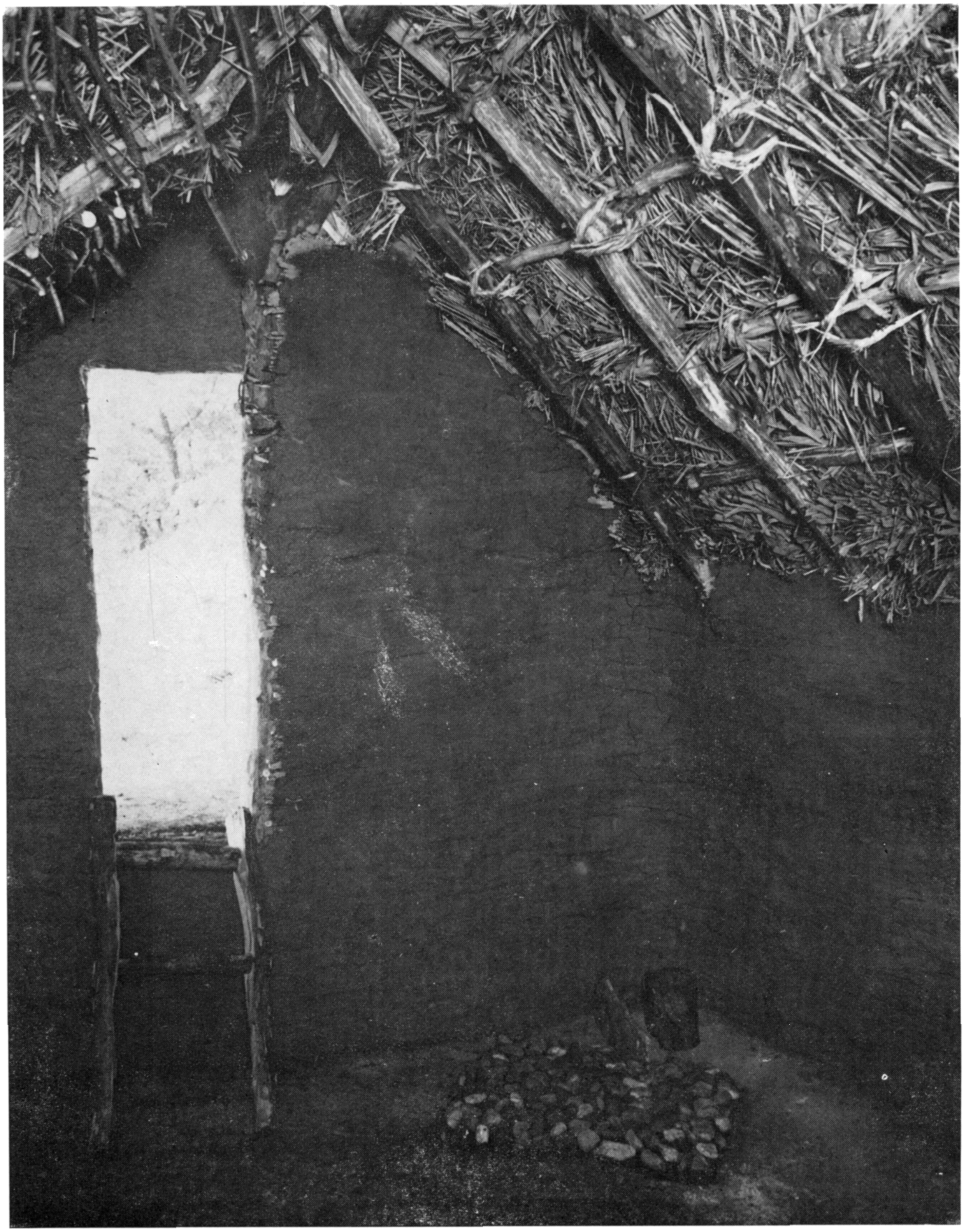


*Fig. 10.* House No. 5 — interior. NW part with the rectangular hearth and descent ladder. View of the lower side of the roof with twine bindings.

(shortly after 0 B.C./A.D.) settlement at Tuchlovice, district of Kladno (*Motyková-Šneidrová 1970*, 241, Fig. 4).

*c) Work inside the building*

The interior furnishings were limited to the barest necessities corresponding to the needs of a small family consisting of both parents and children the existence of which is assumed for the

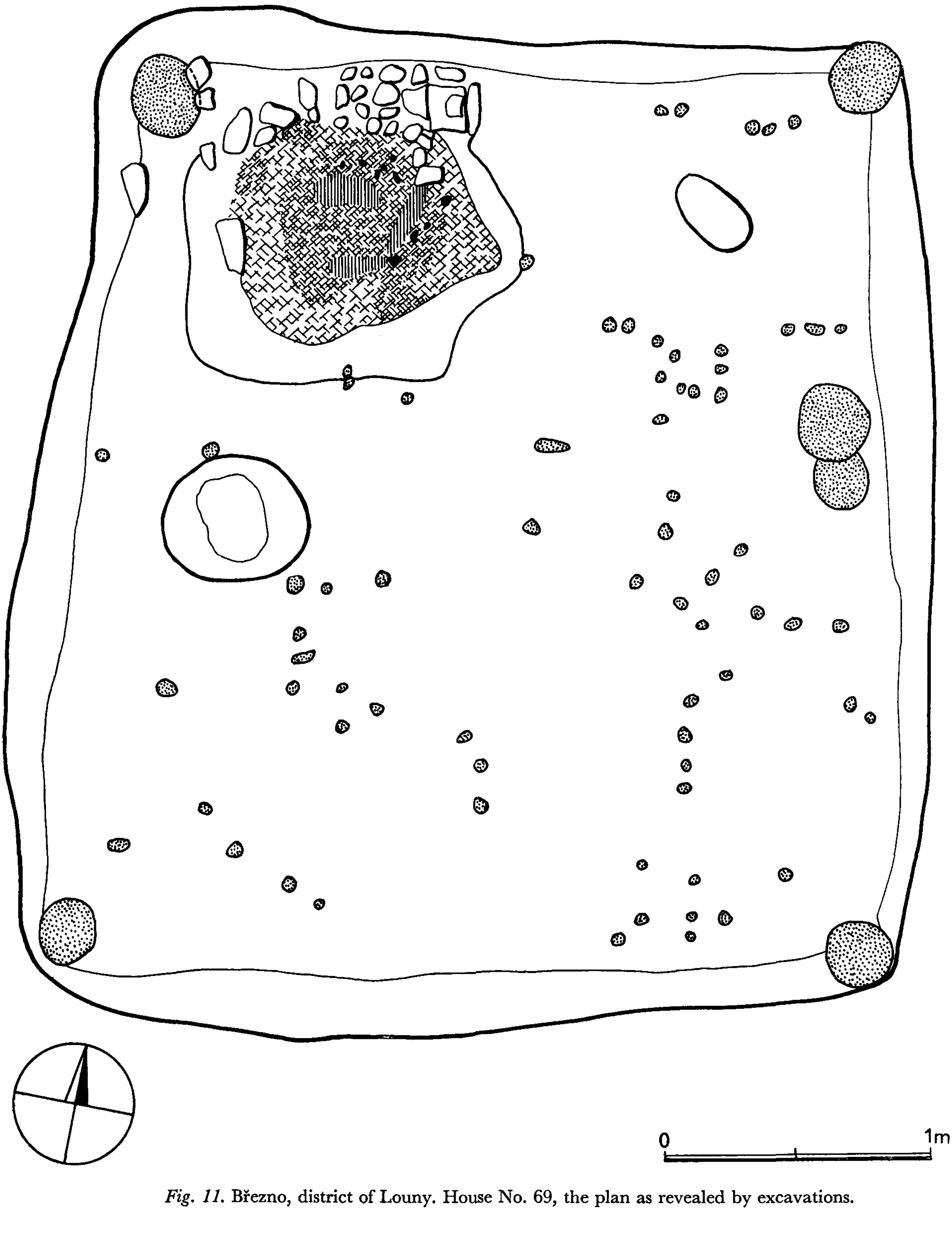


*Fig. 11.* Březno, district of Louny. House No. 69, the plan as revealed by excavations.

Slavic period. Heating facilities were represented by an oblong hearth paved with pebbles, located in the NW corner (Fig. 10). The principal component of the bed was constituted by a simple L-shaped frame attached to the NE corner of the hut. The frame was composed of two pairs of oak trunks resting upon one another and held in place by vertical pegs driven into the earth. The bed space was filled in with branches and covered by straw and reeds, whereby a sleeping platform measuring 175 × 135 centimetres was created. Its length was determined by the necessary distance from the hearth and by the length of the N wall. The width was based on the assumption that both parents and their young children slept on the platform with their feet towards the hearth. Two posts at the opposite southern wall could indicate a bench which could have offered additional sleeping space, for instance, for grown-up children. This interpretation, however, is equivocal and we decided to dispense with the bench. The building was undoubtedly provided with wooden hooks, rods and pegs for hanging-up and drying of objects; these were positioned gradually as the needs arose during the next, heating phase.

## Building of house No. 69 (9th century A.D.)

### 1. The situation as found

The ground plan of house No. 69 was oblong, or precisely, slightly trapezoidal, narrower on the N side. Maximum dimensions amounted to 3.60 × 3.10—3.30 metres. The floor was sunk some 40 centimetres below the original ground level. The feature had four corner posts the distances between which equalled — along the N—S axis and measured between the post hole centres — 3.30 metres, 3.10 metres on the S side and 2.70 metres on the N side. The depths of the respective postholes were 29 centimetres (NW), 39 centimetres (SW), 38 centimetres (SE), and 35 centimetres (NE). There was also a hole for a double post at the E wall which might have had some connection with the entrance. The NW corner contained remains of a stone-built oven. The longer dimension of the house followed the N—S direction (Fig. 11).

### 2. Reconstruction

Corner posts, ground-plan outline, and position of entrance were taken into consideration for the reconstruction. There was a probability of a construction with horizontally laid round timbers or beams but not of a "Blockbau" construction. The siting of posts in the very corners excluded the simple manner of letting the trunks in between the dug-out foundation and posts. The solution that seemed to us to comply best with the observed facts was that of a groove construction (post and beam construction: Fig. 12; the terminology used is that of *J. Vařeka 1977*, and of the encyclopaedia by *V. Frolec and J. Vařeka*, *1983*). In the course of building, the position of the doubled post at the E wall, out of a straight line connecting both corner posts, became rather conspicuous. We have not given full justice to this fact in the reconstruction project. There was a larger space behind the doubled post so that horizontal beams could have been only inserted behind it; this was actually carried out in the building. At the same time, this allowed to keep the outline of the whole E wall straight. For these reasons, I believe that this solution is rather probable; moreover, there are additional advantages in combination with the entrance. There were no supporting posts of the roof which would have left postholes; the roof was thus probably of the type supported from below but resting on the upper construction topping the walls. As for roofing, we hesitated between a gabled roof and a hipped roof. In view of the ground — plan outline, not even a tent-like roof was entirely excluded, but that does not correspond to local traditions and is rather unlikely for our region. The gabled roof could have rested on half-posts resting on a frame which would have left no traces whatsoever. A simpler solution would be to place the supporting posts within the ground plan or outside it. There were, however, no remains of such constructions. In the construction project we took a compromise stand and proposed a roof with a gable arrangement in the S part and a hip on the N side. When we started building in the real, however, I have opted for the hipped roof on second thoughts about the location of the entrance. If there

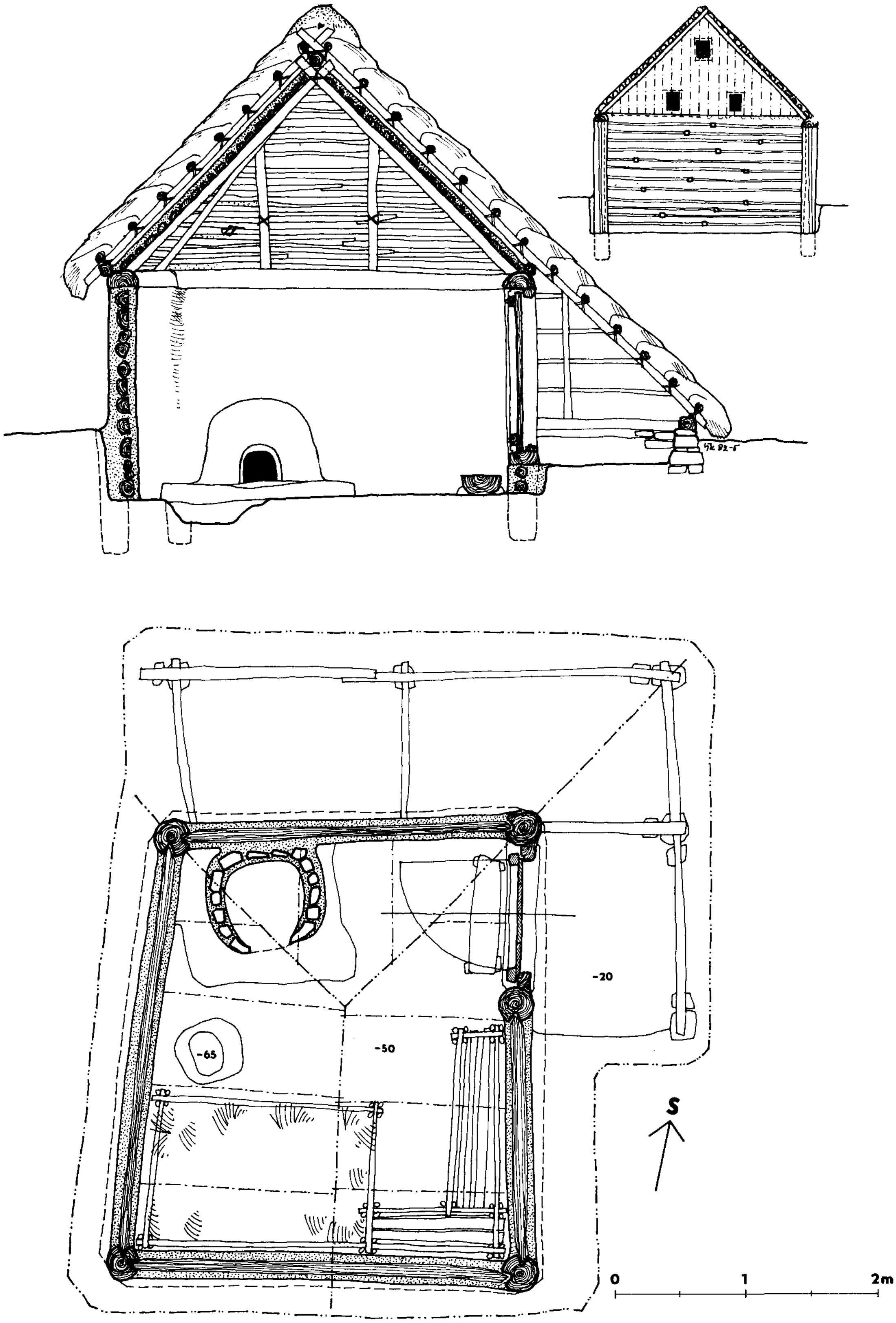



*Fig. 12.* Reconstruction project of house No. 69 before the experiment. Above — transversal section and S gable; below — ground plan. Drawn by J. Škabrada.

were a double-slope roof or even the roof with a hip on the N side, the best place for an entry would not be the longer side of the house but the S end side in which the height of the entry would not be limited by the wall height above ground. Total wall height reached 180 cm, height from floor to the ridge 310 cm.

As for the character of the roof, the project suggested a two-layer construction. We realised that such a way of roofing is not likely for buildings of this period but we decided to use it in view of the next item on our schedule – the heating – because we wanted to achieve a better isolation of the house as against the first light dwelling No. 5. Ventilation apertures were envisaged by the project in the upper parts of N and S gable, of which the S was accompanied by two small windows in the lower part of the gable. This corresponds to the system of three ventilation- and illumination windows of medieval buildings in the so-called pyramidal arrangement, more correctly, in a location in the corners of an equilateral triangle. In a certain modification, this feature was applied in view of the heating experiments.

## 3. Sequence of building works

### *a) Preparation of wood and excavation of the foundation*

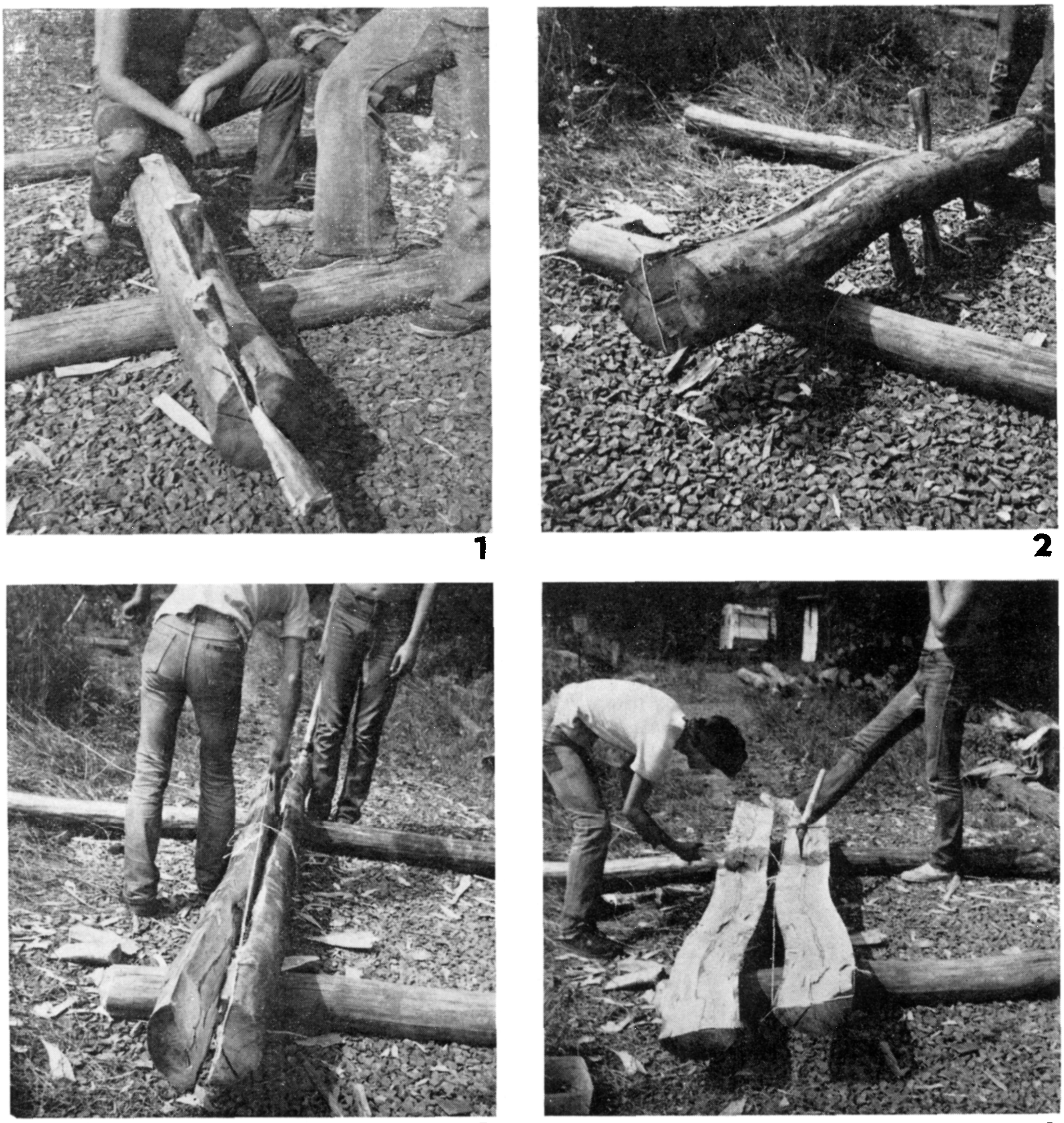
Only in exceptional cases could oak trunks be used for wall construction. We had at our disposal principally beech trunks of larger diameters; in consequence of it, we had to build the walls of half-round timbers starting with splitting of whole pieces. Walls built of thinner round timbers would have been more advantageous in view of the limited amount of labour required. Slavic builders whose supply of building materials was not limited would probably have opted for this procedure. The trunks, some 4 metres long, were ready from the preceding season. Wooden wedges, narrow Slavic axes and a wooden mallet (Fig. 13) were used for splitting. The wooden mallet broke during the work and before we procured a spare one, we had employed an iron mace. Later on, we also put in some wedges of iron as the wooden ones wore off quickly and had to be replaced every now and then. It was necessary to turn the trunk and work from both sides in the splitting process. If the split was running wrong we could get it back into line by cuttisng the natural layers of wood by an oblique blow of the axe. Inner sides of the half-round timber were roughly smoothed by the axe; some of them had to be slightly cut lengthwise in order to get rid of major irregularities and to avoid larger gaps in superimposing one trunk over another. The division of half-round timbers for particular walls was carried out and these were roughly adjusted as to the desired lengths.

This was followed by further procession of wooden components. The first to be treated were corner posts of oak trunks provided each with two grooves and a cube-shaped tenon on their upper ends. Exact adjustments of log lengths and carpentry work–tenons, gouging, and grooves-were going on parallel with building as well as more careful surface finish of the inner sides of half-round timbers. Carpentry work was supervised and more sophisticated tasks carried out by a master carpenter — old age pensioner J. Tajtl of the town of Louny. Students and old-age pensioners worked according to his instructions.

At the same time we started the excavation according to the original observations by means of modern tools. The lobed tool was used in an experimental section; the experience confirmed our observations from the excavation for the first building. We excavated some 4.5 cubic metres of earth.

### *b) Tools employed and time required*

Wedges of iron and wood, a wooden mallet and an iron mace, narrow Slavic axes, an adze, narrow iron chisels, a lobed tool, an auger and wooden equipment for trampling the earth hard. Tenons, grooves, and mortises were executed by means of a chisel, an adze did good service in surface finish. An adze does not run deep into wood and does not chop off splinters but wide and flat flakes of wood; a careful worker is capable of producing an even surface.



1 2 3 4

*Fig. 13.* House No. 69. 1 — 4 — cutting of trunks for building of the walls.

Time limits: Most of the work was done by amateurs, the performance of a master carpenter is especially recorded. On the problems of time limits cf. supra p. 113—114.

At first, the splitting of a beechwood trunk 20—25 centimetres thick and c. 4 metres long took 2 men some 30 minutes. Later on, this time was slightly reduced. Levelling of the cut surfaces of half-round timbers by means of an axe took two men some 10 minutes. Exact adjustment of length and levelling of the ends of half-round timber in preparation for working out a tenon done by means of a chisel took one man 45 minutes. Working out one-side end tenons on half-round timber the same 45 minutes, working out cube-shaped tenons on tops of corner posts 30 minutes, making a groove on a corner post 20 minutes (both latter items done by a master carpenter). Production of a twine of interlaced pairs of willow branches took 4—5 minutes and two men.

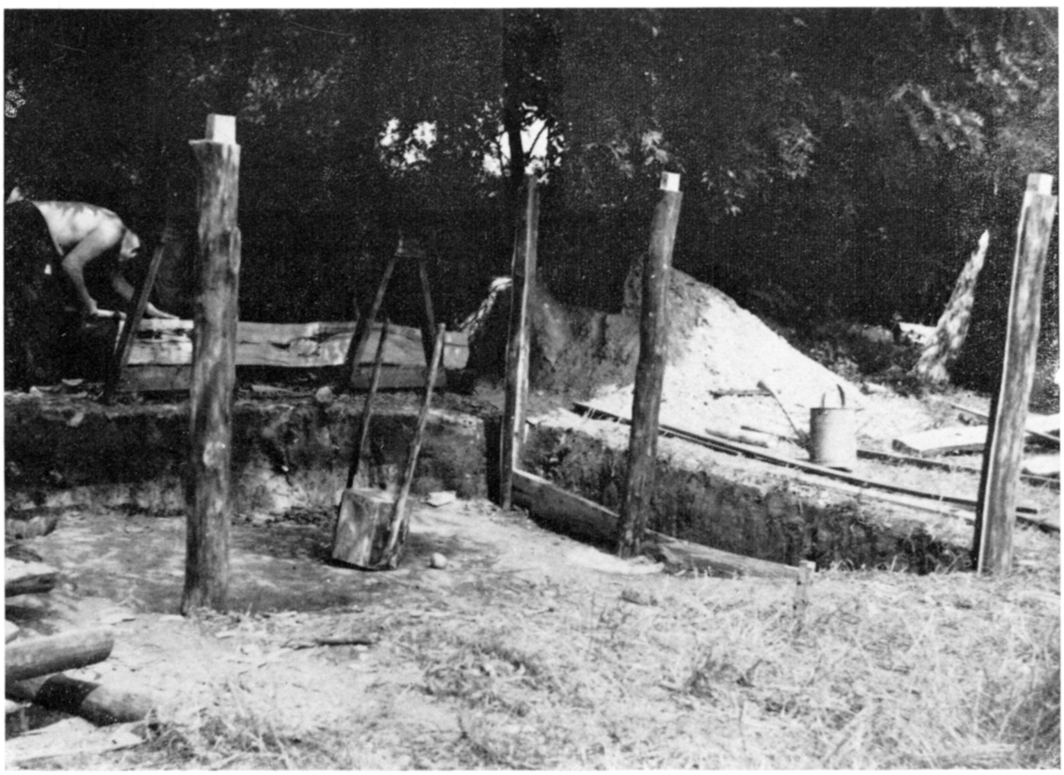


*Fig. 14.* House No. 69. 1 — trampling earth round the entrance post; 2 — posts with grooves and tenons in position.

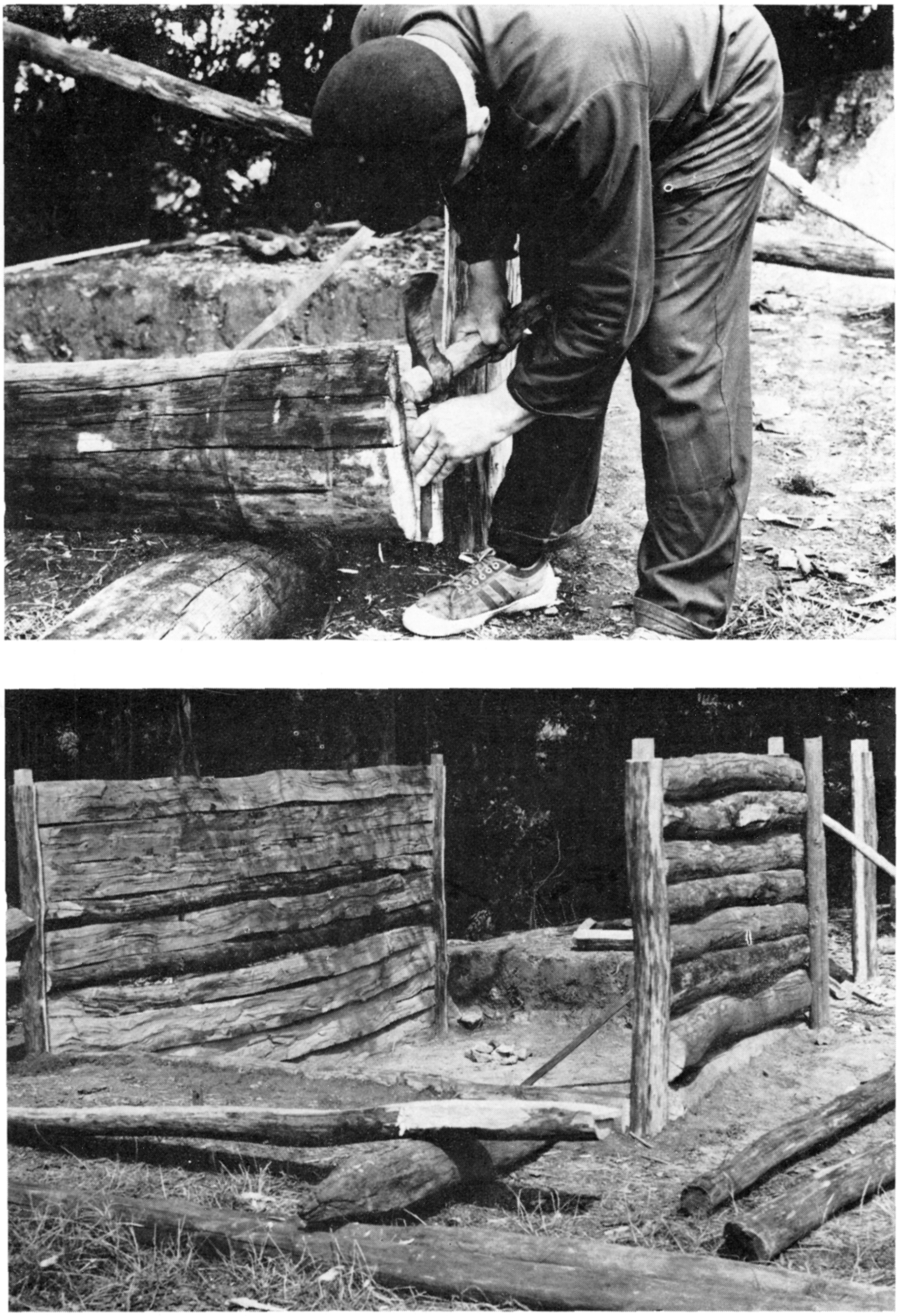


*Fig. 15.* House No. 69. 1 — work on a half - round timber tenon; 2 — building of E and W walls of half-round timbers inserted into post grooves.

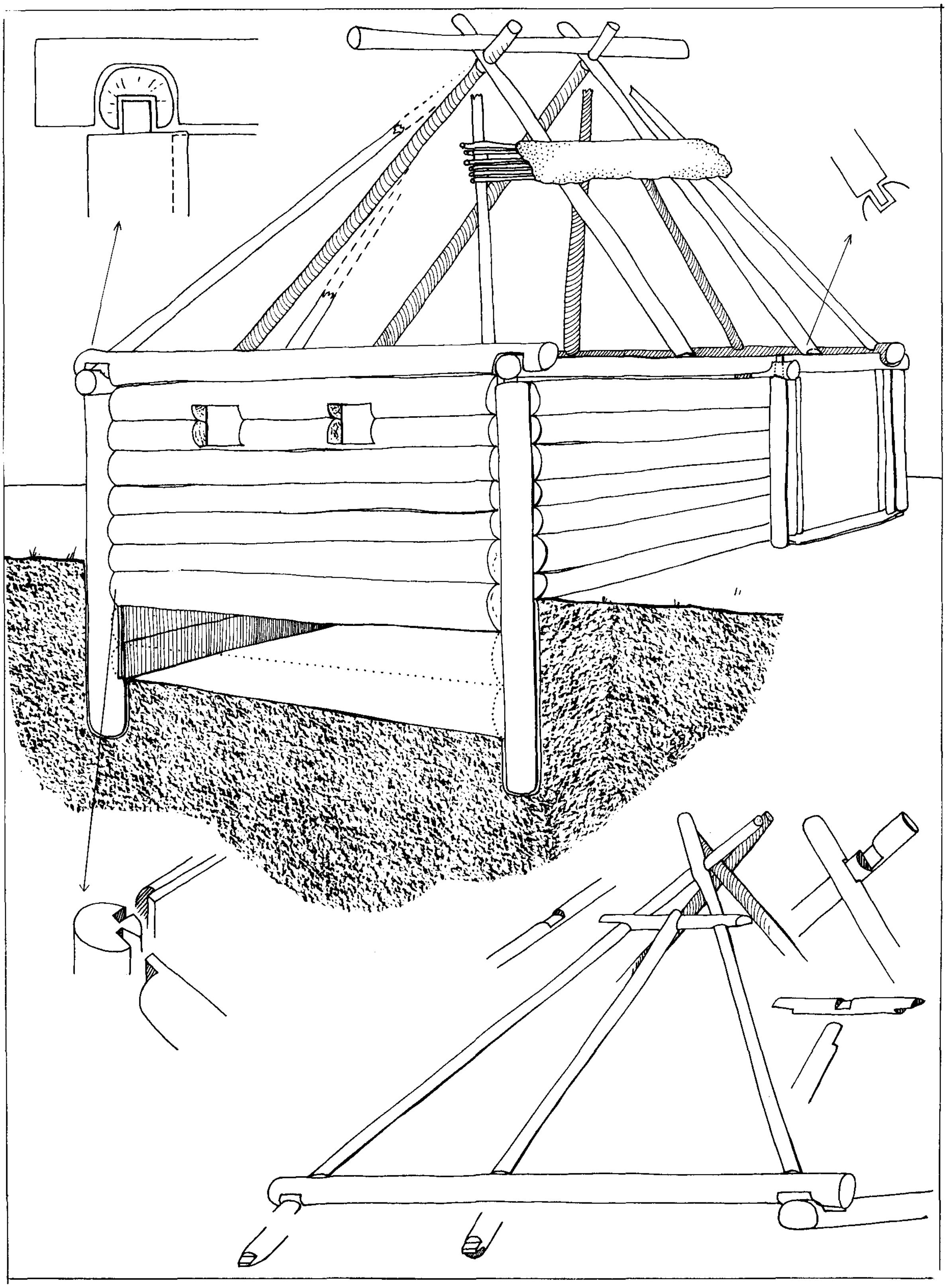


*Fig. 16.* House No. 69. Construction of building. Details: above left the circle — tenoning and rabbetting; below left — a post with grooves and half-round timbers with tenons; above right — detail of tenoning of a pair of rafters; below right — construction of roof (lower mantle). Drawn by R. Pleiner — H. Houfová.

*c) The building proper*

Erection of house No. 69 was carried out in two campaigns in 1982 and 1983. The sinking of corner posts (Fig. 14 : 2) with grooves and top tenons was followed by building of walls. Only two posts were fixed firmly while the other two were inserted into their pits in order to allow for at least an initial manipulation in setting horizontal beams into the grooves. When all the four corner posts were firmly fixed in the ground — the walls having been built to about half of their proposed heights by then —, we had to provide external supports for the corner posts in order to avoid forcing the building frame apart by pressure of the horizontal beams before it could be held together by the upper circuit. There were, however, problems with the W wall which started to fall apart in the upper courses in consequence of which we had to take out and shorten some half-round timbers. Assembling of the walls proceeded fairly quickly; half-round timbers with tenons on both sides (Fig. 15.1) were inserted into grooves in corner posts. All this could have been

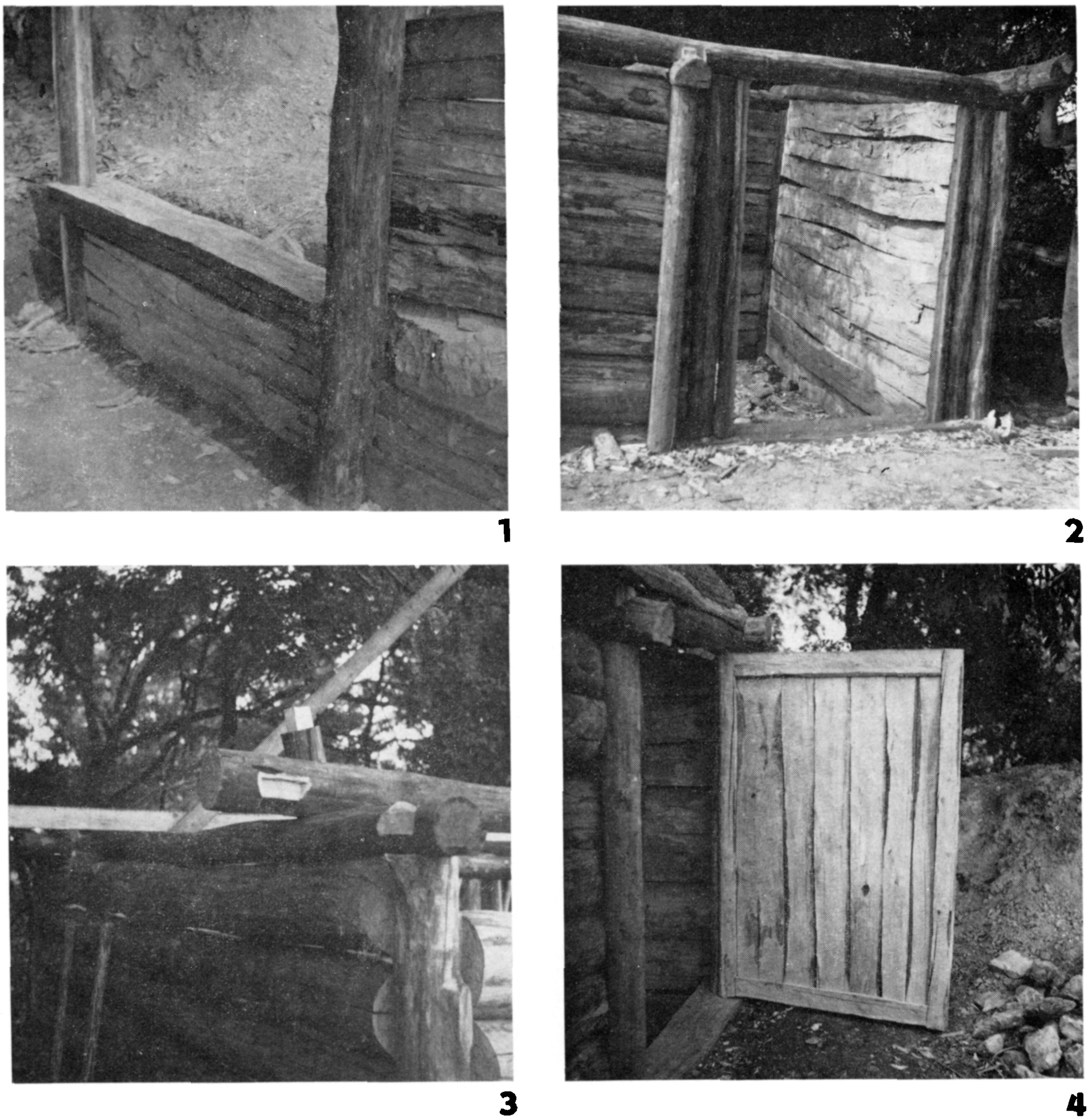


*Fig. 17.* House No. 69. 1 — threshhold; 2 — entrance, doorframe with half-groove; 3 — detail of the SW corner of the circle — tenoning and rabbetting; 4 — plank door.

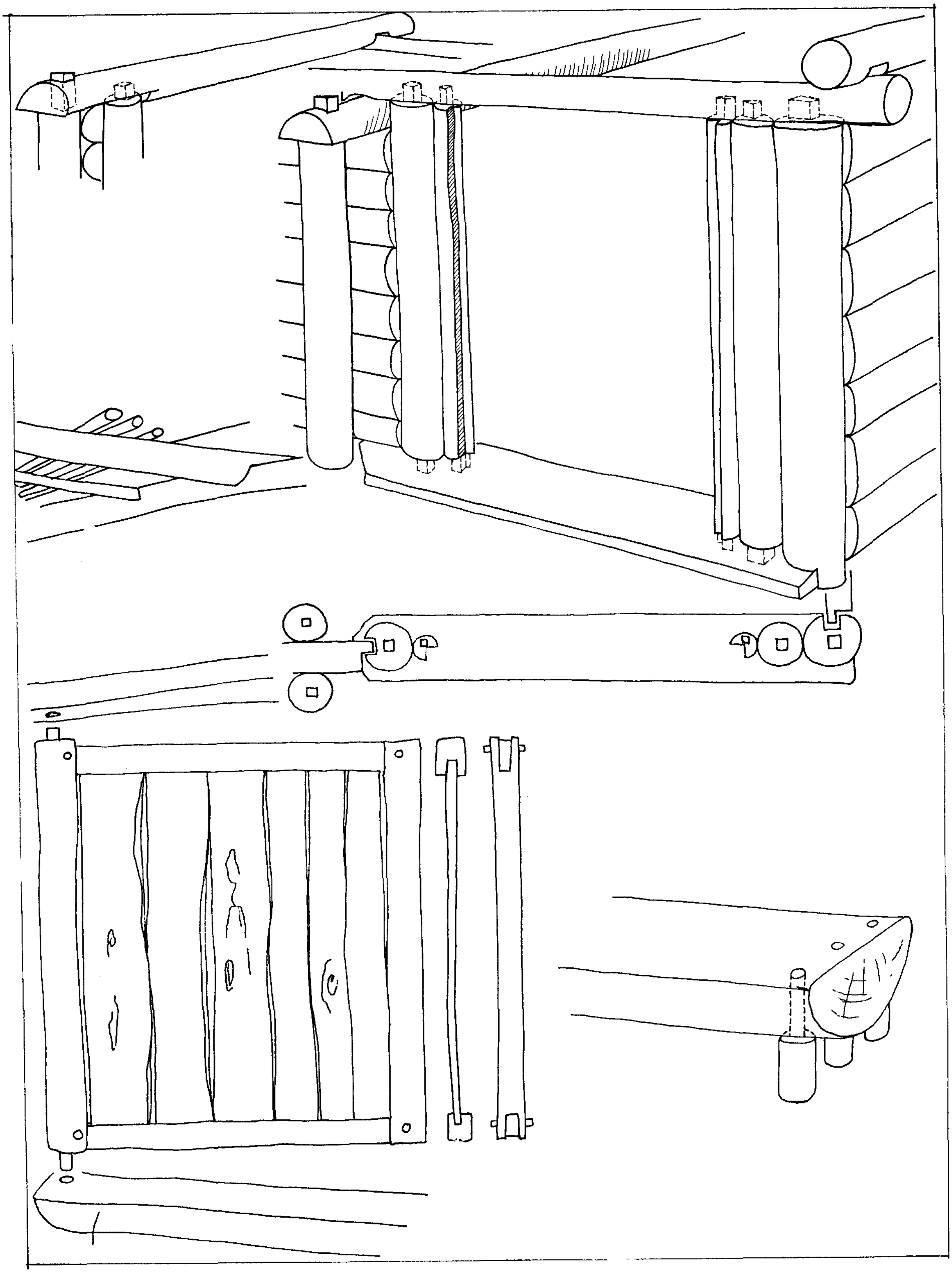


*Fig. 18.* House No. 69. Construction of the entrance area. Above left — a transversal trunk and „polenice" (log-drying space); above right — entrance with a door-frame with halfgrooves and ground plan of the threshhold; below left — a door of planks inserted into the frame grooves: below right — the inner step. Drawn by R. Pleiner — H. Houfová.

much easier and quicker had there been no need to use warped wood and to adjust frequently both the grooves and the terminal tenons. We have started at two opposite sides — W and E (Fig. 15 : 2),; the latter was more complex because of the entry. According to the preserved traces, the E wall was built in a different fashion, as has been noted above in the section on reconstruction. The groove in the SE corner received half-round timbers but these were only inserted behind the post standing slightly outside the connectig line of both corners (Fig. 18). Another post

*Fig. 19.* House No. 69. Transversal trunk tenoned into posts at the entrance and rabbetted by the circle of round timbers.

was sunk at this spot from outside the excavated part which held the horizontally laid half-round timbers from outside. Though there was no trace of such a post, it might not be visible since the post may not have penetrated deeper than the upper dark soil layer. A timber of oak with its respective mortises making up the architrave was laid across the pair of posts with their upper tenons created in this way towards the opposite side (Figs. 18, 19).

The entry was situated close by the NE corner and its construction was partly designed at the underground level. A threshhold consisting of a half-round timber 130 centimetres long and 20 centimetres wide, partly sunk into the N wall and adjusted so that it could have been tenoned into the mortise of a corner post (Fig. 17 : 1) was laid down at the N end of the E wall as the last closing element of the excavated area. Its upper surface was smoothed and provided with mortises for tenons of a doubled door-frame which had tenons on the upper ends as well, intended to be received by the upper circuit. In addition to this, a circular hole was bored at the N end of the treshhold for the pivoting tenon of the door by means of an auger (Fig. 18). The door space was limited on both sides by a double door-frame. The inner door-frame was provided with a half groove for the door along its whole height (Fig. 18).

The door, made by a master carpenter, consisted of a frame with a groove into which timber boards cut out of half-round timbers and smoothed by an adze were set. On the right side, the door-frame proper had round tenons fitting into mortises in the treshhold and the upper circuit. The door, 85 centimetres wide and 130 centimetres high, opens into the outside (Fig. 17 : 4, 18).

Two small windows measuring 30 × 20 centimetres were cut through the S wall at the height of 95 centimetres above ground level. The building of walls was finished by the upper circuit of oak round timbers. On both longer sides, the timbers were mortised to receive the tenons of corner posts, on the end sides they were joined by means of rabbetting to the timbers of the longer sides

*Fig. 20.* House No. 69. Building of the roof.

(Fig. 16; 21 : 2). Then we could remove the auxiliary supports at the corners. The upper circuit was fully sufficient to warrant the coherence of the building, fortified also by means of a transversal junction log in the manner of a perch in open — fire rooms, jointing the E and W wall. Gaps between the wooden wall and excavated surface were gradually filled in with clay and trampled hard.

The upper circuit received mortises 4 centimetres deep for massive tenons of eight pairs of rafters. These were made of ash and oak timbers cut to the length of 220 centimetres. We built a hipped roof so that the four pairs of central rafters of longer sides corresponded to the roof slope of 40—45° while the corner pairs of rafters had a slope of 60° corresponding to the slope of the hip (Fig. 16; 21). Both fronts of the roof contained central obliquely sloping posts tenoned by their lower ends into the upper circuit and let into the horizontal beam, delimiting the ventilation apertures (Fig. 16, 21 : 2). These had a triangular shape and occupied the areas of 5.5 and 6 square decimetres respectively. They were located at the roof ridge much as in the case of the first building No. 5. The upper ends of rafters were left to protrude, crossed and joined by means of mortises. Moreo-

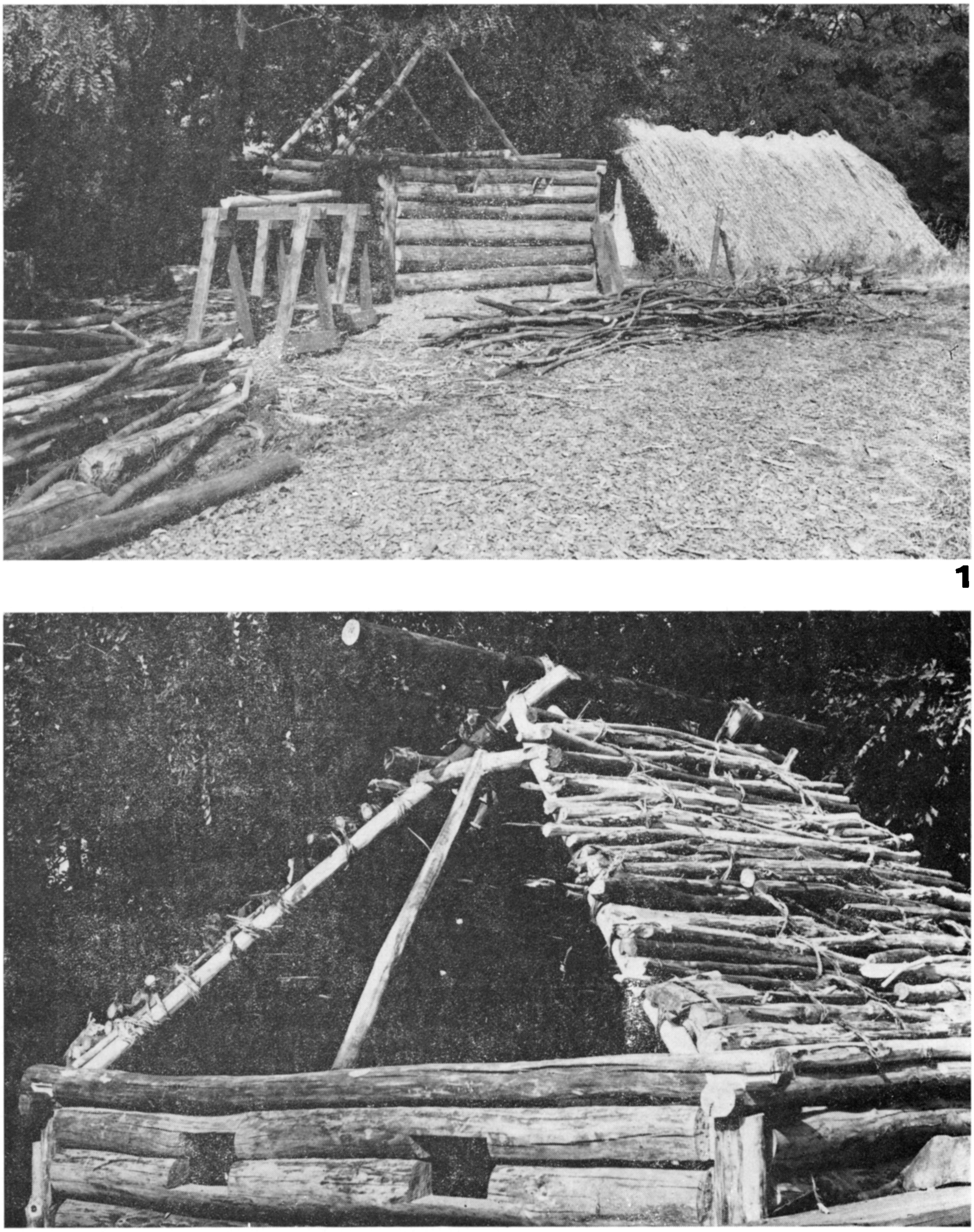


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*Fig. 21.* House No. 69. 1 — construction of roof (lower mantle); 2 — lower mantle of the truss filled in by sticks.

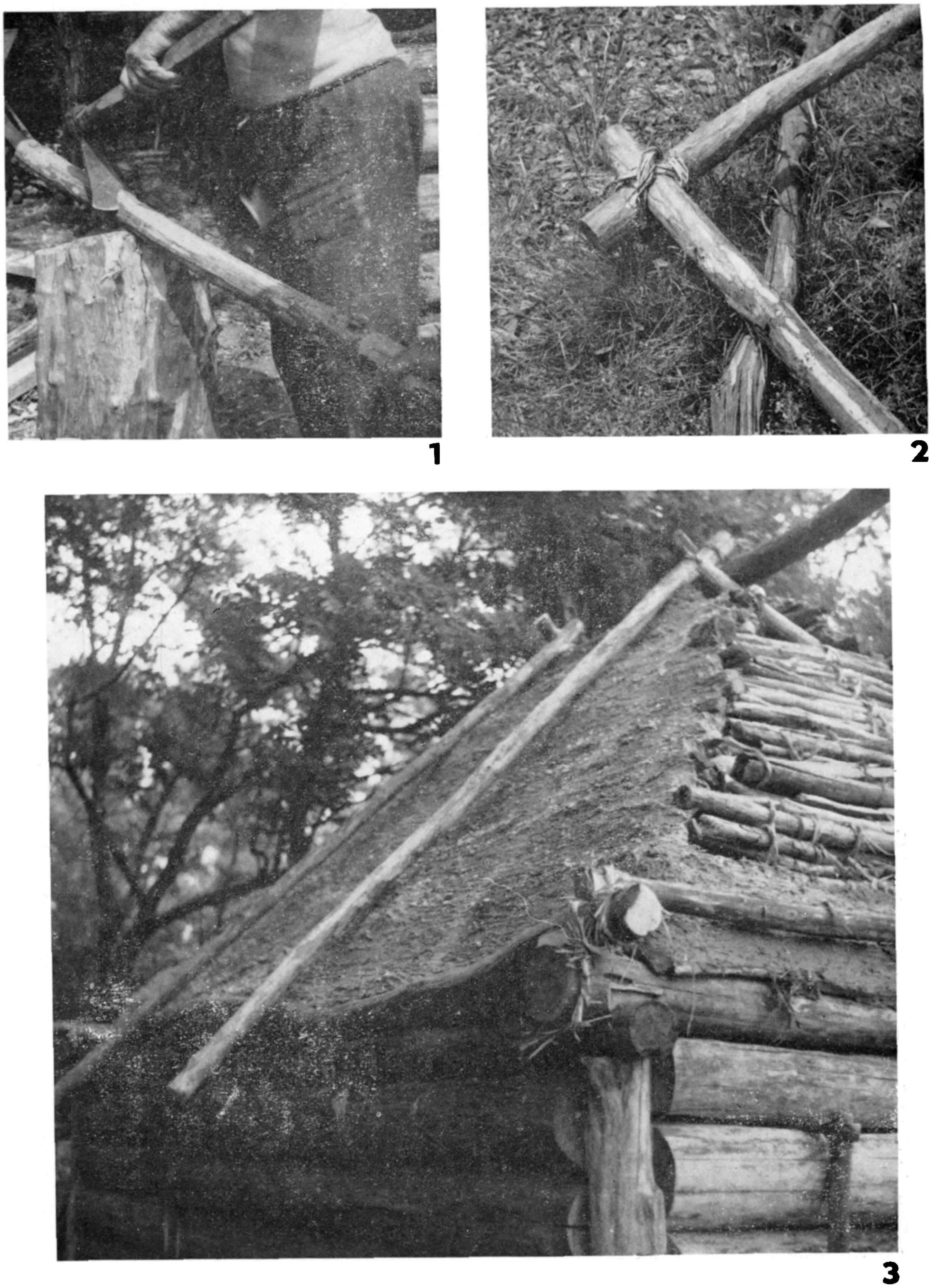

*Fig. 22.* House No. 69. 1 — cutting a shallow mortise into a rafter of the upper mantle of the roof by means of an adze; 2 — tying of rafters of the upper mantle by twines of willow twigs; 3 — clay daub on the sticks of the lower mantle of the roof.

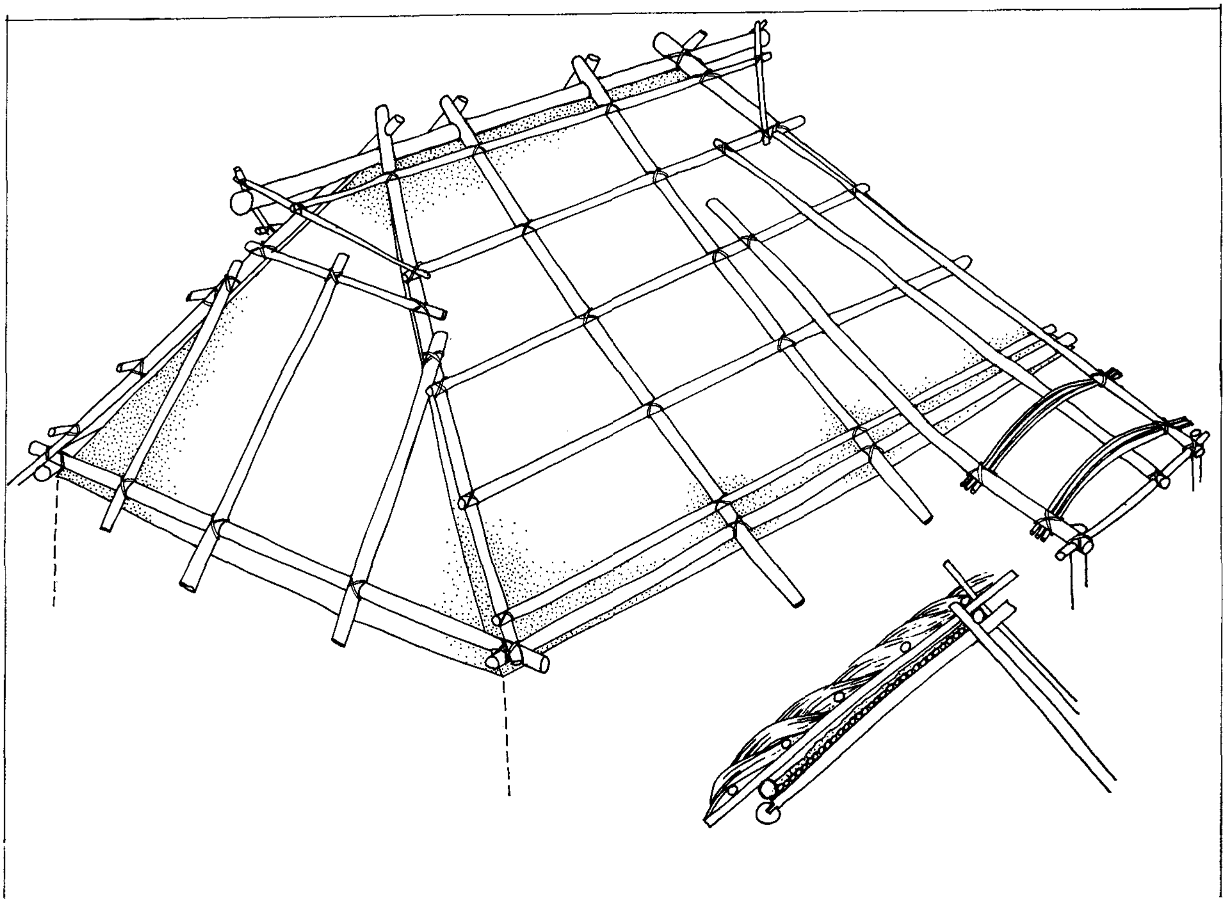

*Fig. 23.* House No. 69. Construction of the upper truss. Below right a transversal section through the roof. Drawn by R. Pleiner — H. Houfová.

ver, these joints were fixed by tying with twines. An oak round timber 285 centimetres long making up the ridge pole of the roof was laid across the meeting- points of rafters and its position was again fixed by tying with twines. A scissors' — shaped truss thus took form. The ridge pole reached over the truss construction proper on the S side by 70 centimetres, on the N side slightly less, as it was necessary to provide cover for the obliquely sloping ventilation apertures. This closed the construction of the lower part of the roof, planned as a two-layer structure. All this was followed by filling in the spaces between the rafters by densely grouped branches and thin trunks, mostly of ash-trees (Fig. 21 : 2). Sticks were bound together with twines and fastened to the rafters in the same way. At first we used spruce twines, later on we introduced interlaced soft-beaten willow twigs and belts of willow bark.

A layer of clay daub was applied to the roof covering at the whole area of the lower mantle of the roof. Work on the upper mantle started by placing a frame of thin trunks joined by shallow mortises in the corners in position and tying it to the upper circuit. The purpose of this was to provide a gap between the construction of the upper coat and the clay daub: this was necessary both for technical reasons and for trapping in an isolation layer of air. The construction of the upper coat was represented by four pairs of rafters on the longer sides, joined at the tops by shallow mortises and fixed by binding. These were suspended from the ridge pole. Their lower ends reached over the underlying frame into which they were mortised and firmly fixed by twine ties. Constructions of the sloping hips consisted of three thinner trunks. The middle one was mortised into a horizontal perch duplicating a beam in the lower coat (Fit. 23). The upper-mantle construction was continued down to the earth at the N side at the NE corner of the building in order to provide storage space at the house. This was followed by tying on horizontal st'cks, mostly of ash wood,

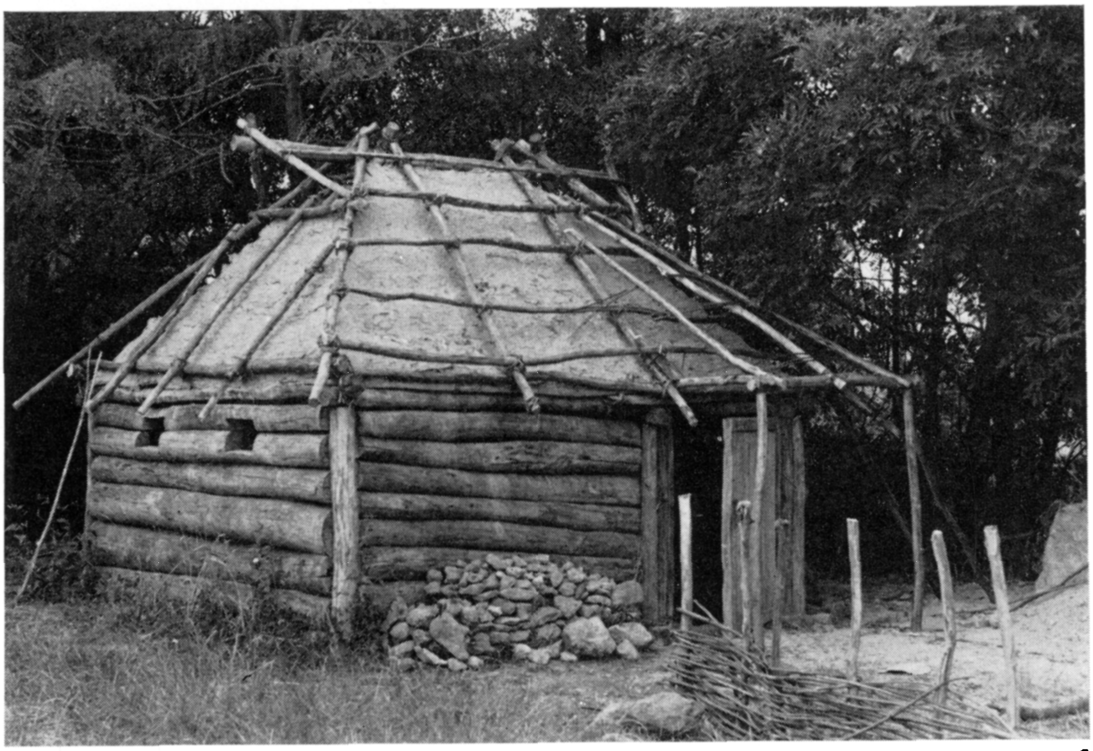

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*Fig. 24.* House No. 69. 1 — construction of the upper mantle of the roof; 2 — construction of the porch over the entrance.

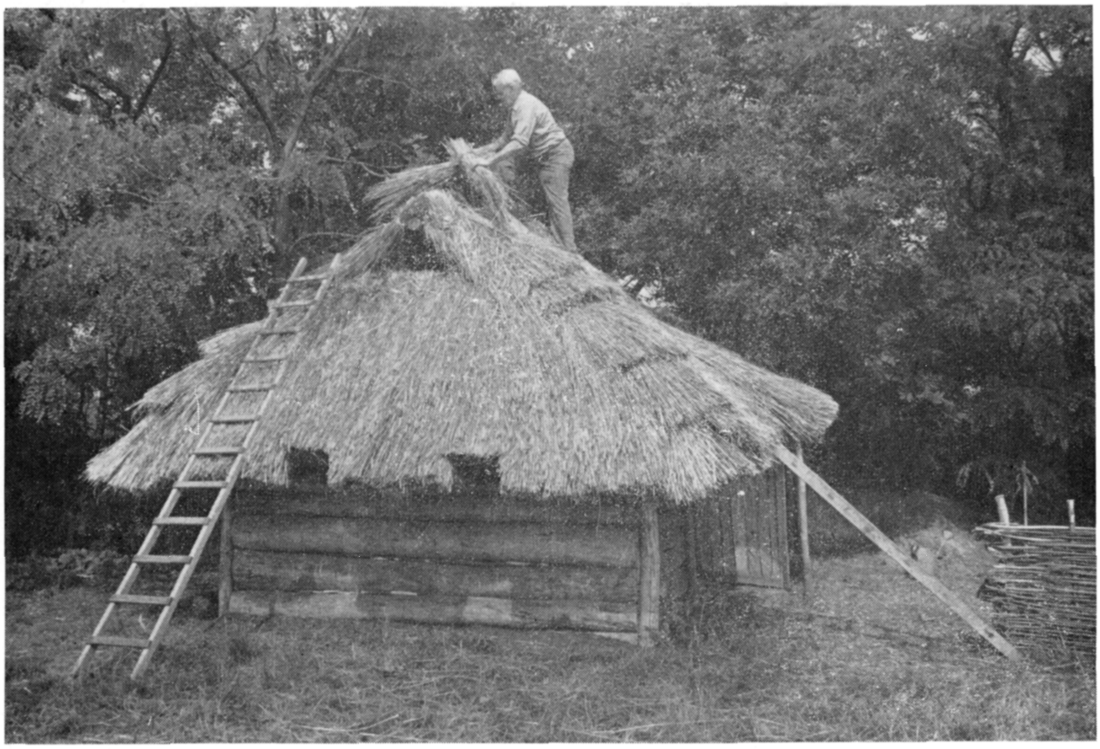

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*Fig. 25.* House No. 69. 1 — covering of the roof by thatch of rye straw; 2 — view of the E side with the entrance.


1

2

*Fig. 26.* House No. 69. 1 — interior of the structure — NW corner, gaps not yet filled in; 2 — SE corner with gaps filled in, outside view.

at intervals of c. 40 centimetres as a base for the covering. Both longer ends of the ridge pole were then joined to the transversal beams in the hips by oblique st'cks, whereby a base for covering and protect'on of the oblique ventilation apertures at the tops of the hips was formed.

A light shelter was built above the entrance into the building. Its construction consisted of two posts set in shallow holes at an interval of 130 centimetres and situated 80 centimetres in front of the E wall. An indication of such a construction may be seen in a post documented in front of the house entrance by the excavation; the distance, however, was almost twice as large. This distance could not have been respected for practical reasons in view of the adjacent house No. 5. A thinner trunk of ash was laid on top of the two above-mentioned posts at the front side; ash-wood sticks mortised both into this trunk and into the trunk of the frame of the upper mantle of the roof (Fig. 23) were laid across on both sides. The base for roofing this shelter over was constituted by three ash-wood sticks connecting the upper third of the roof to the frontal horizontal trunk of the shelter. Slightly convex pieces of wood were selected to create a kind of vaulting. At this part we laid down groups of three stronger twigs which could be arched above the middle stick as bearer of the covering instead of horizontal sticks (Fig. 24 : 2).

We have decided to employ thatch made of rye straw in view of the h'gher frequency of rye finds in the 9th century at the Březno site in comparison with the Early Slavic period. No rye is being grown close to Březno today; we had to cut 6 ares of it at the site of Domoušice 22 kilometres afar and transport it to our site. There it was threshed by means of flails and clubs and made into thatch. At this point it became clear that the quantity will not be sufficient to cover the house, whereupon we have sown a part of the threshed grain on an area of 8 ares and on a plot of the local State Farm close to the experimental buildings. In the next year, we thus acquired a sufficient quantity of straw to complete the thatch. Mr. J. Křivan, the author of the covering of the first building, had some problems with the hip roof, especially concerning the distribution of thatch wh:ch is more complicated on a four-slope roof than in the case of a two-slope roof. An additional repair and general re-shuffling of the covering was necessary (Fig. 25). Not only thatch made of imported straw but also most of the thatch made of the freshly harvested rye grown on the spot were used up for covering.

The building was finished by filling in the wall gaps with suitable splinters, branches and flakes of wood and their daubing with clay both from inside and from outside (Fig. 26). This work was done too late, only after covering the roof; the covering reaching over the wall tops made access to upper parts very difficult.

*d) Activites inside the building*

Remains of a stone-built oven were excavated in the NW corner of the hut. Its foundation had a square form measuring 90 × 90 centimetres; the corners were rounded, especially on the N side, and the outline of the foundation thus approximated a horseshoe shape. The oven was situated somewhat obliquely in a theoretical diagonal joining the NW and SE corners of the hut. As no more than the foundation was preserved, we modelled our reconstruction on the well-preserved oven from Early Slavic house No. 11 of the site of Březno; the dimensions, however, were adjusted to the excavated foundatins of our oven. The oven of hut No. 11 of Březno had a dome-shaped vault of dry-built stone construction. The rectangular gate leading to the interior of the oven was lined with larger stones and there was no special smoke-evacuation device. It was not necessary, as the air circulation carried the fumes along the oven ceiling through the upper part of the gate outside.

A shallow excavation has been made for the first layer of stones in the hut floor in order to stick to the excavation record as we observed a hollow around the fire-stained spot in feature No. 69. We put the stones on top of one another at an angle slightly sloping towards the centre of the oven. At the height of 40 centimetres the oven collapsed. In consequence of this we decided to employ a simple auxiliary construction. From the inner side of the oven dome we fixed in groups of three strong twigs bent in accordance with the proposed vaulting, crossed at the centre of the oven and tied together. We tried to make sure that the stones lean on the twigs as little as possible because we realized that the latter will burn with the first fire in the oven. Then we resumed the procedure in the same way; rows of dry-built stones were superimposed at an angle sloping inside and the oven dome was thus completed. The outside gaps were filled in with clay and the structure thus consol:dated. The keystone of the dome was left removable for the proposed heating experiments. In principle, this is a closed oven with a frontal fire gate at the bottom of the S side measuring 30 × 30 centimetres limited by three big stones. The oven reaches the height of 65 centimetres.

The other principal component of the interior furnishings was a bed. There were two problems to be solved — its location and appearance. In view of the space offered by the house interior, there was no question of locating the bed either along the N or along the W wall. A rather regular clustering of shallow peg holes limiting an oblong area measuring 70 × 160 centimetres was excavated by the E wall. This could correspond to the dimensions of a sleeping platform the disponible surface of which would have been slightly larger as it might have reached over the pegs. From the constructional viewpoint, however, it seems most unlikely that a row of thin pegs would carry the weight of pieces of wood laid across their tops in addition to the weight of people sitting or sleeping thereon. There is a possibility that the pegs only limited the sleeping space; in that case the area enclosed would be fairly narrow. Both parents could have slept on a bed of this kind while children would have been lying around on the floor. I think, however, that the space along the S wall could have served for sleeping accommodation; construction of the bed could have left no traces whatsoever. In accordance with this, we envisaged a bed at the S wall — in keeping with the overall finish of the building — as a bench with its upper surface 33 centimetres above the floor and 100 centimetres wide, made of 8 half-round timbers the surface of which was smoothed by and adze. The bench was immovable and represented an integral part of the walls, as is usual in the vernacular architecture. It was sunk into mortises cut into the W and E walls and supported by posts in the central part. In a way, this was an emergency procedure as the bench should have been incorporated into the walls during their assembly. A similar bench continued on the E side while archaeological evidence was taken into account only in view of dimensions, not of construction. By locating the benches along the corner sides we filled in the S and part of the E wall; this may correspond to ancient facts while the form of the bed is open to discussion.

A narrow seat measuring 25 × 73 centimetres and let into the wall was joined to the W end of the bed. This reached as far as a small pit of circular outline by the oven which may, according to repeated occurrences of such a situation at the Early Slavic settlement at Roztoky by Prague[2], be explained as trace of a vessel sunk into the floor.

The only mobile item of furniture was another small seat made of half-roundtimber, 30 centimetres long, 25 centimetres wide, and 22 centimetres high. A step for descending into the building remains to be mentioned. In a hollowed-out space by the N part of the E wall, two groups of three small posts perpendicular to the assumed entrance 80 centimetres apart were documented by archeology. I think that these are traces of a step which we did as a half-round timber, 90 centimetres long and 24 centimetres wide, sunk into the above-mentioned groups of three pegs. The step could have alternatively been used as a bench (Fig. 18).

## Results of the building experiment

The four basic questions investigated by means of this experiment were answered; the answers, however, are of unequal value. Most reliable are those pertaining to technical sophistication of the building and to consumption of material. No more than a vague idea of ancient realities has been obtained in the aspects of number of working hands and especially of the time demands of the building.

2. Kindly communicated by the author of the excavations, Dr. M. Kuna.

## 1. Technical sophistication of the building

House No. 5 was a rather low-level performance. This is borne out by the fact that, with the exception of covering it was built entirely by unskilled labour with a good measure of success.

House No. 69 was rather more difficult from the viewpoint of know-how and participation and advice of a skilled carpenter – at least in some stages as he was not present at the site permanently — was necessary. The building itself, however, may not be considered difficult as most of the working hands mastered the necessary procedures, limited practically to basic and simple tasks done by a carpenter, after a brief instruction. Our master carpenter lent his hand only exceptionally, when high-precision work was needed. From the viewpoint of construction, this was a simple house that anyone familiar with woodworking — and we think that all adult men of the Early Slavic period were — could have built.

## 2. Number of working hands

In the estimates of the number of working hands we have to take into consideration the minimum necessary for the work on principal and constructional components of the building. In the case of both houses, this minimum amounted to two persons. This is not an optimum number; two people would have some difficulty in such tasks as binding horizontal sticks on the truss of hut No. 5 or manipulation of materials for both buildings. Nevertheless, they would be able to carry out the project. The preparatory stage — felling of trees and transport to the building site — could be done, in an emergency case, by two people. Additional tasks — wattle construction, preparation of clay daub, daubing of walls, and stopping gaps in walls — could be performed by a single worker. During tying together the components with twines, however, a single person would have problems. The same procedure is more easily and quickly accomplished by two people.

Taking into account the experience from building both houses, the most suitable number of working hands employed in construction work amounted to three. The preparatory tasks were carried out better with more people (neighbourly help), for additional work, 1 — 2 persons were sufficient.

We do not know the ancient organization of building work but we think that most of the fundamental procedures must have gone on in the same order as that chosen by us. Some of the additional work might have been running parallel while we did most of these tasks gradually. This, however, would not substantially distort the time demands expressed in the sum total of hours of work.

## 3. Time demands

In evaluating the time demands, we should realize that it was mostly non-professionals — students, apprentices, and old-age pensioners —, whose original vocations were quite different, who worked on the project. Three people with the necessary qualifications were employed: a one-time lumberman (preparation of wood for the first building), a one-time master carpenter (worked at times on the other building) and a self-taught thatcher, an old-age pensioner (covered both buildings). This was the reason why a certain irregularity in periods of time required for the work occurred; it was not felt as an obvious fact during a single action but rather in the course of the whole work day. The total amount of working hours will therefore include a certain distortion represented by a superior performance of these three workers. In estimating the time demands of the ancient builders, another question emerges, namely whether all the tasks that we have carried out were necessary for the building of the houses. A case in point is peeling off the bark which, however, represents no more than a few hours in the overall balance, which is a negligible quantity. In the case of the second house we realized that certain tasks could have been simplified and others may not have been done at all. These are pointed out later on in evaluation of building No. 69.

Both houses could have been covered in a simpler manner; there is no means of knowing whether it might have been quicker. Firmly tied bundles of reeds were used to cover a shed built above an experimental pottery kiln near the hut No. 5; there is no connection with the building experiment and, consequently, no discussion of this here. Their subsequent tying together and fixation, however, were more difficult.

Another possible manner of covering consisted of simple laying down or insertion of reeds or straw much as on the reconstruction of an Iron Age house at Lejre (*Coles 1979*, Fig. 50 lower).In that case, however, some device holding the covering in position — additional rafters, for instance — would be needed, representing an additional time demand.

The first building — house No. 5 — took 860 hours net. This includes felling the trees for rafters (ridge-poles and supporting posts being of imported wood) and overall preparation of wood. Three workers — an optimum number — would have thus built the house in 286 hours, or, given the local conditions, some 6—7 work weeks. It is not possible to put this figure mechanically back to the 6th century when it was imperative to build the house as soon as possible. There were obviously neither leisure days nor limited time of work (42.5 hours per week). I think that an assumption of 60—70 working hours per week for the ancient times may be reasonable, even if allowance for the daily routine tasks is made. Furthermore, we have to admit the possibility that Slavic builders might have been considerably better at woodworking than we are; some tasks, however, might have consumed about the same amount of time — covering the roof or daubing the walls, for instance. The excavation of the sunken part with modern tools could be, on the contrary, somewhat quicker. All in all, we may estimate that three working people of the 6th century A.D. needed c. 3—4 weeks for building a house like No. 5.

Building of house No. 69 took 1547 net working hours. This includes felling trees for rafters and roof sticks, transport of this material, picking up and transport of stones for the oven; imported trunks have been used for the walls. With three workmen this means 516 hours, equal to almost three months given present-day conditions. With the hypothetical assumption of 60—70 working hours per week, we will arrive at an estimated time of some more than seven weeks. This estimate may be lowered even more as, much as in the case of the first building, we assume a higher intensity of work and more skill in woodworking in the Slavic period. One skilled worker — a master carpenter — who took part in the building experiment was obviously not enough to compensate for our lack of experience. I think that our Slavic predecessors were much quicker than we, the more so as the fundamental procedures in building house No. 69 were represented by carpentry work. The estimated time during which three workmen would have been able to complete such a building in the 9th century would roughly equal six weeks. By this we mean the building as carried out by us. As, however, hardly any Slavic habitation structure had a double-mantle roof, and as there must have been a trend to assemble the walls in the simplest manner possible — from round timbers, for instance, the ends of which might have been cut obliquely to provide a tenon — the overall time estimate may be lowered still more. Under these conditions, a similar house type could have been built roughly in the same period of time as the first Early Slavic hut. These considerations of time estimates are rather speculative and they pertain to no more than a possibility to build the house in the period of time indicated above. We do not know what was the real situation. We do not take into account circumstances which might have lowered the speed of building. These are limits and prohibitions of the ideological sphere known from ethnographic evidence. This concerns selection of the building site, choice of materials, propitious time for starting the building, and so forth. A number of ritual practices are furthermore connected with the building proper — drawing of the house plan, start of work, etc. *(Bajburin 1983)*.

## 4. Consumption of material

To build house No. 5, 2.5 cubic metres of wood were required (ash, oak, beech); this covered construction of roof, making up a fundamental part of the building, interior furnishings, and the door. In itself, the hut swallowed 2 cubic metres of wood; the rest represents refuse and material for repairs of roof in the course of building, when a need to replace some of the rafters arose.

Covering the walls with wattle took some 1200 branches of an average diameter of 1.5 centimetre and 1.50—1.80 metres long; there to four cubic metres of clay were needed to daub the walls. For the covering of the building, reeds harvested from some 1000 square metres were used up almost entirely.

House No. 69 consumed almost 6 cubic metres of wood (beech, ash, oak). Of all this, some one cubic metre is represented by refuse and repairs in the course of building; the net consumption amounts to some 4.5—5 cubic metres. This quantity includes all the material for walls, for both truss constructions, shelters, and interior furnishings.

Rye straw harvested from some 1000 square metres was needed for covering the hut. This corresponds to the first experimental building which had a substantially larger but only a double slope roof; house No. 69 with its hip roof required covering of both sloping gables of the end sides.

The quantity of clay needed for filling in the gaps both inside and outside the bui ding was not measured as this work went on in an extremely irregular fashion with intermissions. The retrospective estimate of the clay needed both for this and for revetting the exterior and the bottom of the oven may reach c. one cubic metre. 230 stones of medium size were needed to build the oven.

## Experiments of heating Slavic houses

These represented continuation of the experimental buildings of Slavic houses. This experiment took place three times, always in the winter time (January, beginning of February). In 1982 (17 days) and in 1983 (10 days) we tried out hut No 5, in 1984 (7 days) both huts No. 5 and No. 69 were heated at the same time. We wanted to know what temperatures could have been reached in the winter time and what was the fuel consumption. Another intention was to know the situation of smoke circulation and smoke evacuation in these houses without chimneys. Members of the Institute of Archaeology, students and other interested members of the public participated in the experiment. They took turns in groups of three, sleeping in the huts as the idea was to continue the heating all along or, at least, to maintain the fire. Thermographs and station thermometers were placed both inside and outs'de the house. We measured fuel consumption in baskets. One basket was calculated to contain 0.0276 cubic metres. The consumption was recorded fairly exactly but there were shortcomings in measuring the temperatures. Thermographic records were frequently of poor quality, difficult to read, or they were altogether lacking for a particular period of time. Though the temperature on station thermometers was checked frequently, especially in the course of the day, the minimum values, assumed to have occured around 5 or 6 a.m., important for our observations, were not recorded in most cases. In spite of that we managed to get at least some idea of the thermic situation and isolation properties of both houses as documented by the tables and graphs included herein. For the evaluation of the thermic situation, consultations with Dr. J. Kalvová (Mrs.) of the Department of Geophysics and Meteorology (Faculty of Mathematics and Physics, Charles University, Prague) were useful. Temperature mesurements, smoke circulation, type of weather, direction of wind, and all other circumstances which could influence heating such as kind and quality of firewood used to be recorded in a special log book.

Table 1 and a graph (Fig. 27) of 1982 — house No. 5 provide informations on the outside temperature and temperature inside the hut measured at two spots — by the hearth close by the floor (A) and in the E part of the hut at the height of one metre (B).

The first two or three days were marked by the fact that the hut had not been heated before and also by rather low outside temperatures (maximum values of —2 °C about noon). Higher temperatures were reached only close to the fireplace inside the house; all the remaining space had the maximum of 5 °C. At the close of the third day, when the outside temperature rose a little, the hut was warmer. The difference between the outside and inside temperature reached some 8 °C on subsequent days; on the 6th and 7th day, when the outside temperature rose even higher

*Table 1.* Březno. Thermic situation during experiments in the house No. 5 (1982)

| day | hour | t | A | B | h | not heated | cons. |
|---|---|---|---|---|---|---|---|
| 24. 1. | 8 | −5 | | −2 | 100 | | |
| | 9 | | 5 | 2 | | | |
| | 10 | | 12 | 4 | | | |
| | 12 | −2 | 8 | 4 | 95 | | |
| | 16 | | 7 | 4,5 | 95 | | |
| | 19 | | 7,5 | 5,5 | 95 | | |
| | 20 | −3 | 5 | 5 | 94 | | 0,0552 |
| 25. 1. | 8 | | 5 | 2 | 95 | | |
| | 10 | −3,5 | 5 | 3 | | | |
| | 12 | −2 | 5 | 5 | 90 | 23,00—24,00 | 0,0828 |
| 26. 1. | 5 | | | 1 | 90 | 0,00—6,00 | |
| | 7 | −2 | 3 | | | | |
| | 12 | 0 | 3,5 | 4 | 90 | | |
| | 15 | 1 | 15 | 10 | 87 | | |
| | 17 | 1 | 8 | 7 | 84 | | |
| | 23 | 1 | 10,5 | 11 | 84 | 23,00—24,00 | 0,069 |
| 27. 1. | 10 | 2,6 | 3 | 3 | 90 | 0,00—9,00 | |
| | 11 | 2,5 | 3 | 3 | 95 | | |
| | 13 | 2,5 | 4 | 5 | 95 | | |
| | 14 | 0,5 | 6,5 | 6,5 | 89 | | |
| | 15 | 0,5 | 5 | 6 | 89 | | |
| | 16 | −1 | 4 | 4 | 92 | | |
| | 17 | −2 | 4,5 | 5 | 90 | | |
| | 18 | −1 | 4 | 4 | 92 | | |
| | 19 | −1 | 6,5 | 6,5 | 85 | | |
| | 20 | −1 | 6 | 7 | 88 | | |
| | 22 | −1,5 | 5 | 5 | 90 | | |
| | 24 | −1,5 | 4 | 5 | 91 | | 0,069 |
| 28. 1. | 1 | −1 | 4,5 | 5 | 90 | | |
| | 2 | −1 | 4 | 4,5 | 93 | | |
| | 3 | −1 | 5 | 5 | 89 | | |
| | 4 | 0 | 6 | 7,5 | 91 | 4,00—11,00 | |
| | 12 | 3,5 | 4 | 4 | 77 | | |
| | 13 | 4,5 | 6 | 7 | 81 | | |
| | 15 | 1 | 5 | 5 | 85 | | |
| | 16 | 0 | 5 | 6 | 84 | | |
| | 17 | 0,5 | 6,5 | 7 | 85 | | |
| | 23 | 0 | 4 | 4 | 85 | | |
| | 24 | | 8 | 8 | | | 0,069 |
| 29. 1. | 0 | 0 | 13 | 12 | 76 | 1,00—7,00 | |
| | 7 | 0,5 | 8,5 | 8 | 76 | | |
| | 8 | 0,5 | 9 | 10 | 74 | | |
| | 9 | 0,5 | 8 | 9 | 80 | | |
| | 11 | 3 | 6 | 6,5 | 78 | | |
| | 12 | 3,5 | 7 | 8 | 76 | | |
| | 14 | 4 | 5 | 6 | 80 | | |

| day | hour | t | A | B | h | not heated | cons. |
|---|---|---|---|---|---|---|---|
| 29. 1. | 17 | 2,5 | 6,5 | 7 | 85 | | |
| | 19 | 3 | 6,5 | 5 | 81 | | |
| | 20 | 2,5 | 9,5 | 10 | 82 | | |
| | 21 | 1 | 17 | 23 | 65 | 21,00— | |
| | 23 | 1,5 | 11 | 15 | 70 | 24,00 | 0,0138 |
| 30. 1. | 8 | 3 | 8 | 11 | 80 | 0,00— | |
| | 9 | 4 | 7,5 | 8 | 84 | 8,00 | |
| | 10 | 5 | 9 | 10 | 85 | 10,00— | |
| | 15 | 7 | 8,5 | 9 | 90 | 15,00 | |
| | 17 | 7 | 8 | 14 | 80 | | |
| | 19 | ? | 10 | 15 | 70 | | |
| | 21 | 5 | 19 | 24 | 70 | | |
| | 23 | 4 | 15 | 16 | 65 | | 0,069 |
| 31. 1. | 2 | 3 | 8 | 10 | 75 | 2,00— | |
| | 7 | 1 | 4 | 4 | 90 | 7,00 | |
| | 8 | 1 | 4 | 6 | 90 | | |
| | 10 | 2,5 | 5 | 6 | 80 | | |
| | 12 | 2 | 5 | 7 | 70 | | |
| | 15 | 2 | 7 | 15 | 65 | | |
| | 17 | 1 | 6 | 7 | 70 | | |
| | 19 | 0 | | 4 | 75 | | |
| | 21 | 0 | 6 | 8 | 70 | 22,00— | |
| | | | | | | 24,00 | 0,0828 |
| 1. 2. | 5 | −2 | 0 | 0 | 85 | 0,00— | |
| | 8 | −1 | 0 | 1 | 90 | 8,00 | |
| | 10 | −1 | 1 | 2 | 75 | | |
| | 12 | 3 | 8 | 9 | 70 | | |
| | 14 | 3 | 9 | 10 | 65 | | |
| | 16 | 0 | 4 | 5 | 65 | | |
| | 18 | −2 | 9 | 11 | 70 | | |
| | 20 | −3 | 5 | 6 | 70 | | |
| | 22 | −4 | 10 | 8 | 71 | | |
| | 24 | −4 | 10 | 11 | 70 | | 0,0828 |
| 2. 2. | 3 | −5 | 4 | 3 | 76 | 0,00— | |
| | 8 | −7 | 0 | 0 | 85 | 4,00 | |
| | 10 | −4 | 2 | 5 | 82 | | |
| | 12 | ? | 5 | 7 | 80 | | |
| | 14 | 0 | 6 | 6 | 75 | | |
| | 16 | −2 | 5 | 5 | 76 | | |
| | 18 | −2 | 2,6 | 3 | 76 | | |
| | 20 | −2 | 6 | 4 | 71 | | |
| | 22 | −3 | 7 | 7 | | 22,00— | 0,0552 |
| | | | | | | 24,00 | |
| 3. 2. | 4 | −3 | 2 | 0 | 75 | 0,00— | |
| | 8 | −4 | 0 | 0 | 76 | 8,00 | |
| | 10 | −3 | 4 | 5 | 80 | | |
| | 12 | −3 | 2 | 4 | 76 | | |
| | 14 | −2 | 6 | 7 | 75 | | |
| | 16 | −3 | 6 | 7 | 71 | | |
| | 17 | −3 | 12 | 13 | 70 | | |

| day | hour | t | A | B | h | not heated | cons. |
|---|---|---|---|---|---|---|---|
| 3. 2. | 18 | −4 | 11 | 14 | 65 | | |
| | 20 | −6 | 13 | 11 | 62 | | |
| | 22 | −6,5 | 9 | 9 | 65 | | |
| | 24 | −8 | 8 | 8 | 65 | | 0,069 |
| 4. 2. | 2 | −8 | 10 | 7 | 65 | 2,00— | |
| | 8 | −7 | 0 | −1 | 80 | 8,00 | |
| | 10 | −5 | 6 | 4 | 75 | | |
| | 12 | −4 | 4 | 8 | 75 | | |
| | 14 | −4 | 7 | 9 | 70 | | |
| | 16 | −5 | 7 | 9 | 65 | | |
| | 18 | −6 | 8,5 | 9 | 65 | | |
| | 19 | −6 | 6 | 7 | 70 | | |
| | 20 | −7 | 6 | 7 | 70 | | |
| | 22 | −8 | 4 | 7 | 70 | | |
| | 23 | −8 | 3 | 8 | 65 | | 0,069 |
| 5. 2. | 2 | −8 | 4 | 3 | 75 | 2,00— | |
| | 8 | −5 | 0 | 1 | 80 | 8,00 | |
| | 10 | −5 | 5 | 4 | 75 | | |
| | 12 | −4 | 9 | 8 | 75 | | |
| | 14 | −3,5 | 8 | 9 | 66 | | |
| | 16 | −4 | 10 | 13 | 65 | | |
| | 18 | −4,5 | 11 | 11 | 65 | | |
| | 20 | −5 | 9 | 10 | 65 | | |
| | 22 | −5,5 | 5 | 6 | 70 | | |
| | 24 | −5,5 | 2 | 7 | 71 | | 0,1656 |
| 6. 2. | 5 | −5 | 0 | 0 | 76 | 0,00— | |
| | 8 | −5 | 2,5 | 3 | 80 | 8,00 | |
| | 10 | −4 | 1,5 | 3 | 81 | | |
| | 12 | −4 | 4 | 5 | 79 | | |
| | 13 | −3 | 4 | 5 | 79 | | |
| | 15 | −2 | 5 | 6 | 79 | | |
| | 17 | −3 | 5 | 6 | 78 | | |
| | 18 | −2 | 5 | 6 | 80 | | |
| | 20 | −2 | 5 | 7 | 81 | | |
| | 22 | −2 | 5 | 6 | 84 | | |
| | 23 | −2 | 4 | 6 | 84 | | |
| | 24 | −2 | 5 | 7 | 82 | | 0,1656 |
| 7. 2. | 2 | −2 | 6 | 10 | 78 | 1,20— | |
| | 8 | −1 | 3 | 4 | 87 | 8,00 | |
| | 9 | −1 | 4 | 6 | 89 | | |
| | 10 | 0 | 8 | 10 | 84 | | |
| | 12 | 4 | 6 | 11 | 80 | | |
| | 14 | 6 | 9 | 13 | 86 | | |
| | 15 | 6 | 10 | 13 | 76 | | |
| | 16 | 5 | 9 | 12 | 77 | | |
| | 18 | 2 | 9 | 13 | 75 | | |
| | 20 | 2 | 9 | 14 | 74 | | |
| | 21 | 1 | 9 | 11 | 72 | | |
| | 22 | 0 | 10 | 12 | 72 | | |
| | 24 | 0 | 10 | 12 | 70 | | 0,0828 |
| 8. 2. | 0 | 0 | 10 | 12 | 70 | 0,30— | |

| day | hour | t | A | B | h | not heated | cons. |
|---|---|---|---|---|---|---|---|
| 8. 2. | 4 | −1 | 4 | 5 | 82 | 4,00 | |
| | 8 | 0 | 3 | 3 | 94 | | |
| | 9 | 0 | 4 | 5 | 92 | | |
| | 10 | 0 | 7 | 8 | 88 | | |
| | 11 | 0 | 7 | 8 | 85 | | |
| | 12 | 1 | 8 | 10 | 84 | | |
| | 13 | 1 | 8 | 8 | 85 | | |
| | 14 | 1 | 8 | 9 | 84 | | |
| | 15 | 1 | 9 | 12 | 80 | | |
| | 16 | 1 | 8 | 11 | 81 | | |
| | 18 | 2 | 10 | 13 | 78 | | |
| | 19 | 3 | 10 | 13 | 76 | | |
| | 21 | 3 | 11 | 14 | 72 | | |
| | 22 | 3 | 13 | 19 | 65 | | |
| | 24 | 3 | 12 | 16 | 62 | | 0,069 |
| 9. 2. | 8 | 0 | 4 | 5 | 81 | 0,20— | |
| | 9 | 2 | 6 | 7 | 80 | 8,00 | |
| | 10 | 3 | 9 | 13 | 76 | | |
| | 11 | 4 | 9 | 14 | 74 | | |
| | 12 | 5 | 11 | 16 | 65 | | 0,0276 |

Temperatures given in degrees centigrade. t = temperature outside; A = inside temperature at the spot A; B = = inside temperature at spot B; h = humidity in %; cons. = fuel consumption in cubic metres

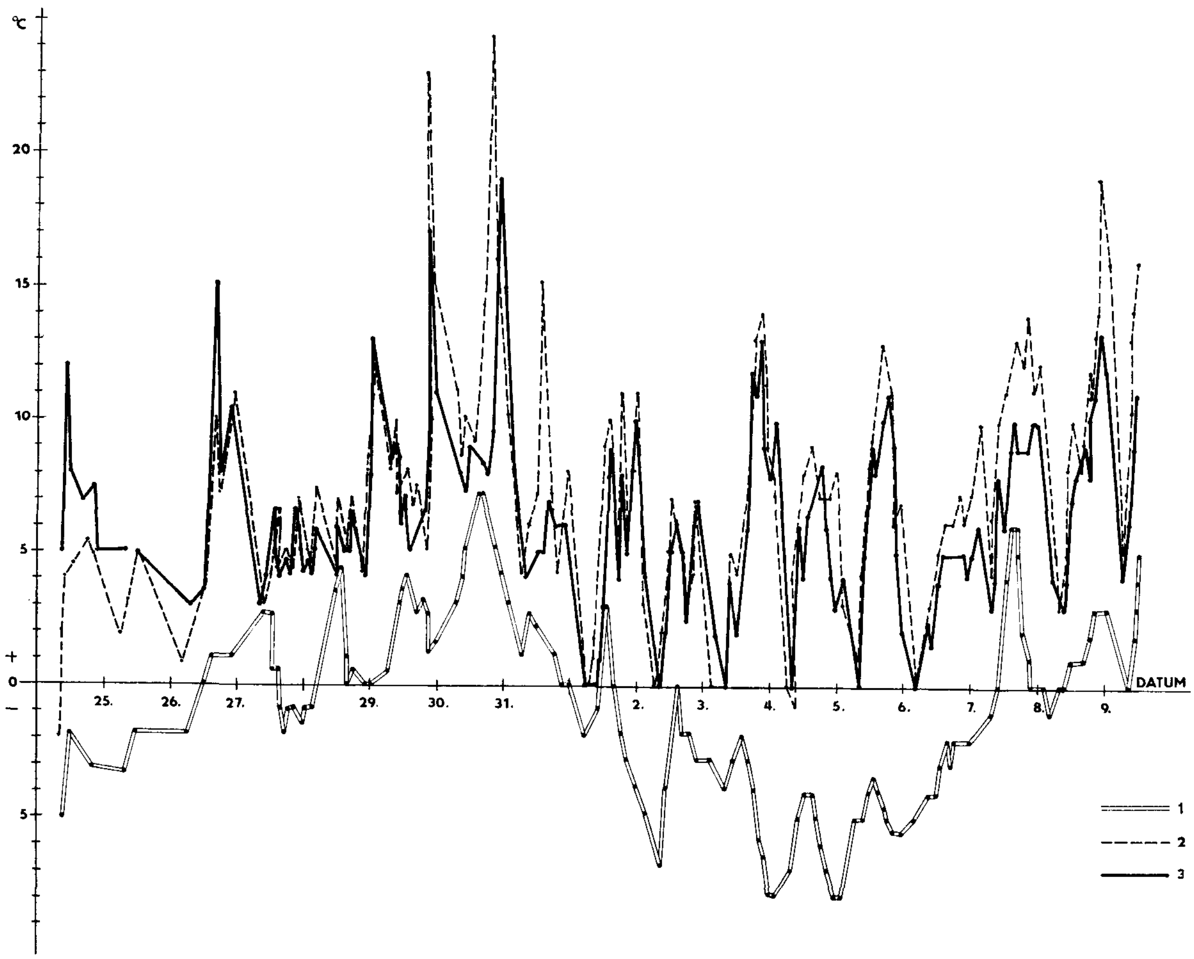



*Fig. 27.* House No. 5. Graph of the sequence of temperatures during the heating experiment of 1982. 1 — temperature outside; 2 — temperature inside at spot B; 3 — temperature inside at spot A.

(day maximum values of 4—7.5 °C), it augmented to extreme values of 17—20 °C. Further observations showing a rather stabilized situation bear out an immediate connection between the inside and outside temperature. In minimum values, the difference between outside and inside of the house wavered between 4—8 °C (Fig. 28). This points out the limited isolation properties of the house which, in temperatures below zero, offered a protection of some 6—7 °C. Intensive heating increased the temperature mostly to values between 7—14 °C, even in rather cold periods of time, which could be sufficient in view of the ancient way of life. Overall fuel consumption in 16.5 days amounted to 1.35 cubic metres, average daily consumption was 0.083 cubic metres.

The experiments of 1983 confirmed, in principle, the observations from the previous season, as documented by the respective graph (Fig. 29) and Table 2. (Data for the 13th February when the experimental groups were changed are lacking.) Inside temperature was measured at one spot only, in the E part of the hut at the height of 120 centimetres, roughly corresponding to spot B of 1982. The heating was more economic so that the daily average of fuel consumption amounts to 0.0725 cubic metres.

The experiment of 1984 was carried out in the second decade of February. This was not a cold period; only at its close fell the ouside temperature below the zero point, oscillating, at noon around 3 °C. This time, the scene of the experiment was house No. 69 heated systematically for the first time.Though hut No. 5 was also heated, this was not going on for the whole experimental period. It was occupied for the first two days, then it was deserted for three days, and only for the forelast day was it heated again (Fig. 30). This distorts the temperature image of house No. 5 as the period of stabilization of the thermic situation is not documented. In consequence of this, it is not possible to compare heating of both houses in 1984; data from hut No. 5 of 1982 are used for comparison. The reason for this limitation was the lack of dry firewood needed before all for house

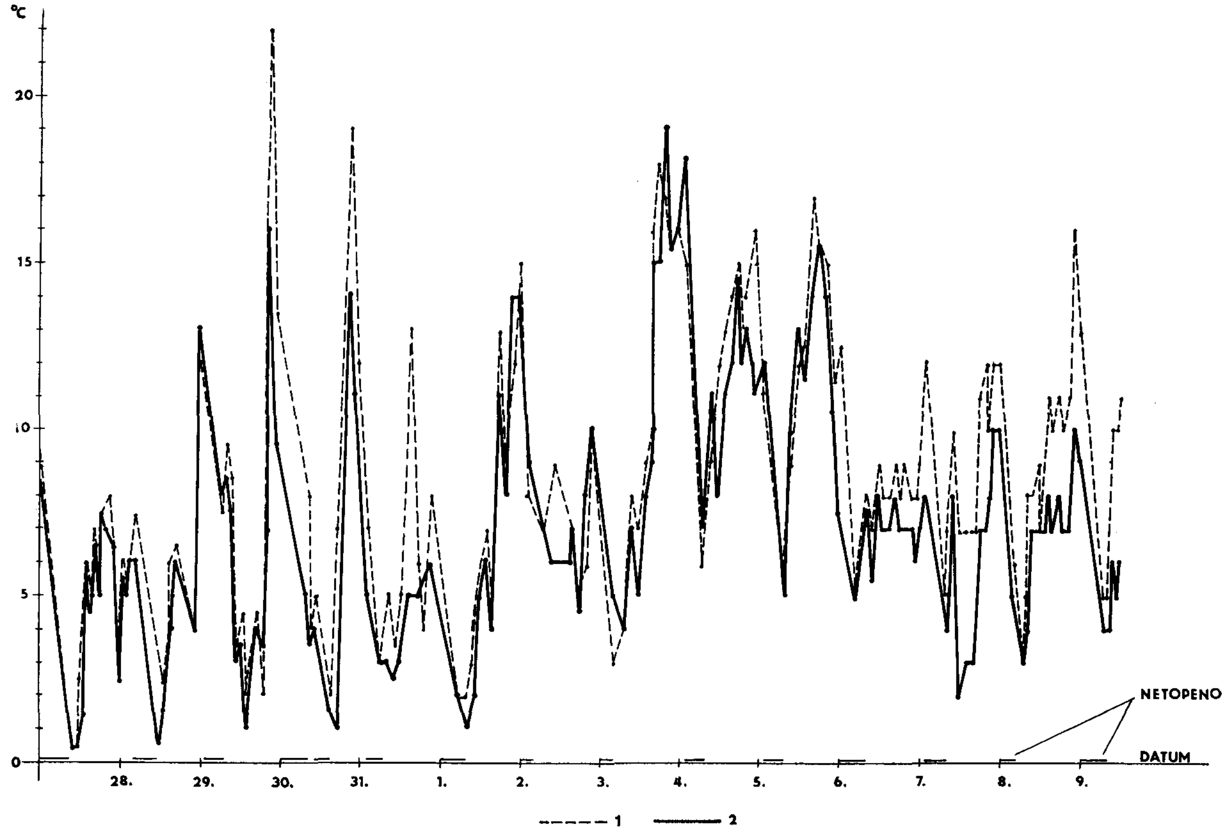



*Fig. 28.* House No. 5. Graph of differences of outside and inside temperatures during the heating experiment of 1982. 1 — difference between temperature outside and inside at spot B; 2 — difference between outside and inside temperature at spot A. Double line on the scale — unheated period.

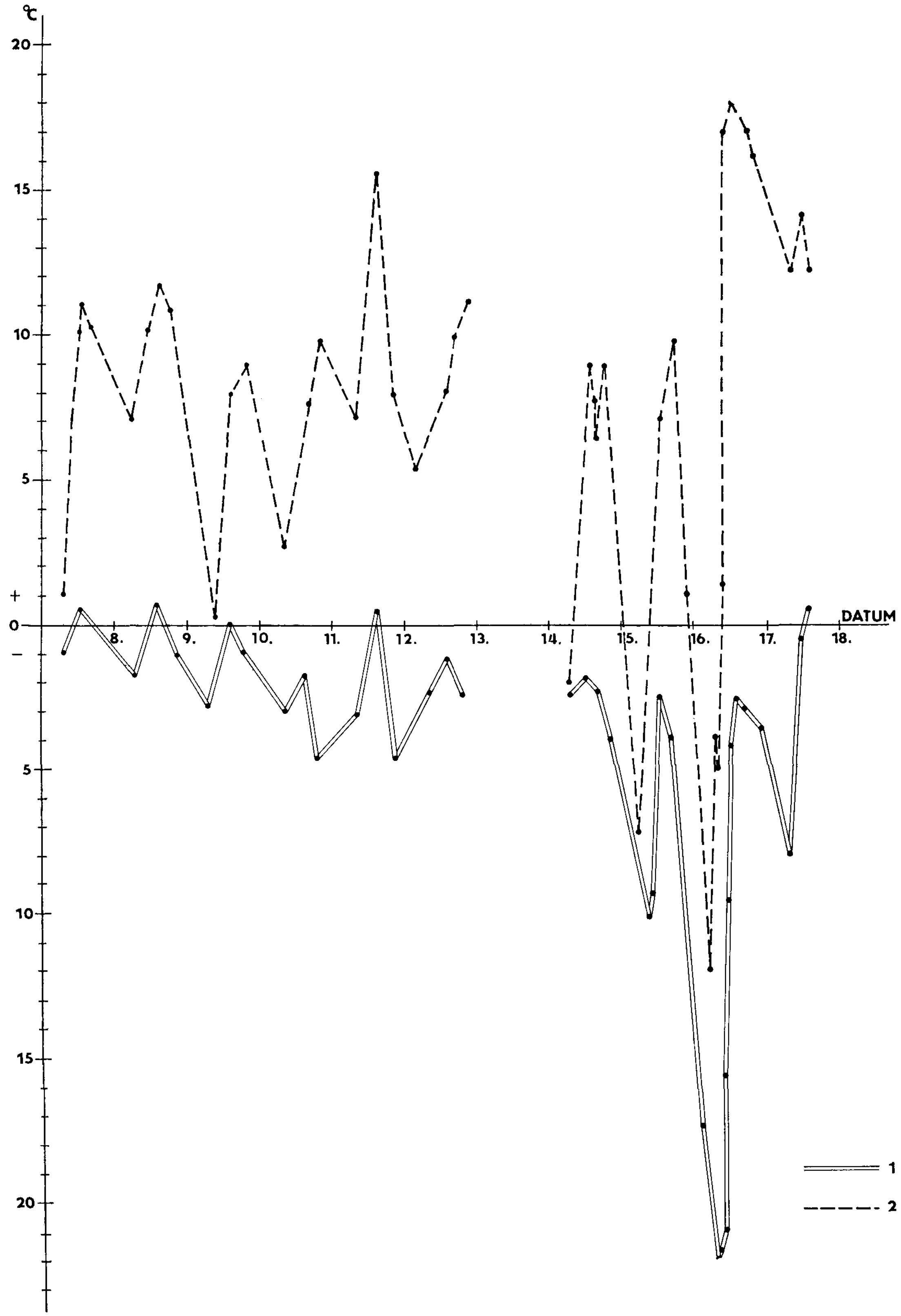



*Fig. 29.* House No. 5. Graph of the sequence of temperatures during the heating experiment of 1983. 1 — outside temperature; 2 — inside temperature.

*Table 2.* Březno. Thermic situation during experiments in the house No. 5 (1983)

| day | hour | t | T | not heated | cons. |
|---|---|---|---|---|---|
| 7. 2. | 9 | −1 | 1 | | |
| | 10 | 0 | 7 | | |
| | 13 | 0,4 | 10 | | |
| | 16 | 0,4 | 11 | | |
| | 17 | 0,2 | 10,2 | | 0,0414 |
| 8. 2. | 8 | −1,8 | 7 | | |
| | 10 | −0,4 | 10 | | |
| | 14 | 0,6 | 11,8 | | |
| | 20 | −1,2 | 10,4 | | 0,069 |
| 9. 2. | 10 | −2,8 | 0,2 | | |
| | 13 | 0 | 8 | | |
| | 19 | −1 | 9 | | 0,0552 |
| 10. 2. | 9,20 | −3 | 2,7 | | |
| | 14 | −1,7 | 7,4 | | |
| | 19 | −4,7 | 9,8 | | 0,0552 |
| 11. 2. | 10 | −3,2 | 7 | | |
| | 14 | 0,4 | 15,6 | | |
| | 20 | −4,8 | 7,8 | | 0,069 |
| 12. 2. | 10 | −2,6 | 5,2 | | |
| | 14 | −1,2 | 7,5 | | |
| | 19 | −2,6 | 10 | | |
| | 23 | | 11,2 | 23,00–24,00 | 0,0552 |
| 13. 2. | | | | | |
| 14. 2. | 9,30 | −2,5 | −2 | 0,00–9,30 | |
| | 13 | −1,7 | 9 | | |
| | 16,30 | 2 | 7,4 | | |
| | 17,30 | 6,2 | | | |
| | 20 | −4 | 9 | | 0,069 |
| 15. 2. | 9 | −10,2 | −7,4 | 0,00–9,30 | |
| | 9,30 | −9,2 | −4,2 | | |
| | 12,30 | −2,4 | 7,2 | | |
| | 16 | −4 | 10 | | |
| | 21 | −17,4 | 1,2 | 20,00–24,00 | 0,1656 |
| 16. 2. | 2 | −22,2 | −12 | 0,00–9,30 | |
| | 6,30 | −22 | −12 | | |
| | 8 | −21 | −3,8 | | |
| | 9,15 | −15,4 | −5 | | |
| | 11 | −9,4 | 1,4 | | |
| | 13,15 | −4,2 | 17 | | |
| | 14 | −2,5 | 18 | | |

| day | hour | t | T | not heated | cons. |
|---|---|---|---|---|---|
| 16. 2. | 17,30<br>21 | −3,2<br>−3,6 | 16,8<br>16 | | 0,069 |
| 17. 2. | 8<br>11,15<br>12,30 | −8<br>−0,5<br>0,5 | 12<br>14,2<br>12 | 0,00–<br>8,00 | 0,0552 |

Temperature measured in degrees centigrade: t = outside temperature; = T inside temperature; cons. = consumption in cubic metres.

No. 69. Two station thermometers were placed in building No. 69, close by the oven at the W wall at the height of 140 centimetres (1) and in the SE corner of the house at the height of 170 centimetres (2), with an additional thermohydrograph at the centre of the E wall at the height of 40 centimetres.

Table 3 and a graph included in the text (Fig. 30) show the course of the experiment. In the first 2—3 days, the participatnts tried to obtain a passable temperature quickly; this is indicated by large intervals between maximum and minimum temperatures inside. The following days brought about a certain "warming up" of the house; the comparison of minimum temperatures outside and inside indicates differences of c. 7—8 °C. The maximum temperature inside the house in those days varied between 15 and 21 °C. The comparison of both houses bears out better isolation properties of bulding No. 69 corresponding to its construction and double-coated roof; even if this house follows the outside temperature, there is a certain delay. House No. 69 was easier and quicker to heat to a bearable temperature than hut No. 5; this is probably due to its considerably smaller dimensions. Moreover, it seems that it was heated more intensively, taking into account the fuel consumption and comparing it to the preceding two stages of heating hut No. 5. During the six days of heating house No. 69, 0.593 cubic metres of wood were burned, bringing the daily average to 0.098 cubic metre.

We had problems with smoke circulation. Smoke was leaving house No 5 both through the two ventilation apertures at the gable tops and through the roof (Fig. 31 : 1). When we lit a fire in a house completely covered with snow, a belt lining the roof ridge melted down and smoke could leave that way (Fig. 31 : 2). House No. 69 had only the ventilation apertures for the evacuation of smoke, which in consequence, had a tendency to stay inside. Most of the smoke was produced in the course of kindling the fire; after this, smoke rose to the height of some 1—1.2 metres above the floor, hanging there as a compact mass and issuing out only in part (Fig. 32). Under favourable conditions (clear weather, dry and good firewood) its level rose higher, was diffused more quickly, and left by one of the apertures or by both at the same time. A rather troublesome circumstance was represented by two window slits for admission of light in the S wall; these let in cold air which held or even lowered the smoke level. It was impossible to close the window slits as in such conditions it would be extremely difficult to breathe in the house. Building No. 69 had better conditions for reaching higher temperatures but was less advantegous as to circulation and evacuation of smoke in comparison with hut No. 5. In principle, both houses required carrying out most of the activities in their lower parts, under the smoke level; we had to sit, kneel, or squat while working. This corresponds to the ethnographic evidence, where, in similar conditions, most of the furniture as seats or benches are low and people move about in the houses bent with bowed heads. We did not succeed in disclosing the manner of regulation of smoke evacuation, though there were certain indications in the course of experiments when we closed one or another aperture under certain weather conditions and direction of wind. We want to follow these questions using a model hut built in the manner of Slavic shelters but of modern materials with detachable components. We want to use this structure for explaining certain regularities of the heating process with respect

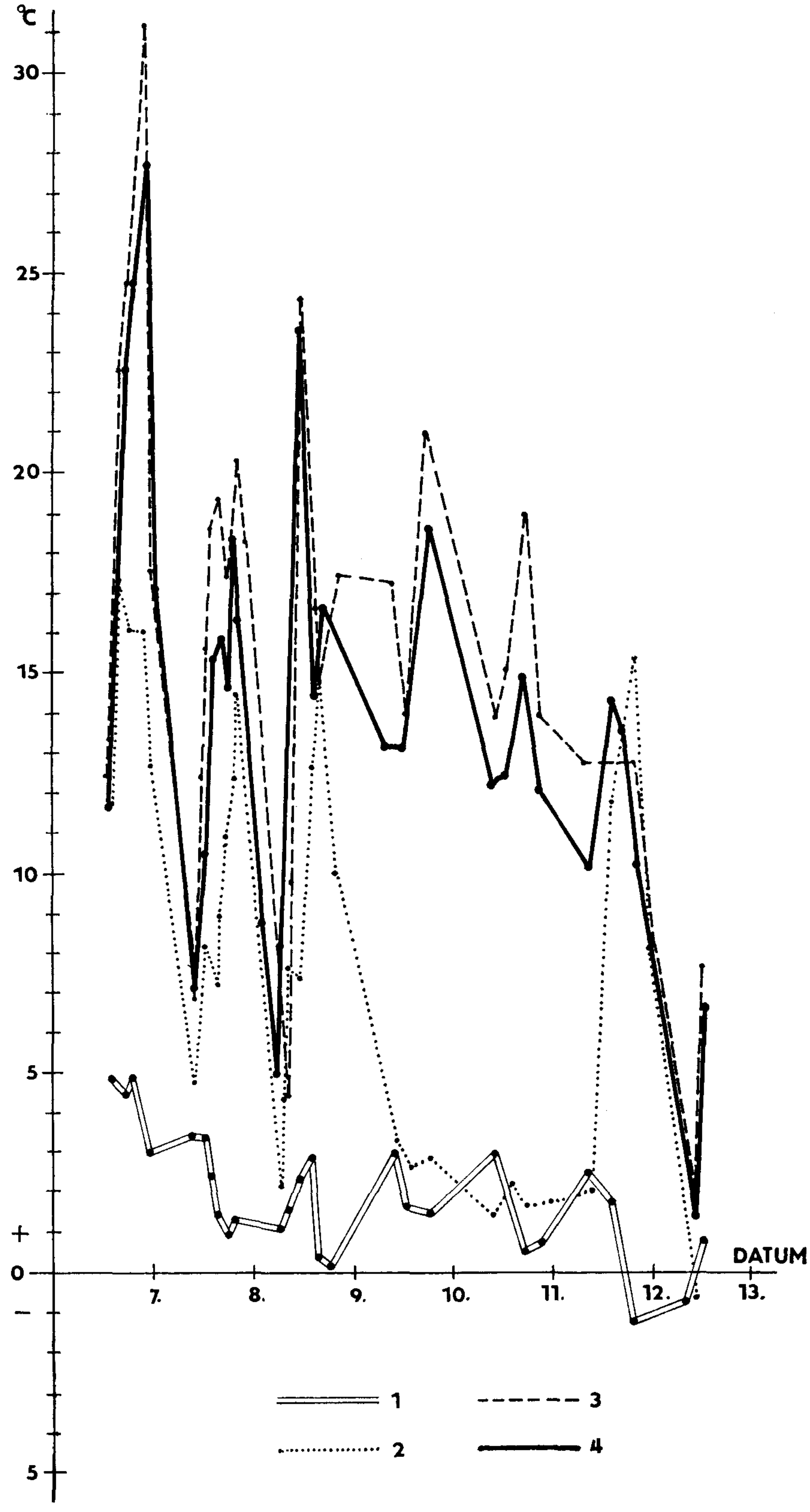



*Fig. 30.* House No. 69, hut No. 5. Graph of the sequence of temperatures during the heating experiment of 1984. 1 — outside temperature; 2 — temperature inside house No. 5; 3 — temperature inside house No. 69 at spot 2; 4 — temperature in house No. 69 at spot 1.

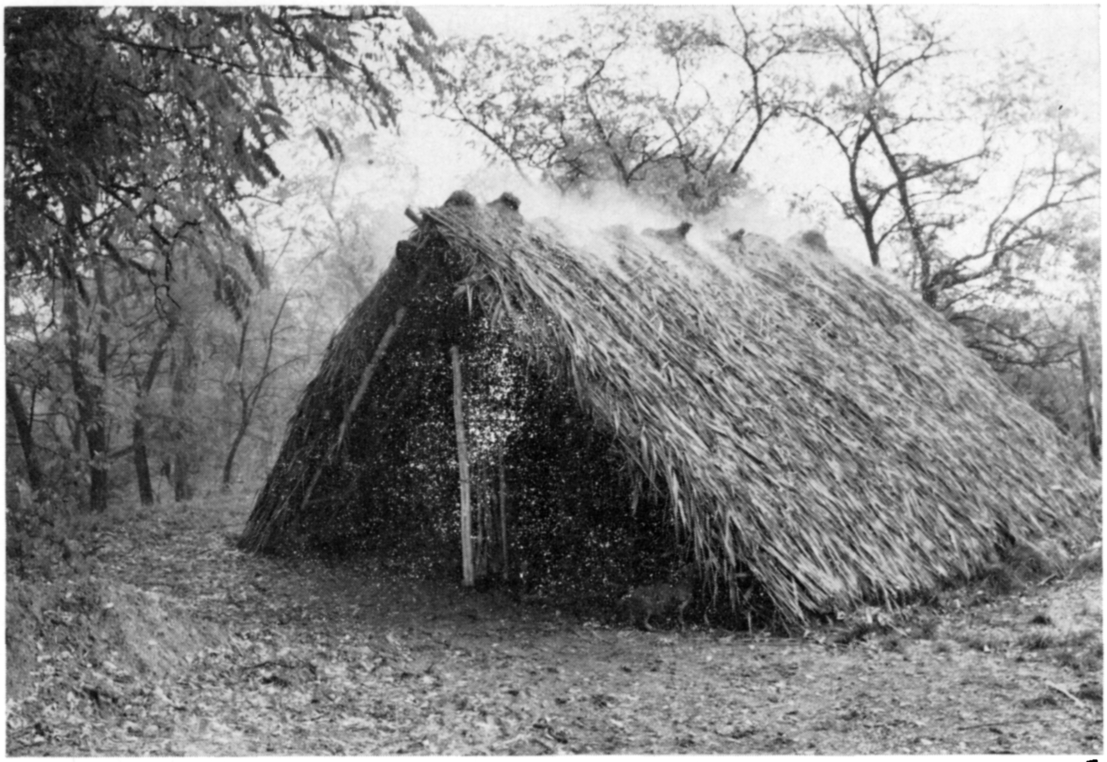
*Table 3.* Březno. Thermic situation during experiments in the house No. 69 (1984)

| day | hour | t | 1 | 2 | not heated | cons. |
|---|---|---|---|---|---|---|
| 6.2. | 15 | 4,8 | 11,2 | 12,2 | | |
| | 18 | 4,4 | 22,4 | 22,4 | | |
| | 21 | 4,8 | 25,2 | 24,8 | 21,00– | |
| | 23 | 3 | 27,8 | 31,2 | 24,00 | 0,115 |
| 7. 2. | 1 | | 17,4 | 17 | | |
| | 11 | 3,2 | 7 | 7 | | |
| | 12,45 | 3,2 | 10,4 | 12,2 | | |
| | 14 | 3,2 | 14,8 | 15,4 | | |
| | 15,30 | 2,2 | 15,2 | 18,5 | | |
| | 17 | 1,2 | 15,6 | 19,5 | | |
| | 18,30 | 0,8 | 14,6 | 17,4 | | |
| | 21 | 1,3 | 16,2 | 20,5 | 21,00– | |
| | 23 | | 18,2 | | 24,00 | 0,124 |
| 8. 2. | 9 | 1,2 | 4,8 | 4,4 | 0,00– | |
| | 10 | 1,5 | 8,4 | 9,8 | 9,30 | |
| | 12 | 2,5 | 23,6 | 24,4 | | |
| | 14,30 | 3 | 14,4 | 16,4 | | |
| | 17 | 0,2 | 16,5 | 15,2 | | |
| | 20,30 | 0,1 | 15,6 | 17,6 | 20,30– | |
| | | | | | 24,00 | 0,039 |
| 9. 2. | 11,30 | 3,01 | 13,2 | 17,4 | 0,00– | |
| | 14,45 | 1,6 | 13,2 | 14 | 11,00 | |
| | 19 | 1,6 | 18,7 | 21 | 19,00– | |
| | | | | | 24,00 | 0,144 |
| 10. 2. | 11,30 | 3 | 12,2 | 14 | 0,00– | |
| | 15 | 1,8 | 12,4 | 15,4 | 11,30 | |
| | 18 | 0,6 | 15 | 19 | | |
| | 22 | 0,8 | 12 | 14 | 22,00– | |
| | | | | | 24,00 | 0,065 |
| 11. 2. | 10,45 | 2,6 | 10,2 | 12,6 | 0,00– | |
| | 15 | 1,8 | 14,5 | | 10,00 | |
| | 20 | −1,2 | 10,7 | 12,7 | | 0,089 |
| 12. 2. | 9 | | | | 0,00– | |
| | 11 | −0,6 | 1,4 | 1,4 | 11,00 | |
| | 13,30 | 0,8 | 0,8 | 7,8 | | 0,017 |

Temperatures given in degrees centigrade: t = outside temperature; 1 = inside temperature at the spot 1; 2 = = inside temperature at the spot 2; cons. = consumption in cubic metres.

to the location of hearth, entrance area, and ventilation apertures and to different orientation towards the cardinal points. The hearth will be mobile and different components will be detachable so that different versions of entrance location will be tested. These observations will be significant for identifying the optimum circulation and evacuation regime for smoke and they may help us in interpretations of archaeological remains in the cases where the entrance area will not be preserved.

The general idea may be completed by reference to the climatological characteristics of the



1

2

*Fig. 31.* House No. 5. 1 — evacuation of smoke through the ridge and upper parts of the roof; 2 — evacuation of smoke through the upper parts of the roof where the snow cover has melted in a strip.

region in which the Březno site is situated. Only data on present-day situation are available; the period of 6th—9th centuries A.D. under consideration here will be slightly different. I will give here no more than an overall review of the temperatures which are most important for our experiments. The data are taken from "Podnebí Československé socialistické republiky — Tabulky" (Climate of the Czechoslovak Socialist Republic — Tables), Praha 1961, tab. 1, 6, 7, 9, 10 and 13—16 and cover the period 1926—1950; the review of the average air temperature is based on a wider array of data from the period 1901—1950. Table 4, included herein, gives the data of the Žatec climatic station as that which is the closest to the site of Březno.

*Table 4.* Žatec. Characteristics of the temperature situation

| month | t | t max | t min | td max | td min | T | S | F | I |
|---|---|---|---|---|---|---|---|---|---|
| I | −1,7 | 9,0 | −14,3 | 0,4 | −4,5 | | | 23,9 | 13,2 |
| II | −0,5 | 10,6 | −13,3 | 2,6 | −3,7 | | | 20,0 | 7,3 |
| III | 3,7 | 17,6 | − 9,5 | 7,9 | −0,8 | | | 17,5 | 1,8 |
| IV | 8,4 | 23,3 | − 3,2 | 13,9 | 3,6 | | 0,5 | 5,0 | 0,1 |
| V | 13,7 | 28,1 | 1,1 | 19,0 | 7,7 | 0,5 | 4,0 | 0,8 | |
| VI | 16,8 | 30,9 | 4,9 | 22,3 | 10,7 | 2,5 | 10,0 | | |
| VII | 18,4 | 32,6 | 8,0 | 24,3 | 13,0 | 4,0 | 14,9 | | |
| VIII | 17,5 | 31,9 | 6,7 | 23,9 | 12,4 | 2,8 | 12,4 | | |
| IX | 14,1 | 29,0 | 2,6 | 20,2 | 9,2 | 0,9 | 5,4 | 0,1 | |
| X | 8,2 | 21,6 | − 3,2 | 12,6 | 4,7 | | 0,2 | 3,5 | |
| XI | 3,1 | 14,0 | − 5,1 | 6,3 | 1,6 | | | 10,3 | 1,5 |
| XII | −0,3 | 9,8 | −14,4 | 1,3 | −3,1 | | | 21,5 | 10,3 |

Temperatures measured in degrees centigrade. t = average air temperature; $t_{max}$ = monthly average of maximum temperatures; $t_{min}$ = monthly average of minimum temperatures; $td_{max}$ = daily average of maximum temperatures; $td_{min}$ = daily average of minimum temperatures; T = average number of tropical days; S = average number of summer days; F = average number of frost days; I = average number of ice days.

The above-mentioned data indicate that the Žatec region, including the site of Březno, represents a region with relatively favourable temperature conditions. It is close to the warmer regions of Bohemia and Moravia such as some parts of the Labe-river basin or fringe areas of the Moravian lowlands.

Experiments with heating Slavic houses have shown that given a suitable fuel consumption, the structures may have been warmed up to a sufficient temperature. Though this is slightly below the modern standard, we assume that it might have been sufficient for the early Slavs due to their different and much simpler mode of life. In a constantly inhabited building, the situation might have been more tolerable. We may perhaps also take into account the "heating effect" of taking in domestic animals (such as sheep or goats). Suitable temperatures were reached in spite of the fact that the isolation of the structure above ground — especially in the case of house No. 5 — was not sufficient. The isolation properties of the huts were enhanced by sinking the habitation space below ground. In the case of house No. 5, this included more than a half of the wall heights and with house No. 69 c. one third.

Calculation of the fuel consumption for house No. 5 in the first two stages of the experiment will lead to a daily average of c. 0.08 cubic metre, in the case of house No. 69 this will amount to 0.10 cubic metre. If the heating were continuous — which we do not assume for the Slavic period — the consumption over the cold period of some 5 of 6 months will rise to 12—18 cubic metres. These figures are included herein only for the sake of a rough idea; we will never know how did Slavic housewives actually warm up their homes, if fires were lit only for cooking or whether the heating lasted longer. Ethnographic data indicate that in the last century and even later, country cottages were practically not heated in the wintertime and fires were lit only for cooking. We may recall that not so long ago, the bedchambers were never heated at night. In estimating the

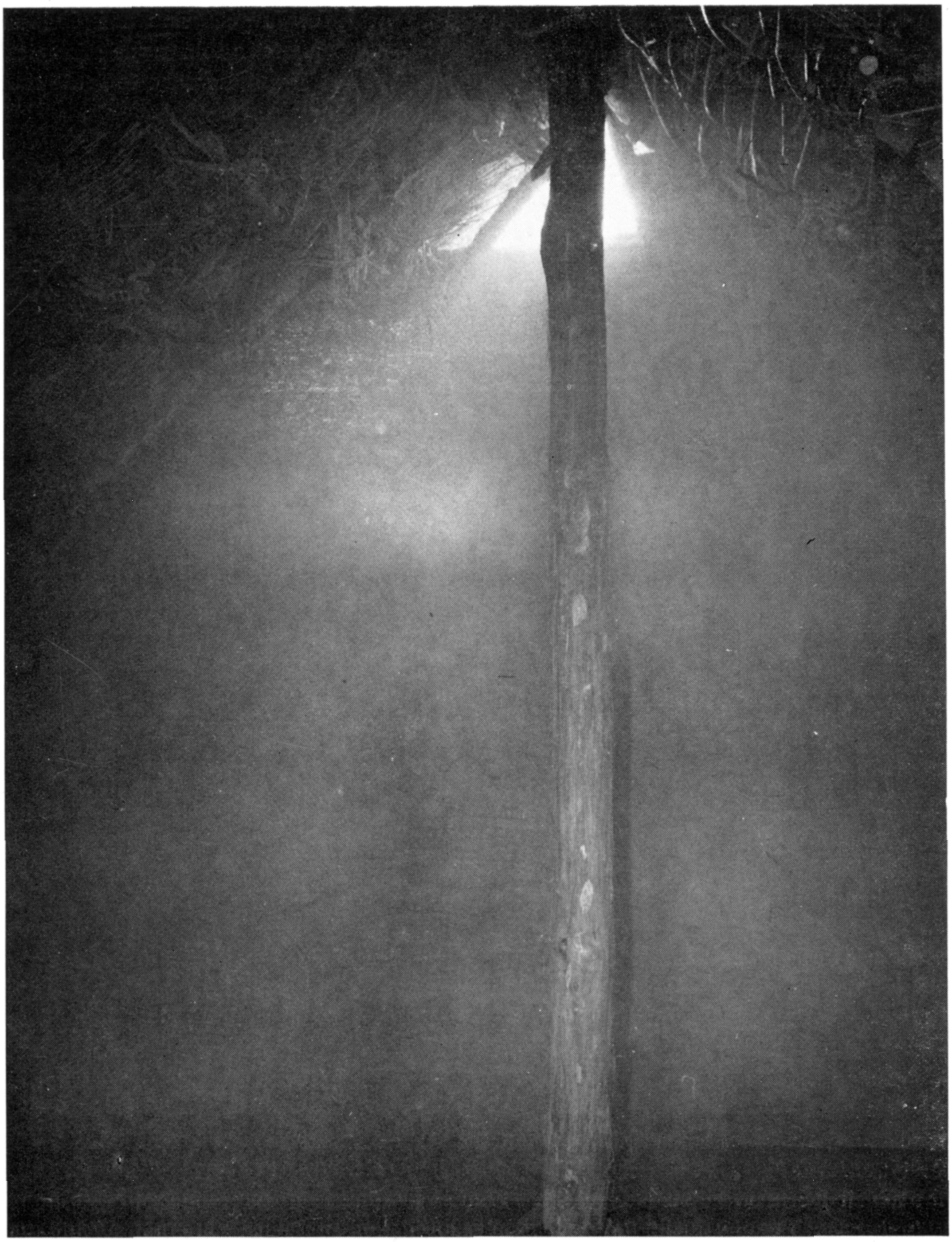


*Fig. 32.* House No. 5. Interior view towards the E ventilation aperture; the veil of smoke is clearly visible.

minimum consumption, we may thus count on the quantity of fuel needed for cooking and baking. Partly — but not completely — this quantity will be contained in the fuel needed for heating. Though the thermic process on of food is temporarily limited, it requires a more intensive fire at a certain stage. Data were gathered during experimental living in Slavic houses. The daily average quantity of firewood used up during this amounted to 0,05 cubic metre for cooking. This represents some 18 cubic metres of firewood per year.

Considerations concerning wood consumption are significant not only for the household fuel but for production purposes as well — such as pottery firing, wood for hut construction, for production of tools and equipment. All in all, this will suggest rather large figures for individual houses. A question pertaining to the prehistoric period in general arises as to the size of a community which could at one time be settled at a single spot without serious interference with the ecological situation.

## Experimental living in a Slavic house

At the end of spring 1984, house No. 69 of the 9th century was inhabited for thirteen days to test the practical properties of Early Slavic houses. A small family of Mr. J. Červinka consisting of both parents and three children aged 3, 8, and 13 years respectively[3] intended to try out whether the house space suffices both for the rest and for the necessary work procedures of such a grouping. This was connected with identification of areas suitable for various kinds of activities carried out inside the house under unfavourable weather conditions, as well as of areas for storage of the necessary equipment. The prerequisite of the experiment was the closest approximation of the activities carried out in the house; the basic component of these was represented by food preparation. We wanted to define the manoeuvring space needed for this, storage space for different kinds of foodstuffs which had to be at hand, capacity categories of vessels and their number required for feeding such a group of people. All this had to be harmonized with the most probable range of food types and with their consumption. We assumed that a substantial role was played by cereal nourishment[4]. We re-opened the questions of heating during this experiment — fires were lit both in the oven and in the hearth in front of it in connection with cooking and baking. In between, answers to various questions of minor importance emerged — of the time needed for cooking, of time for minor maintenance tasks and repairs, and, in this way, of at least an approximate knowledge of the daily routine of the family. We also observed the frequency of damage and destruction of the tools and quantity of refuse during the experiment. Here, however, we will take up the living experiment only at its fundamental level, that is, in connection with spatial exploitation of the house. The whole course of the experimental action with all observations and evidence gathered will require independent evaluation.

## Spatial exploitation of the house and its mobile equipment

The experimental house with an area of 9.5 square metres was provided with a sleeping bench occupying the whole S wall and some space along the E wall (Fig. 33). Central and N parts of the interior were thus available, supposing that the sleeping benches could have partly been used for daily work, especially their edges. All in all, this left a space of some 7—8 square metres for location of equipment and movement of people, after subtracting one square metre for an oven in the NW corner.

The following items were placed in the house and its activity range space outside by the entrance according to archaeological evidence, theory, and analogies to the simplest rural cottages the equipment of which I could study at the Wallachian open-air museum at Rožnov-pod-Radhoštěm, having been completed in part in the course of the experiment: 2 water buckets of wood with capacity below 16 litres, 1 rotary quern mill for grinding grain on a wooden base, vesssels of pottery — 1 storage jar of 20 litres' capacity, a larger vessel of c. 7 litres, two vessels containing 3 litres each, 1 vessel of 2 litres, 4 vessels of 1 litre, a baking plate, 1 bowl containing one litre and 1 corn-drying tray measuring 58 × 47 centimetres. Of wooden items, there were: 2 bowls of the capacity of 1.5 and 0.75 litres each, 1 "vahan" (a kind of wooden dish or tray), 5 spoons, 2 adles, 2 wooden pest-

3. The experimental grouping consisted of Mr. and. Mrs. Červinka from Prague with their two children, and of J. Dragoun, 13 years old.

4. Availing ourselves of the occassion, we staged a simple dietary experiment the guidelines of which — especially in the aspect of calorical consumption — were elaborated by Dr. E. Neustupný, CSc., of the Institute of Archaeology, Prague. The youngest child did not participate in the dietary experiment.

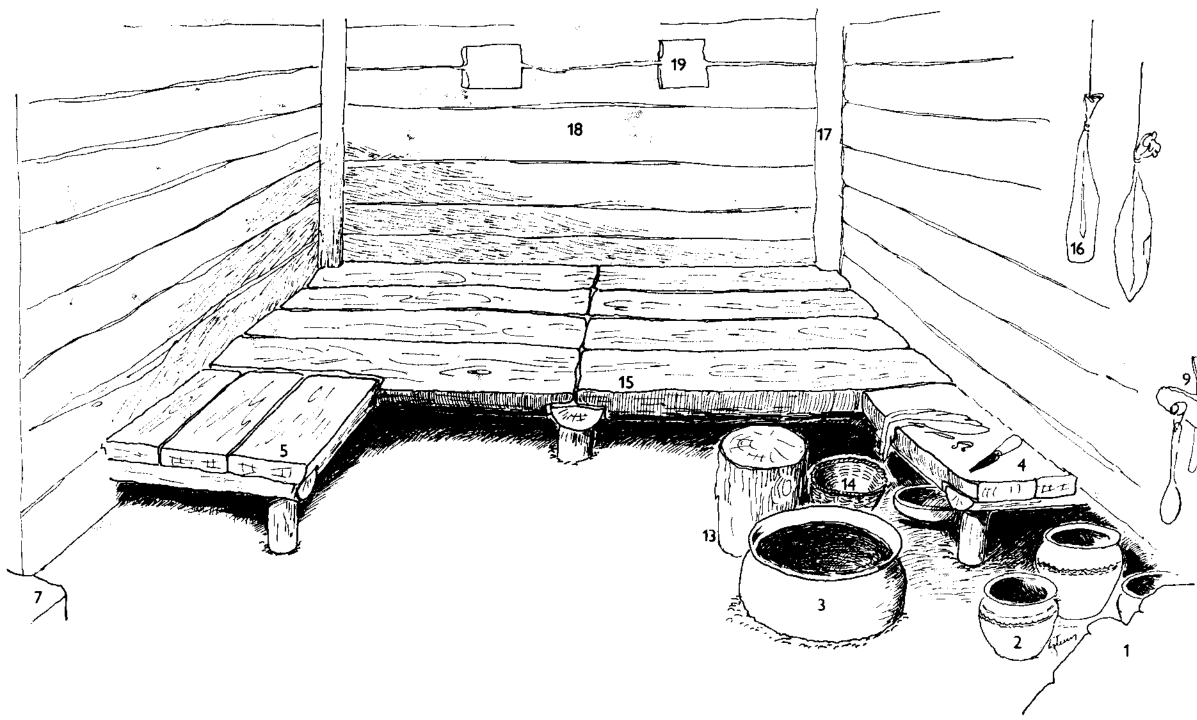



*Fig. 33.* House No. 69. Interior view of the S half of the structure (key at Fig. 36). Drawn by R. Pleiner.

les and 1 wooden mixer[5]. Furthermore, two branched trunks with shortened branches for suspension of various items including vessels (for drying) were placed inside the house and outside at the NE corner (Fig. 34). Both of these were installed during the experiment; they are parallel to those described by *V. Mencl* (*1980*, 49, 111). In the course of the experiment, a holder for spoons, a small wooden board for food processing, a wooden cover of the oven gate, a wooden pitchfork for removal of pots from the fire and 2 smaller baskets were manufactured. The wooden equipment included a small shovel and a mallet; an instrument for spreading flour, a wooden oven-rake and a broom for sweeping the oven were added during the experiment. Iron items consisted of 3 knives, 1 sickle, 1 axe, 1 adze, 1 chisel, 1 auger, and 6 firesteels. There were also flint stones for striking light, cloth bags, a bone needle, and reed mats covering the sleeping benches.

An important adjustment of the interior based on traditions of vernacular architecture was represented by installation of two cross-bars below the roof making up a space for drying logs ("polenice"). Parallel to a transversal round timber joining the posts at the door-frame to the W wall we fixed another transversal timber at the interval of 35 centimetres. In this way we obtained a suitable space for drying wood above the oven gate which could also be used for storage (Fig. 18). A wooden stump brought into the house by experimenting personnel during the procedures served both for work and for sitting.

The original location of tools and equipment was changed but little in the course of the experiment. I enclose herein the final location corresponding before all to female occupations. These were manifested more clearly during the experiment than male activities for which we have not prepared — and, indeed, we could not have — any substantial work schedule. Most of the male activities would anyhow have taken place outside the house, regardless of whether we think about work in the fields, felling trees, or anything else. This, in turn, would require repair and maintenance of the respective equipment which did not materialize in our case. Throughout the experiment, male work consisted of preparation of felled trees, needed for fuel and for incidental minor production activities and repair work. The husband lent his hand to the wife, which, though not

5. Dr. J. Langer, CSc., of the Wallachian open-air museum at Rožnov pod Radhoštěm, kindly made the necessary arrangements for manufacturing of wooden vessels.

*Fig. 34.* House No. 69. Branch with cut-off twigs at the NE corner.

in accordance with past activities, was necessary in the case of some more complicated tasks as corn grinding or kindling of fire.

The fundamental division of the habitation space into the male and female spheres of activity is known from ethnographic sources (*Ränk 1949*, id. *1951*). The experient confirmed clearly the W half of house No. 69 in the function of a zone of female work in connection with food preparation. This represented some 2 square metres available for moving around while working which, however, were sufficient. The wife worked either kneeling on the ground or sitting in the W part on the edge of the bench; in most cases, however, she used a low seat made of a piece of half-round timber. In the daytime, a mill for grinding corn with a wooden base was placed on the W end of the sleeping bench; during the night it rested on the floor by the N wall of the hut. It would certainly have been more advantageous to put it straight under the bench but that was impossible in view of the thickness of the bench timbers. The person who ground grain on the mill was, in most cases, sitting on a low seat or stump. Vessels as measures of grain and freshly ground flour and sometimes also the "vahan" were at hand on a small bench at the W wall. The range of equipment connected with grain-grinding was completed by a jar for storage of corn partly sunk into the earth by the bench. In this way, a space for such work was delimited in the W half of the house at the border of the S and middle third.

Food processing was going on in front of the oven, that is, in the middle third of the W half of the house. Cooking vessels and a water pot were on the floor by the W wall. A simple and flar spoon-holder was fastened on the wall 65 centimetres above the floor; this held spoons, pestles, and a mixer. Cloth bags with flour, pulses, dried fruit, salt, and herbs (spices) in addition to a bag with fire-striking implements were suspended from the "polenice" at this spot. In addition to firewood, this space contained both wooden bowls and the "vahan". Other vessels for occassional storage of foodstuffs such as milk and vessels which could be termed "manipulation receptacles" — for instance, for soaking the pulses in water — were situated farther by the W wall behind the oven (Figs. 35, 36). Worthy of notice is the fact that the floor space behind the oven was cold even if a fire was lit in the oven. I thought that shelves would be needed in the course of the experiment. The practice disproved this assumption as there would have been problems with shelves placed too high for work going on at the floor or slightly higher; if, alternatively, the shelves were placed too low, they would have occupied valuable space. Suspension of tools and utensils from the walls or their location on the floor by the walls proved to be advantageous. Another area well-suited for storage purposes was the "polenice".

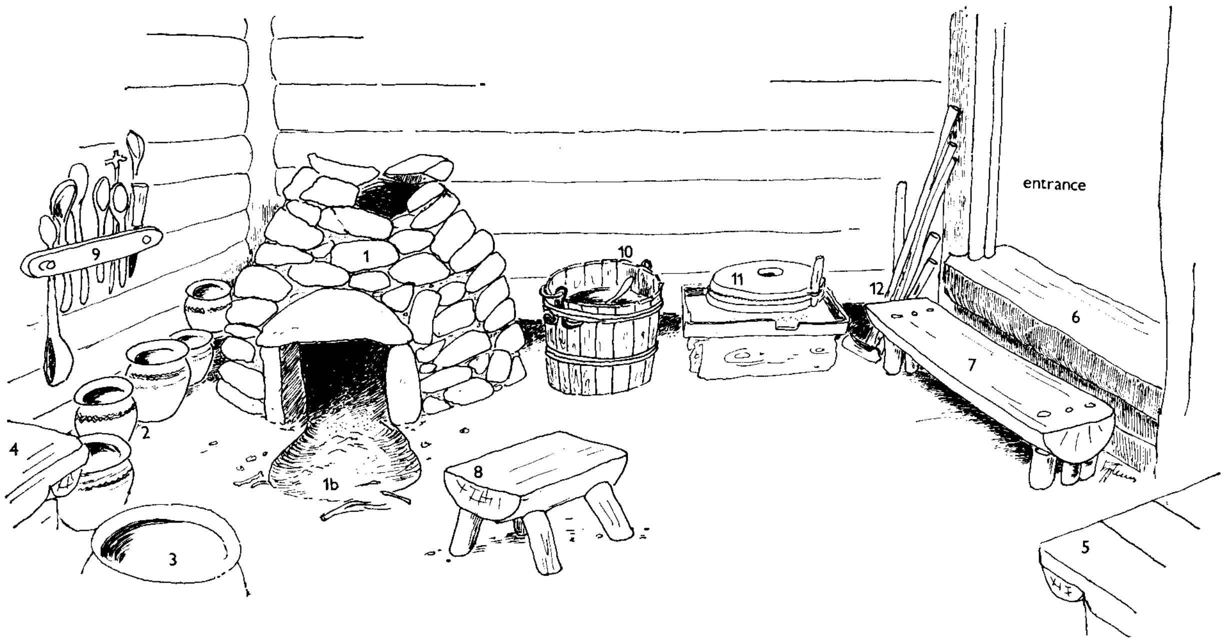



*Fig. 35.* House No. 69. Interior view of the N half (key at Fig. 36). Drawn by R. Pleiner.

The person who was litting the fire could kneel at the oven gate as it was best to set the fire going by blowing on the smouldering grass or straw in the last phase. The wife cooked on a hearth in the oven gate and in front of this; the clay-daubed floor of the oven was used for baking.

As the W half of the house with the oven and hearth represented the female working area, the E part of house No. 69 might be identified as the realm of the male. This was the NW corner and part of the central third of the house, that is, a zone connected with the entrance. The experimental house allowed the husband almost 2 square metres as a work area; edges of the smaller sleeping bench and a step below the entrance might afford some additional space for sitting and deposition of tools. This division of the habitation area corresponds to ethnographic parallels where the male area is usually connected with the entrance parts while the female space is situated more inside the structure (*Bajburin 1983*, 77, 78). The tools — above all, those of iron — were deposited on the floor by the step in the NE corner. Though they were well at hand in this position, they would probably have suffered from corrosion after a longer period of time and their suspension on the walls or driving the axe into wood somewhere seems more probable. At this point, our arrangements probably did not correspond to past reality. Location of a water bucket in this zone — in the NE third by the oven — might seem a bit problematic. Though in an occupied part of a suitable working space, there was s'mply no other place for it, assuming a need of a certain quantity of water inside the hut 'n the wintertime (Figs. 35, 36).

Dur:ng the meals, usually served in two wooden bowls, the family was sitting on the bench by the S wall. Father and mother ate from one bowl and the children from another. The order in

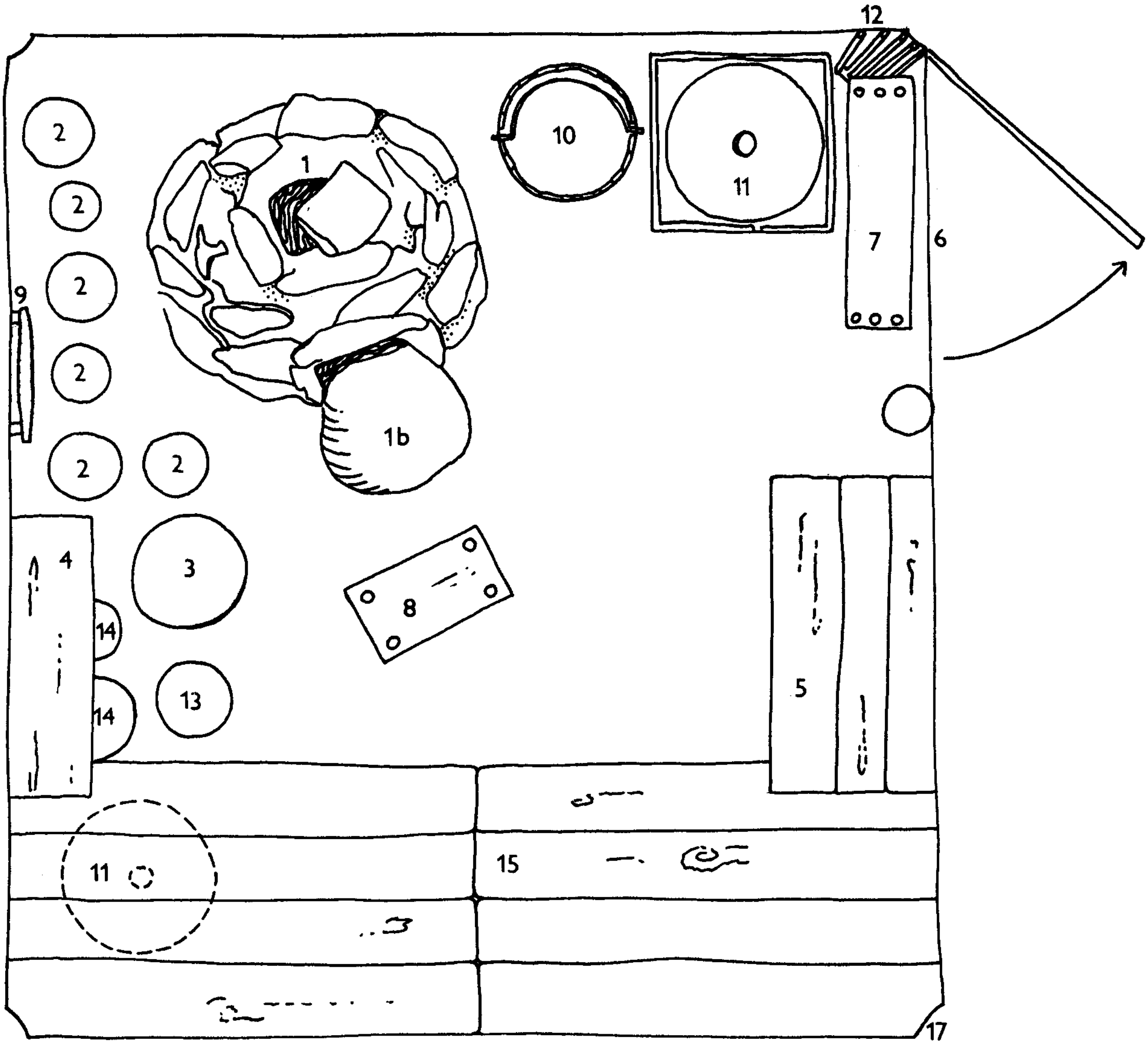



*Fig. 36.* House No. 69. Schematic plan of location of the furnishings drawn by R. Pleiner — H. Houfová. Key: 1 — the stone oven; 1b — a hearth at the oven gate; 2 — free- standing vessels; 3 — a storage jar partly sunk in the ground; 4 — a side bench; 5 — a narrower sleeping bench; 6 — entrance; 7 — a step; 8 — a low seat; 9 — spoon-hanger; 10 — water bucket; 11 — rotation mill (full circle — overnight location, dashed circle — day location); 12 — tools; 13 — stump; 14 — basket; 15 — a wide bench — the principal bed; 16 — suspended bags; 17 — corner posts; 18 — a wall of half-round timbers; 19 — window slits cut through.

which the family sat down emerged by itself and was gradually fixed. The mother was sitting on the W end of the bench, the father at her side, and the children on the E end.

Both benches were by their dimensions fully suitable for rest and sleeping. Both parents with the infant child occupied the wider bench by the S wall while the other children slept on the smaller bench at the E wall. There is even a possibility that the overall area of 3.5 square metres singled out for sleeping may be slightly overestimated, as all the members of the family used sleeping bags during the experiment, occupying thus more space, and, moreover, the height of both parents surpasses markedly even the present average. If some 0.5 square metre were subtracted from the ares needed for the benches, the free space at the centre of the hut could be enlarged.

## Activity-range space by the house

It has been observed that activities outside the house connected with living and working inside were concentrated to belts along its two walls. This concerned before all the E side with the entrance, and, to a lesser degree, the S side by the SE corner so that an overall inclination to the entrance area is visible. The range of intensive utilization of the adjacent space did not surpass the width of 2 metres.In addition to some kinds of work and deposition of several objects, this was the area in which the children were to be found most frequently. The area along the W side of the house was not used. The N side where the roof leaned on the ground served as shelter for firewood. Even without this, however, it is hardly likely that the family were much active in this area.

The family sat, worked, and rested, sometimes even ate, at the E wall (partly also at the S wall); the mother may have washed dishes there.The second water bucket was to be found here. The trunk with hewn-off branches 170 centimetres high and serving for suspension of used vessels for drying was sunk into the earth at the NE corner.

A small cooking hearth was established outside the house, 7 metres northwards from its NE corner. Its location was defined by the adjacent experimental hut No. 5. No systematic activities took place here as we wanted to imitate winter conditions, concentrating all the activites inside the house.

## Heating, fuel consumption, ventilation, and lighting

Due to the outside temperatures at the end of May and beginning of June, heating was superfluous and fuel consumption corresponded to the needs of thermic procession of food. Three and exceptionally two meals per day were cooked. There are no data for two days of the experiment. Throughout the other eleven days, fire was kept for cooking and baking for the overall time of 52.5 hours (daily average of c. 4 hours 45 minutes), for which 0.62 cubic metres of firewood were needed. Comparison with the hourly average of fuel burned to heat the houses in winter experiment phases shows that the quantity of firewood needed for cooking and baking is substantially higher — almost three times as much. The explanation may be sought in the intensive effort to reach the desired temperature.

When the wife was cooking on a hearth situated in front of the oven gate, combustion and smoke circulation were facilitated by opening the top aperture of the oven. However, fire was going on even if the top aperture was closed, as this was a closed oven (cf. supra). For baking such foods as e.g. unleavened bread in the pre-heated oven, it was naturally advantageous to close both the top aperture and the gate.

Both dislocation and dimensions of ventilation apertures and window slits of house No. 69 were conceived wrongly, as was manifested in the heating phase of the experiment. Both triangular ventilation apertures in the end sides under the ridge pole proved to be too small during the winter heating procedures and were enlarged even before the living phase, the S one to the extent of 20 square decimetres, the N one to 12 square decimetres. Further removal of sticks and twigs was difficult. Smoke evacuation was slightly better afterwards. The window slits were located too high in the S wall of the house; not enough daylight was coming in and there was a negative impact on smoke evacuation. Their location was result of a compromise solution by which I attempted to adjust the window positions of the original project. Though the properties of house No. 69 with respect to air circulation and smoke evacuation are not good, the family could heat the house, cook and bake therein. It was advantageous to leave the door open except on the days of strong E wind; this, however, would be unpracticable on winter days. When the firewood was dry, there was little smoke; kindling of fire always produced a veil of smoke hanging relatively low above the floor. The mother was most afflicted by smoke and shed bitter tears frequently. Nevertheless, even this limited exposure period produced a certain resistivity formed by habit, as was indicated by comparison of the reactions of those who were new to the project with reactions of the experimental family.

The amount of daylight penetrating into the interior by both window slits in the S wall is very limited, especially in cloudy weather periods. Nevertheless, a habit of working even in such conditions may be formed. No artificial lighting (such as torches or oil lamps) were used during the experiment, firstly because, as a matter of fact, it was not necessary in springtime, and secondly because we had no clear-cut ideas about the ways and means of employing these devices.

*Fig. 37.* House No. 69. Striking fire with a firesteel during the living experiment.

Main activities carried out within the house

These include kindling of fire, grinding of grain, cooking and/or baking in adverse weather conditions or in winter.

Kindling of fire

The basic sequence consists of three phases: fire-striking — catching of the spark — ignition of fire. This was carried out by Mr. J. Červinka who acquired a certain skill by repeated exercise. For the first phase we used lyre-shaped fire-steels corresponding in shape to those found at the Devínska-Nová-Ves cemetery (*Eisner 1952*) and pieces of Baltic flint collected at the coast of present-day German Democratic Republic (Fig. 37). Striking sparks was not difficult but catching them presented certain problems. Ethnographic parallels (*Plessingerová 1962, 1963*) and informers (in our case recruited from among re-emigrees from Wolhynia) indicate several possibilities: the spark may be caught in touchwood, wood tinder, textile fabric, or its thread. In his late mediaeval Herbarium, *P. Mattioli* (*1929 edition*, 695) suggests also bunches resembling whitish cotton which occur at the roots of colt's foot[6]. This is a plant called "podběl" in Czech (Tusillago Farfara L.). We tried out touchwood and wood tinder. Both substances offer the advantage of keeping the spark smouldering whereby subsequent manipulation in setting dry grass ablaze by blowing is enabled. Touchwood must be adjusted before by immersion in muck or by boiling in ash lye and by subsequent drying and beating. We have used alternatively muck-bathed touchwood, touchwood boiled in ash lye, or simply touchwood boiled in water and dried. No substantial differences have been observed. I have not managed to get such details as, for instance, the length of the immersion period. Touchwood collected from foliate trees in the vicinity namely Phellinus igniarius[7], was employed. It was observed later on that most of these were mature pieces unsuitable for our purpose. This may be the reason why we did not succeed in catching the spark freshly produced into the tinder. The same problems turned up with wood tinder, though we succeeded once in catching the spark directly. This led to inclusion of tinder of burnt fabric into the sequence; the spark was caught in this and transferred to touchwood or wood tinder. This interlude, of course, does not correspond to ancient behaviour. The third, ignition phase, presented problems as well, especially at the beginning of the experiment. Later on, we managed to set dry grass on fire by means of smouldering touchwood without major difficulties. In the first days, 15—20 minutes were needed to light a fire; later on, this time was shortened to about half that length and, in favourable circumstances, when all the substances used were dry, a fire was ablaze in 5 minutes. During the daytime, fire could be frequently re-kindled by blowing on glowing charcoal pieces in ashes; in the mornings this was exceptional. Even the short experimental period indicated that skill and swiftness in lighting a fire is a matter of practice; Slavic housewives surely needed a minimum of time for this. The necessities for kindling fire, however, had to be kept absolutely dry. Though we kept both tinder and grass in the house by the oven or on its dome, they were both influenced even by external environmental conditions — fog, for instance.

## Corn-grinding

We availed ourselves of the services of an original Slavic rotary quern set of a diameter of 43 centimetres from the site of Mikulčice. This was lent to us adjusted and with all accessories by Dr. M. Beranová, DrSc. (Mrs.) of the Prague Institute of Archaeology. A rope was tied tightly round the runner and a vertical side handle of wood was inserted between the rope and the stone and fastened there. The central orifice of the runner stone contained an axle positioned on top of a wooden tenon of the nether stone. In the course of our experiment, the mill was equipped by a wooden base board with elevated edges. The elevations were interrupted at one spot to allow sweeping of flour into a receptacle. The nether stone must have been immobilized by wedges.

We ground rye and wheat. If a finer flour was desired, it was necessary to feed small quantities of grain into the central orifice and grinding was more difficult as the grinding surfaces of stones were closer to each other. In addition to fine flour there was always a certain proportion – say one third — of coarse flour. This, of course, could be recycled to get finer flour. In measuring the losses during grinding, we arrived at a value of 4%; this corresponds to modern norms allowing no more than 4% of grinding losses in mills.

For a day of an exclusively cereal menu, the experimenting family needed 1.7 kilograms of flour. At first, the mother needed almost two hours to grind this quantity of flour; later on, this time was slightly shortened. This time limit cannot correspond to past reality. Even if we neglect the skill of Slavic housewives acquired by practice, the fact was that we used a worn-out set of original (archaeological) millstones with almost smooth working surfaces in the experiment. Mr. F. Mrázek, a master miller of the town of Louny, whom I asked for advice, pointed out that this fact exercises a major influence on both performance and time within the range of c. 50%. According to his own experience, the estimate of the time needed for grinding the above-mentioned quantity of corn in the manner applied in the experiment could move around 30 minutes.

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6. Communication of Ing. Z. Tempír, Institute of scientific and technical informations for agriculture, Prague. It is interesting to note that the traditional Czech name of this plant — „koňské kopyto obecné“ (Mattioli's Herbarium, 1929 edition, 695) corresponds exactly with the denomination in English.

7. Determination by Ing. Kunc, Mycological service, Prague 1, Karmelitská St.

## Cooking

There were no problems either with cooking in pottery vessels both in the house on the earth by the oven gate and on an exterior hearth, or with baking in the oven build of stones. We assumed that within the diet of early Slavs, cereal components played a major role. Together with the fact that procession of foods of this type is more complex than the preparation of meat and, consequently, more demanding in terms of space and equipment, this led us to a programme of eleven experimental days with "cereals only" menu while meat was served on two days.

"Cereals only" diet consisted of soups, sweet and salted porridges of wheat and rye flour, lentils, peas, and eggs. We used salt, honey, dried fruit, and onions; lard and bacon were the sources of fat and herbs collected in the vicinity served as flavouring. Milk was an important addition. The mother baked unleavened bread of rye and wheat flour and, on two occassions, she confected small round loaves of bread. Meat was either roasted on a flat stone laid at the edge of the oven or boiled in a larger vessel.

Pots copying Slavic pottery both in shape and in size were used in thermic procession of food. Composition of the pottery paste was not authentic; we used the heavy loamy clay of Březno tempered — according to a rough estimate — by fine sand. The clay of the pots imbibed water if it was poured in but the liquid was not oozing out. The pots were put straight into the fire during cooking (Fig. 38). Contents of all the pots had to be mixed frequently as the cooking was mostly carried out at the hearth by the oven gate so that only one half of the pot was usually exposed to fire (Fig. 38 : 2). This, however, did not matter much; in ten minutes, soups or porridges reached the boiling temperature much as if the cooking were done on an exterior hearth where the pots were exposed to fire completely. The time required for the cooking proper corresponded to modern conditions of cooking on gas or electricity. The vessels of clay conserved heat and substances were boiling in them even after the pots had been removed from fire (Fig. 39).

The experimenting family found out that pots of the intake of 3 litres were most suitable for cooking soups and porridges. A seven-litre intake pot was used for boiling pulses though it seems that a five-litre pot would do perfectly well; such a pot, however, was not available. One-litre pots served as containers for milk and for manipulation — water was poured into the cooked foods from them or they were used for soaking flour. Pulses were immersed in a pot of three litres. A pot of two litres was used for milk fermentation. Most frequently used, and consequently also most practical, were one-litre and three-litre pots.

The evidence gathered during the living experient tallies with theories of division of single-room Slavic houses which I have put forward in the analysis of Early Slavic huts at Březno in relation to ethnographic parallels (*Pleinerová 1975*, 47, VII : 1—6). In the experiment, the division along the longer axis separating male and female space was visible; however, even a transversal division into a better and a worse part with a so-called holy corner in a diagonal position to the oven could be applicable to the experimental house No. 69 (*Ränk 1951*, 24). No concrete traces of such a division were retrieved by excavations and they are hardly likely to be expected. Ethnographic evidence indicates that it might have been visualized by differing layout of the floor — partly of earth and partly paved with wood; in other cases, division lines were visualized by the ridge poles and by cross-beams above ovens connecting both walls (*Ränk 1951*, 30, 39). Living in the experimental house showed that the available space was sufficient both for the rest and for the work of a small family, provided that it was divided and that certain activities were assigned fixed places.

For the fundamental activity of cooking — including preparatory work, storage of foodstuffs, and serving of meals — the crockery available in the house was sufficient. This included 11 vessels of pottery and 3 of wood. Ancient Slavic households might have had more vessels but this quantity was sufficient. That is in contrast with the ideas of *I. M. Kravčenko* and *M. L. Strunka* (*1984*), on which the reconstruction of the interiors of Slavic huts carried out according to finds from the site of Obuchov II were based. The authors reckon with 29 pottery vessels in the case of house No. 6 at the site (*Kravčenko — Strunka 1984*, Fig. 7). In fact, no more than six vessels have been found in the

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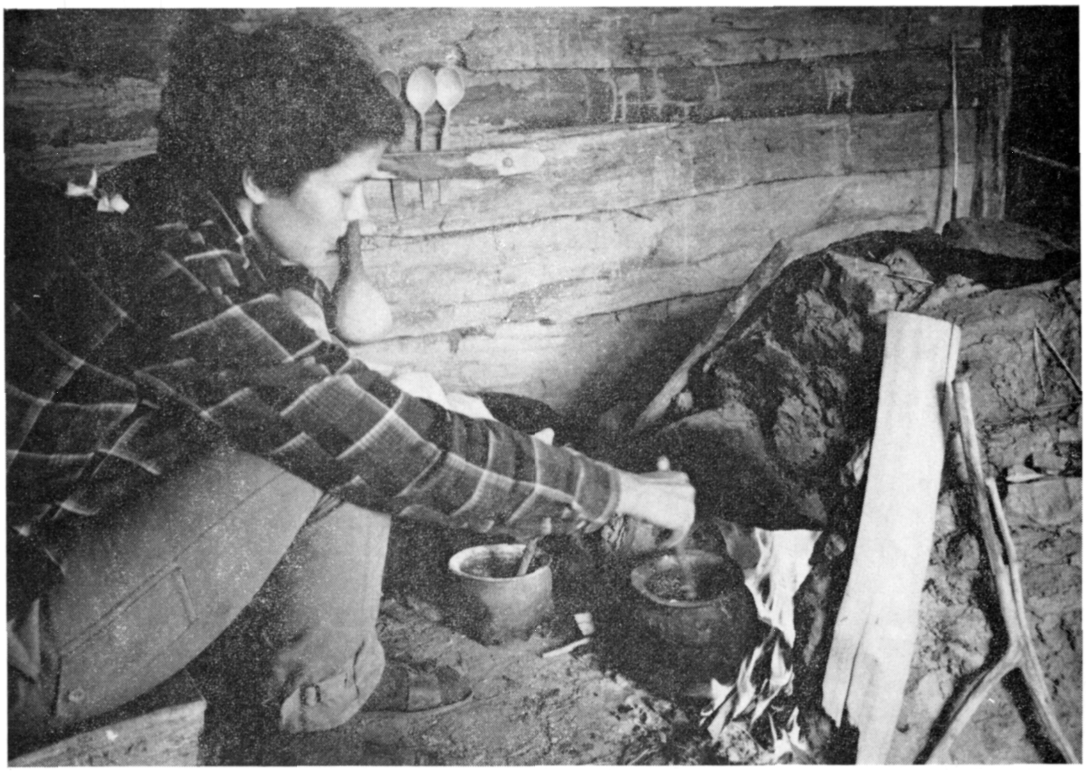

2

*Fig. 38.* House No. 69. 1, 2 — cooking on the hearth at the oven gate.

*Fig. 39.* Removal of hot vessels from the outside hearth.

original position on a low loess bench along the front side of the house while the other 23 items are represented by sherds and fragments from the hut filling only and they may not be in connection with the original furnishings of the house — or rather with its inventory in a given and discrete time segment[8].

As for the capacity of vessels, a five-litre pot was not available during the experiment. All the other crockery, prepared according to a rough estimate of the inventory of Slavic huts excavated at the site of Březno, fulfilled the needs of the experimenting family in a satisfactory manner. The

8. The contribution by N. M. Kravčenko — M. L. Strunka (1984), though some of its reconstruction details have escaped the enclosed documentation, takes up functional division of the interior of Slavic habitation shelters. In this aspect it is inspiring and it corresponds to our observations.

higher frequency of use of three-litre and one-litre pots is interesting and will have to be compared with intake categories of pots on individual Slavic sites. (It is hardly likely that much evidence could be obtained for individual houses as the find groups are frequently limited in numbers and, moreover, most of the finds are from fillings which may not represent inventories of the respective houses.) This would require statistical testing of frequencies of certain vesssel capacities. Measurements of the pot intakes have been carrried out but the goal was different — explanation of the system of hollow measures derivable from Slavic pottery vessels was sought (e.g. *Marešová 1980*; *Bialeková — Tirpáková 1983*). It is difficult to utilize these data for our purpose. Hollow measures were studied by *B. Gramsch* (*1977*) according to finds from the walled site of Tornow. He defined intake categories of pots and followed the frequencies. The most numerous categories were — in addition to small vessels — Class II consisting of vessels containing 0.85—1.25 litre, and Class III including those of 1.90 to 2.75 litre (*Gramsch 1977*, 355, 356, Abb. 2; 4). Gramsch's Class II corresponds to our experimental evidence and to preliminary observations of the Březno finds, while there is a certain difference against Class III which is not so numerous. In general, however, the conclusions are similar enough. This implication of a degree of identity is rather surprising as two completely different milieus requiring quite different functions of vessels are being compared. The primary purpose of the Tornow vessels is assumed to have been the storage of foodstuffs. Some of the pots might therefore have served as measures while the village demanded common everyday use of the pottery in households with only a part of the whole group being employed for storage.

The experiment yielded evidence for storage and conservation of foods requiring low temperatures such as milk, fats, or meat. A sunken-floored feature offered favourable conditions as the floor and the adjacent air layer had quite similar storage properties as underground storage cellars which were thus not necessary for common everyday use. The situation would be different with a greater quantity of foodstuffs which would have to be conserved for a prolonged period of time.

## Repairs, additional adjustments, and present state of the experimental houses

On two occassions we had to repair the clay daub of the roof ridge of house No. 5. We also had to fix the filling sticks of the door which, after drying, were not fitting to the door frame. The repair did not help and the same problems re-emerged; this time, the door was made as a frame filled with dense wattling of willow twings (Fig. 40 : 1).

In the heating experiment, it was observed that the edge parts of the pebble-paved hearth were damaged by sweeping off the ashes. This pointed to the need to delimit the hearth in some way. No delimitation — as, for instance, one of stones — was observed in the archaeological record; for this reason we chose a manner which could also have been used on rectangular pebble hearths of Viking sites (such as Hedeby; *Graham-Campbell — Kidd 1980*, 76, Fig. 4, 32), that is, a frame of thinner round timbers daubed with clay (Fig. 40 : 2). Similar hearth delimitations were observed at Gdańsk (*Barnycz-Gupieniec 1974*, Pl. XXIX). This was at first sufficient, but as time went on, the round timbers were burnt through at some spots.

The clay daub of both interior and exterior walls stuck on but crackled. After the first winter, seven months subsequent to the erection of the house, the walls were plastered over on several spots with clay and the whole E wall where the clay daub crackled most was re-daubed with a more liquid suspension. No other repairs were necessary up to now. The only case of an obnoxious effect was observed at the bottom of a wall of house No. 5 in the inner sunken space, where the daub of clay is in contact with soil humidity. The daub flakes off there in a low layer above the floor. This does not take place in the area in which the walls are warmed up by fire, neither does it occur outside where the clay daub rests on sods.

House No. 69 required repair of covering. The straw which was not properly thrashed attracted mice which damaged the thatch substantially in the wintertime. We were unable to carry out the repair perfectly; moreover, we realize that the thickness of covering amounting to almost 20 centimetres in the case of house No. 69 and even thinner in the case of house No. 5 does not correspond

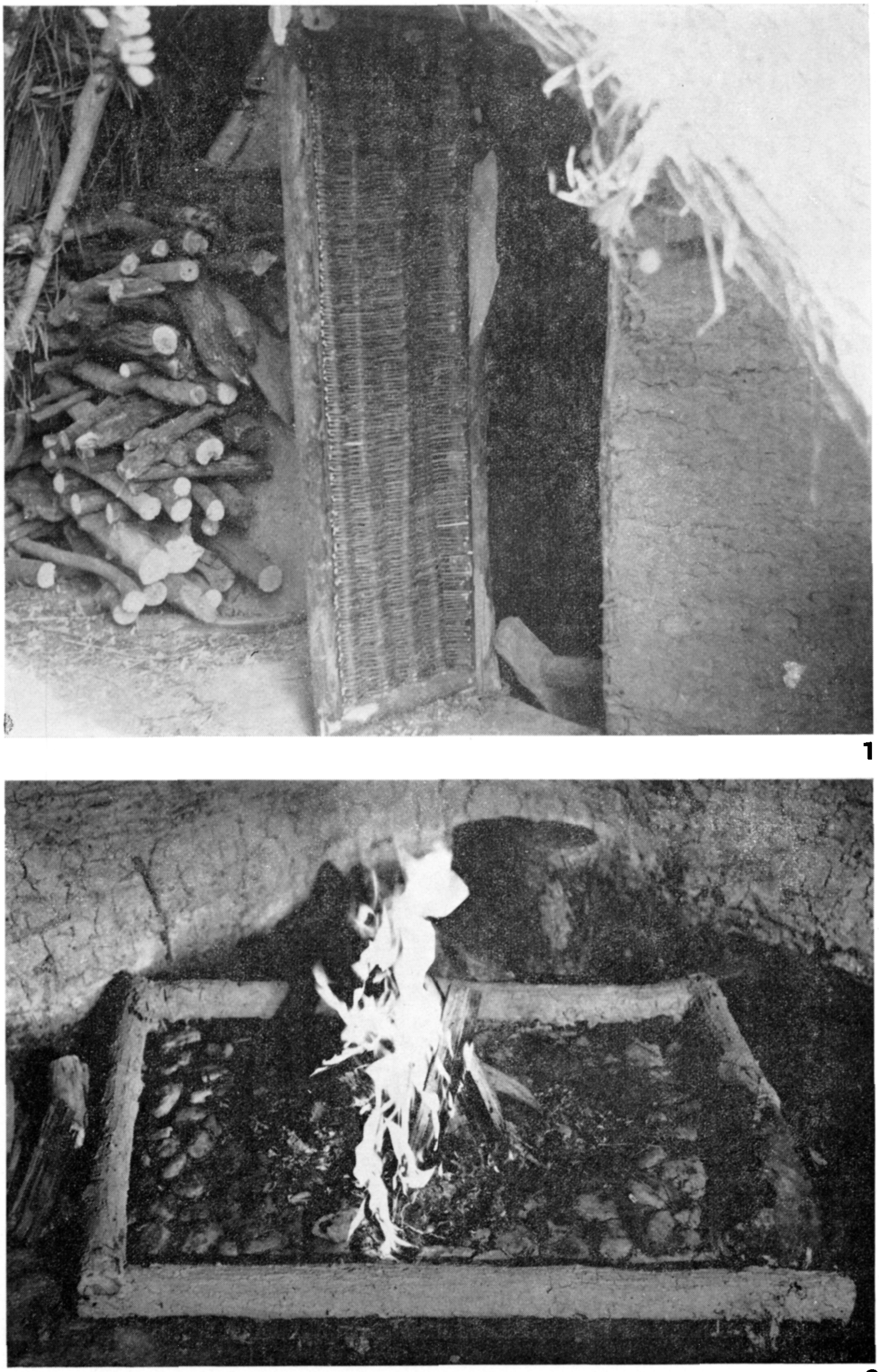

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*Fig. 40.* House No. 5. Repairs and additional adjustments. 1 — a variant of a wattle door; 2 — delimitation of the rectangular hearth.

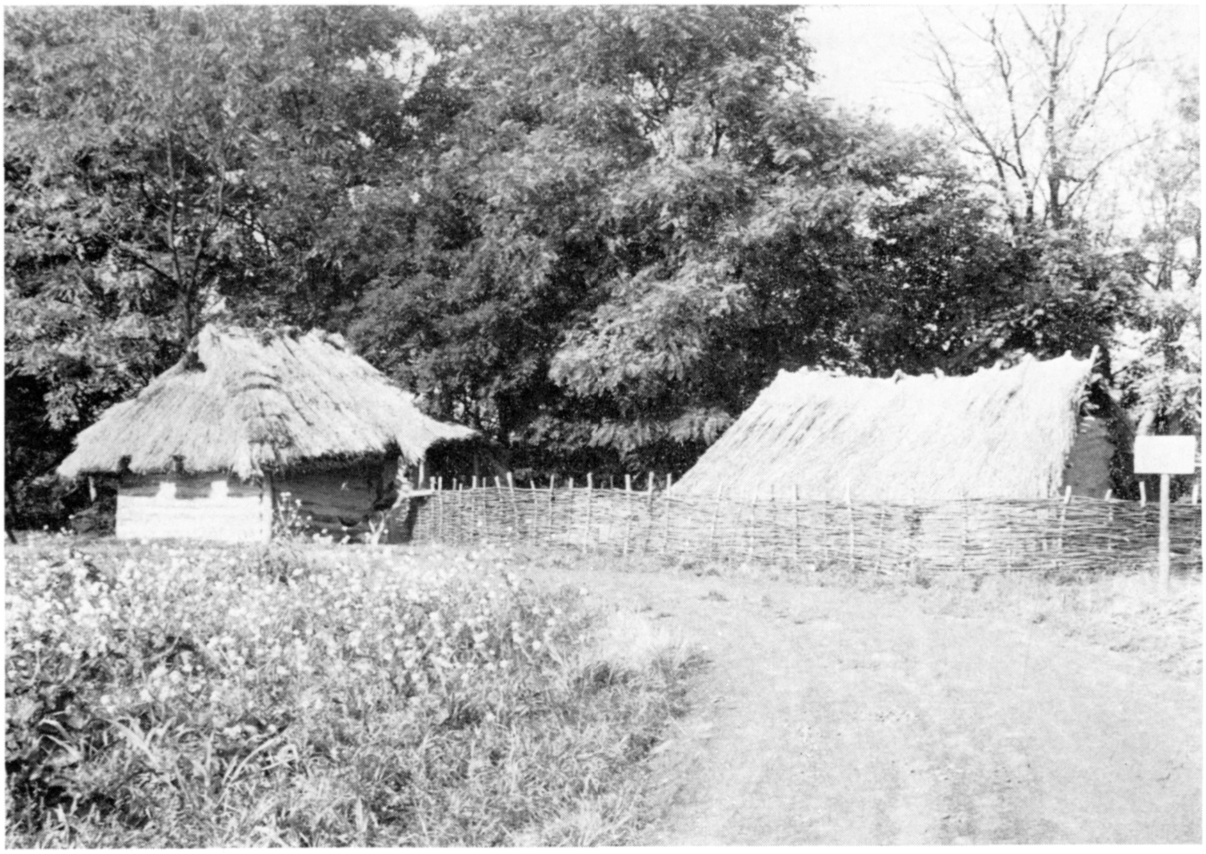

*Fig. 41.* Březno, district of Louny. General view of both experimental buildings.

to the thickness of 30 centimetres usual in recent vernacular architecture (*Mjartán 1963,* 106). Up to now, there were no negative consequences of this; it will undoubtedly influence the durability of covering. No satisfactory solution could have been reached in view of the lack of material. The heating experiment pointed to insufficient provisions for smoke evacuation; this was the reason for substantial enlargement of both ventilation apertures below the roof ridge. An additional adjustment of the house No. 69 is represented by the „polenice" (log-drying space) built into the structure even before the living experiment.

The present state of both experimental houses — No. 5 being exposed for four years and No. 69 for two — is good (Fig. 41). The buildings are not being used continuously; in addition to the described experiments — mostly of short duration — they are occassionally heated during excavation campaigns. Continuous habitation would, no doubt, inflict wear or even damage on some parts of the structures; on the other hand, such procedures as e.g. continuous heating would undoubtedly have favourable, we may say, conserving effects.

Both construction and covering of the roof of house No. 5 are in serviceable order. Contrary to the Allerslev houses (*Hansen 1962,* Figs. 6—10), the clay daub of the Březno structures does not flake off the walls; at Allerslev, however, flaking off could have been initiated by constructional deformation. In this aspect, our observations tally with those made at the experimental Celtic homestead of Butser Farm, where clay daub crackled but stuck to the walls (*Reynolds 1979,* 29). In the case of house No. 69 filling of gaps between the half - round timbers of walls is probably not well done since the clay keeps falling out.

## Problems of the building experiment

The complex of problems pertaining to the building experiment is not visible in its results only; it looms large over the very conception of the project. The experiment elaborates on a reconstruction which, in itself, is burdened by many unanswered questions. There is no need to refer to reconstruction drawings or small-scale models which may neglect obscure elements of the structure. Life-size building requires complex and total solutions and, especially, verification of the project as to its stability. Even if the author proceeds systematically through detailed analysis of recordeed archaeological remains towards an idea of the structure above ground (such as, for instance, the well-conceived and well-planned procedure of P. Reynolds 1983 in building two Celtic structures), the result is always alternative, that is, represents one of the range of possibilities. This is brought about not only by the incomplete state of the preserved evidence – a fact that is sometimes not even realized (*Vencl 1968*) — but by different possibilities of its explication. The experiment thus departs not from real facts, but from a possibility of how the structure might have been assembled. Another prerequisite of the building experiment — identical material (most frequently wood, clay, stone) — creates problems of a rather practical nature. In most cases, it is possible to identify composition of natural vegetation in a given time and place, but the problem may lie in the absence of the same kinds of wood on the same spot in recent times. The range of tools is frequently also known; the experiment may precise or even explain their purpose and efficiency. The most difficult problem is that of application of adequate technologies and work procedures about which very little is known. Woodworking — one of the fundamental building techniques of the pre-and protohistorical periods — has not been systematically investigated. Except the study of prehistoric carpentry by *A. Zippelius (1954)*, we have to resort to individual examples selected at random. After about 800 A.D., the situation is better. Investigations are being carried out in regions in which vestiges of wooden construction elements survive and which do not include our territory. Several papers of Polish specialists (*Kaźmierczyk 1969*; *Barnycz-Gupieniec 1974*) take up the problems of building in ancient times. The intention to document more systematically the level of carpentry work is borne out by the Greenwiche symposium which generated a volume of studies on techniques of woodworking before 1500 A.D. (such as e.g. *Wallace 1982*).

Before 800 A.D., the helpfulness of ethnography is considerably limited. Two extremes define the range of interpretations: the fear to consider ancient builders as too primitive on one side, and reluctance to assign application of sophisticated techniques to them on the other side (West Stow Environmental Archaeology Group 1974, 81). My general impression is, however, that architecture historians and ethnographers invariably have the tendency to expect more primitive techniques of carpentry work than those which actually existed. The contradiction betweeen archaeological evidence and results of ethnographic investigations has been amply demonstrated by *A. Zippelius* (*1954*, 50, 51). This is borne out very well by the example of funerary structures of the Central-Germany sites of Leubingen and Helmsdorf (*Höfer 1906*; *Grössler 1907*). Both cases, evidently copied from ancient habitation structures, indicate that highly sophisticated construction work and superb command of the techniques vis'ble even in details may be expected in the Early Bronze Age. The site of Leubingen yielded evidence for a supported gable roof formed by rafters in the form of beams joined to the ridge pole by mortise and tenon. Wooden boards closely adhering to the rafters were fastened to them by pegs of wood, making up the outer coat of the covering. This sophisticated plan is carried out with great skill. The above-mentioned coat was covered by a layer of reeds topped by stones representing a transition into the body of the funerary barrow covering the edifice. Fastening of the covering of reeds by means of stones may not be applied in the case of a habitation structure. No other types of archaeological evidence indicate techniques of roof-covering. We know something about daubing the walls with clay and about the preparation of this clay, as these are well-documented by the archaeological record. Moreover, this technique, which underwent no fundamental subsequent development, may be profitably studied by ethnographic evidence (e.g. *Mjartán 1963*, 116).

In spite of the seemingly hopeless situation at the starting point of the experiments, some positive results are available. An undoubted contribution is represented by the general evidence concerning material consumption. These will not be substantially influenced by possible mistakes in construction as they are conditioned above all by the size of the structure. We are also capable of evaluating technical difficulties of particular buildings, which, again, will stand out in spite of certain departures from the original finish of the project. Most elusive are conclusions about the time needed for carrying out various tasks; this is influenced by a number of factors referred to above on several occassions. Differences between experience and practice of ancient and modern builders are considerable; a certain role is played by differences in finish. Comparison of the time limits of house No. 5 of the Březno experiment shows that, by and large, they correspond to evidence obtained during the first Danish experiments at Allerslev, directed by O. Hansen in 1956—1958 (*Coles 1979*, 152). Papers on experimental undertakings in archaeology compare the Danish time limits to an example of building a rather primitive log cabin in 19th-century Canada (*Coles 1968*, 13). The time needed to build the Canada cabin was some thirty times shorter. This difference is astouding even if we realize that the type of building was different and that the cabin was smaller.

On the other hand, an experiment may allow at least some idea about the building sequence to be formed, in the sense that it will rule out all assumptions completely wrong. There is a possibility of obtaining direct knowledge of the character of the structure via the experiment. House No. 5 at Březno, for instance, represents a structure which might have been built without any major preliminary measures by settlers just arrived at the site. House No. 69, on the contrary, seems to have been built by people inhabiting the site for some time. Important evidence on the stability of houses has been gained during experimental building of Anglo-Saxon structures (*West Stow Environmental Archaeology Group 1974*, 79). The builders observed that even in cases where the stability of houses could not have been presumed theoretically according to recorded construction posts, results were good and stood up to the practical demands. Coherence of sheltering structures is achieved by interaction of other components as well, such as, for instance, walls and the roof interconnected with the carrying components of the whole. Some of the evidence obtained during experimental erection of structures belonging to a certain period of time is of universal relevance and may be applicable to prehistoric building arts in general. Familiarization with everyday routine of men, women, and children of yore, made possible by the experiment, is highly significant. Notwithstanding the problematic moments of the experiment, the results are helpful for archaeological investigations not only by initiating the effort to discover and identify certain construction traces in the excavations according to experience from experimental buildings but also in interpreting the find associations. All things taken together, results of building experiments represent an unquestionable asset.

The last two decades saw an increase in building reconstructions of archaeologically recovered structures, both of singular buildings and of whole settlement complexes. They are important for relations with the general public but their building left a considerable amount of practical experience. Building experiments have been initiated as well. Review of the situation may be found in *J. Coles* (*1979*) and *J. Malina* (*1980*), and it is thus unnecessary to list all instances. I wish to bring to notice a rather less known centre at Beaune (Rickard 1983; in SE France), principally an open-air museum displaying buildings from the Palaeolithic age through the Neolithic down to the Gallo-Roman period. In addition to this, a number of experimental production activities are undertaken at the Beaune centre. In the case of building experiments following a particular research programme, the public-relation aspect represents no more than an accompanying phenomenon. Sometimes, however, both functions blend together and limits between an archaeological open air museum and an experimental centre may be difficult to draw. Furthermore, we know of examples when a building experiment represents a component of a broadly conceived scheme. Such instances include an experimental imitation of practical life in a Celtic homestead at Butser Farm (*Reynolds 1979*), or an interesting experiment of a group headed by S. West at the West Stow site[9], oriented towards integration of an Anglo-Saxon settlement complex into ancient environmental conditions.

9. The West Stow experiment is so precise that huts are reinserted into their original positions and posts set into

The Březno experiment belongs to those examples investigating problems of prehistoric and early historic art of building. In a certain sense, it corresponds to experiments of Danish archaeologists, both to the pioneering undertaking at Allerslev (*Hansen 1962*) and to some activities at Lejre. I think that an asset of the Březno experiment is its emphasis on practical life in the houses carried farther than elsewhere. After the termination of experiments, the Březno houses may be employed for public relations but we will still have a possibility of following gradual destruction procedures and necessities of repair over longer periods of time. We will acquire thereby an idea about the longevity of prehistoric and early historic structures.

*English by Petr Charvát*

Photographs by:

J. Langer — Figs. 34, 37, 38;
K. Mareš — Figs. 4:2, 7:4, 9:2;
I. Pleinerová — Figs. 6:2, 7:1—3, 9:1, 10, 13, 14, 17, 21:1, 22, 26, 31:2, 40:1, 41;
L. Svoboda — Figs. 1, 8, 15, 21:2, 40:2;
J. Škabrada — Figs. 4:1, 5, 6:1, 31:1, 32;
P. Štingl — Figs. 19, 20, 24, 25, 39.

## SOUHRN

Stavební experiment, zaměřený na poznatky, vyplývající jak z pracovního postupu, tak z provozních vlastností budovaného objektu, může být jednou z metod pro řešení otázek osídlení v pravěkých a časně historických podmínkách. Výzkum v Březně u Loun přinesl řadu domových půdorysů, vhodných pro úvahy o jejich konstrukci (*Pleinerová 1975*) a poskytl i po praktické stránce předpoklady pro uskutečnění takové akce. V r. 1981 byla zahájena experimentální výstavba časně slovanského domu 5 (*Pleinerová 1982*) a v r. 1982 a 1983 stavba slovanského domu č. 69 z 9. stol. n. l. Nešlo jen o rekonstrukce, které by podaly představu o nejpravděpodobnějším vzhledu obydlí. Ty měly základní význam, avšak teprve ve spojení s otázkami, které jsme chtěli řešit. Byly jimi technická obtížnost stavby v tehdejších podmínkách, doba trvání výstavby, optimální počet pracovníků pro realizaci stavby a spotřeba materiálu. Vycházeli jsme z konkrétního půdorysu, snažili se používat stejného stavebního materiálu, pokud možno shodných pracovních postupů a stejného nářadí jako slovanští stavebníci. Experiment se rozrostl v šíře zaměřenou akci, která zahrnovala 1. etapu stavební, 2. etapu zaměřenou na vytápění a 3. etapu, sledující provozní a obytné vlastnosti příbytku.

Stavba domů

Vlastní stavební činnost si vyžádala praktickou i teoretickou přípravu. Bylo to vyhodnocení zachovaných pozůstatků, které vyústilo v projekt rekonstrukce, na němž se podílel především ing. arch. J. Škabrada, CSc. ze Státního ústavu pro rekonstrukci památkových měst a objektů Praha a při první stavbě spolupracoval i dr. J. Vařeka, CSc. z Ústavu pro etnografii a folkloristiku ČSAV Praha. Dále bylo třeba vybrat ze sortimentu staroslovanského nářadí základní typy dřevoobráběcích nástrojů, přičemž spolupracoval doc. dr. R. Pleiner, DrSc., AÚ Praha a zhotovit jejich repliky (obr. 1). V přípravné fázi bylo nutné obstarat potřebný stavební materiál. Dr. E. Opravil CSc., AÚ Brno – exp. Opava určil zbytky zuhelnatělých dřev z výplně slovanských objektů. Podařilo se nám získat alespoň některé druhy; jasany jsme mohli pokácet na místě, zatímco dubové a bukové kmeny byly dodány Severočeskými státními lesy, závodem Žatec (obr. 4).

Při obou stavbách jsme se snažili používat odpovídající pracovní postupy. Týkalo se to především omítání stěn mazanicí, dále pak spojování dřevěných prvků. Mimo čepování, používaného hlavně u stavby č. 69, jsme spoje prováděli svazováním houžvemi nebo kolíkováním.

Stavba domu č. 5 (6. stol. n. l.)

Půdorys budovaného objektu byl nepravidelně obdélníkový, se zaoblenými rohy o maximálních rozměrech 4,60 × 4,20, orientovaný Z-V, zahloubený 80 cm pod původní povrch, s ohništěm v sz. rohu (obr. 2). Rekonstrukce vycházela z těchto zjištění: při středu obou užších stran byly stopy po velkých nosných kůlech. Na nich zřejmě spočívala hřebenová vaznice, nesoucí dvouspádovou střechu. (V předběžném návrhu rekonstrukce jsme jako o možné variantě uvažovali i o kombinaci valbové a sedlové střechy, s valbou na vých. straně). Podél obvodu zahloubení, těsně při stěnách byly odkryty jamky po malých kolících, které spolu se zaoblenými rohy půdorysu ukazovaly na pletené stěny. Z toho jsme mohly odvodit, že střecha dosedala na zem, neboť její tlak by lehké pletené stěny neunesly. Dotažením střechy na zem byla zároveň zajištěna potřebná stabilita domu. Výšku obydlí od podlahy k hřebeni jsme propo-

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holes identified in the excavation. Some of the reconstruction ideas, however — such as raised floors of pithouses — do seem a little bit off the mark to me; obviously, I have not managed to collect all the necessary data, having access to no more than the text in Mediaeval Archaeology XIII (West 1969).

četli na 3 m, a to na základě šířky zahloubené části půdorysu a sklonu střechy 40—45°, obvyklého pro naše klimatické podmínky. Vstup do příbytku byl ze záp. štítové strany (obr. 3; 9).

Po vykopání zahloubené části obydlí se práce soustředila na stavbu krovu (obr. 5; 6:1). Na zavěšené krokve (lemězy) jsme se snažili použít především takové kusy, které měly rozvětvení, tvořící přirozený hák (obr. 6 : 2). Střechu jsme pokrývali rákosovými došky, vázanými na vodorovné tyče (obr. 7 : 1, 2). Na jižní straně střechy jsme zkusili výplet jako podklad pro krytinu (obr. 7 : 3), ukázalo se však, že by pak byla nutná jiná technika pokrývání. Stěny byly vypleteny vrbovými a jasanovými pruty (obr. 7 : 4), poté omítány mazanicí, ve štítových stranách jak z vnitřku, tak zevně, boční strany byly omazány jen z vnitřku. Mazanice se skládala ze žlutky zalité vodou a promísené plevami a kousky rákosu nebo slámy. Tato příměs tvořila zhruba šestinový až pětinový podíl. Při vrcholu obou štítů byly ponechány volné dva trojúhelníkové větrací otvory pro odchod kouře (obr. 8). Kromě obdélníkového, oblázky vydlážděného ohniště (obr. 10) bylo obydlí vybaveno při severní stěně jednoduchým ložem sestávajícím z rámu z dubových kulatin, jehož vnitřek byl vyplněn větvemi, rákosem a slámou.

Stavba domu 69

Půdorys domu byl mírně lichoběžníkový se zúžením na sev. straně, orientovaný delší osou S—J. Jeho největší rozměry činily 3,60 × 3,30 m, v sz. rohu na podlaze, zapuštěné zhruba 40 cm pod úroveň tehdejšího povrchu, stála pícka z kamenů (obr. 11). Rekonstrukce vycházela především z umístění rohových kůlů a z absence soch. Nálezové situaci odpovídá nejlépe drážková konstrukce, zakončená věncem, z něhož je možné vztyčit krov. V projektu rekonstrukce je tzv. krov na kobylu s valbou na sev. straně (obr. 12 dole). Při realizaci jsme zvolili zastřešení valbové, a to vzhledem k dodatečné úvaze o umístění vchodu na vých. boční straně, jak se jevilo v archeologickém nálezu. Při sedlové střeše i při krovu na kobylu by bylo výhodnější situovat vchod ze štítové strany, která by neomezovala jeho výšku. Střecha byla v projektu koncipována jako dvouplášťová, což je prvek známý z některých středověkých staveb. Byli jsme si vědomi, že na malém obytném objektu z 9. stol. se asi nemohl vyskytovat, použili jsme ho však ve snaze vyzkoušet zdokonalenou izolaci v kontrastu s lehčí stavbou 5 ze 6. stol., a to s ohledem na další pokusy s vytápěním.

Práci jsme začali štípáním kulatin na stavbu stěn (obr. 13), neboť jsme měli k dispozici jen bukové kmeny velkých průměrů. Polokulatiny byly na obou koncích opatřeny čepy a vkládány do drážek rohových kůlů (obr. 15). Východní stěna byla zčásti provedena jednodušším způsobem, a to pouhým zasouváním polokulatin za kůl u vchodu, umístěný v poněkud větším odstupu od zahloubené stěny (obr. 16). V těchto místech byl pod věnec položen příčný kuláč, který jsme pak využili pro tzv. polenici přidáním dalšího břevna v odstupu 35 cm (obr. 18, 19). Nůžkový krov z krokví, zadlabaných do věnce, nahoře překřížených, spojených dlaby a převázáním houžvemi, tvořil spodní plášť střechy (obr. 20, 16 vpravo dole), vyplněný tyčovinou a omazaný hlínou (obr. 21). Horní plášť byl zavěšen na hřebenovou vaznici, položenou mezi překřížené konce spodních krokví (obr. 22—24) a pokryt došky ze žitné slámy (obr. 25).

Uvnitř obydlí jsme v sz. rohu postavili kupolovitou pícku z kamenů s topným otvorem vymezeným v pravoúhlé formě většími kameny. Podél jižní a u východní stěny jsme umístili lavice na spaní a sezení, zabudované na pevno do stěn obydlí. Úzkou lavičku jsme ještě připojili k záp. stěně (obr. 33).

Na čtyři základní otázky, které jsme pokusem sledovali, jsme získali tyto odpovědi: technická náročnost stavby 5 byla malá, což dokládá skutečnost, že s výjimkou práce na krytině byla vybudována jen neodbornými silami s celkem dobrým výsledkem. Stavba domu 69 byla po řemeslné stránce obtížnější a účast a rada tesaře, alespoň v určitých etapách, byla potřebná. Stavbu však nelze považovat za obtížnou, neboť už po krátké instruktáži zvládla většina pracovníků potřebné postupy, které se v podstatě omezovaly na základní a jednoduché tesařské úkony.

Odpovědi na počet pracovních sil a čas nutný k výstavbě ve slovanském období poskytují jen rámcovou představu o tehdejší realitě. Je třeba vycházet z minimálního nutného počtu lidí pro práci na konstrukčních částech stavby. U obou objektů jej představují 2 pracovní síly. Při některých úkonech, dále při manipulaci s materiálem a zejména v přípravné fázi (kácení stromů a doprava na místo) se s výhodou mohlo uplatnit více lidí. Po zkušenostech z obou staveb se nám jako optimální jevil počet 3 osob. Stavba domu 5 zabrala 860 hodin čistého času, což by při počtu 3 osob znamenalo 287 hod. Odhadneme-li možnou pracovní dobu ve slovanském období na 60—70 hodin týdně, počítáme-li s větší zručností při práci se dřevem a zřejmě i větší pracovní intenzitou, bylo by v 6. stol. pro postavení domu 5 včetně získání a přípravy materiálu při 3 lidech zapotřebí asi 3—4 týdnů. Stavba 69 nám zabrala 1547 hod. čistého času, započítána je i příprava dřeva, kácení, transport atd. Vyjdeme-li ze stejných předpokladů jako u domu 5, pohyboval by se odhad doby na výstavbu v 9. stol. asi kolem 6 týdnů. Je možná ještě další časová redukce, neboť asi nebylo nutné kmeny štípat vzhledem k možnosti výběru vhodného materiálu, čepy kulatin mohly být provedeny jednodušším způsobem, pouhým sešikmením, střecha zřejmě nebyla dvouplášťová. Přiblížili bychom se tak době výstavby domu 5. Při časových odhadech však pomíjíme okolnosti, které mohly naopak výstavbu prodlužovat. Jde o různá omezení a zákazy z oblasti ideologické, které jsou známy z etnografického materiálu. Týkají se výběru stavebního místa, výběru materiálu, doby započetí stavby atd. Řada rituálních úkonů je dále spojena s vlastní výstavbou — např. vymezení půdorysu, počáteční práce atd. (Bajburin 1983).

Poznatky o spotřebě materiálu jsou celkem objektivní. Na dům 5 bylo zapotřebí 2,5 m³ dřeva, na výplet stěn 1 200 prutů, průměrně o síle 1,5 cm a délce 1,50—1,80 m, hlíny na omazání stěn jsme měli mezi 3—4 m³. Na krytinu střechy nám stěží postačil rákos, pokosený na ploše zhruba 10 arů. Na dům 69 jsme spotřebaovali téměř 6 m³ dřeva, na krytinu stejné množství slámy jako u domu 5, neboť bylo nutné pokrýt i oba skloněné štíty valby. Hlíny na vymazání spár a k omazání vnějšku pece a jejího dna bylo zapotřebí asi 1 m³.

## Pokusy s topením ve slovanských domech

Na výstavbu příbytků jsme navázali pokusem, zaměřeným na jejich vytápění. Chtěli jsme zjistit, jaké teploty mohlo být dosaženo v zimních podmínkách a jaká byla spotřeba paliva. Poznat jsme chtěli také poměry v cirkulaci a odchodu kouře v těchto domech bez komínu. Experiment jsme provedli třikrát, vždy v zimním období, v lednu a počátkem února. V r. 1982 (17 dnů) a 1983 (10 dnů) jsme se soustředili na dům 5, v r. 1984 (7 dnů) se topilo v obou příbytcích 5 a 69 současně. Do obydlí i ven byly instalovány termografy a staniční teploměry. Spotřebu paliva jsme odměřovali na koše. Přestože se vyskytly nedostatky v měření teplot (nekvalitní termografické záznamy; chybí většinou údaje o předpokládaných minimech kolem 5—6 hod. ranní), získali jsme určitou informaci o izolačních vlastnostech obou domů.

Po 3 dnech topení se v obou příbytcích začala teplotní situace normalizovat. Dům 5 bezprostředně kopíroval venkovní teplotu a ze srovnání minimálních teplot venku a uvnitř vyplývá, že poskytoval ochranu asi 6—7 °C při teplotách pod bodem mrazu (t. 1, obr. 27, 28). Rovněž dům 69 kopíroval venkovní teplotu, avšak s určitým malým zpožděním. Z porovnání minimální venkovní a vnitřní teploty vyplývá pro něj rozdíl zhruba 7—8 °C (t. 3, obr. 30). Pozorování svědčí o nevelkých izolačních vlastnostech domu 5 a poněkud lepších domu 69. Ten byl i rychleji a lépe vytopitelný, to však podmiňovaly i jeho podstatně menší rozměry. Rozdíl proti domu 5 byl i v tom, že se v něm topilo převážně v peci, jen vyjímečně na předpecním ohništi. Nadto se zdá, že byl vytápěn i poněkud intenzivněji. Denní průměr spotřeby dřeva byl 0,098 $m^3$, zatímco pro dům 5 činil 0,083 $m^3$. Odhad celkové spotřeby paliva v chladném období 5—6 měsíců by se tak pohyboval mezi 12—18 $m^3$, za předpokladu, že by se topilo soustavně, s čímž patrně nelze ve slovanském období počítat. Toto množství zahrnuje spotřebu na vaření a pečení jen zčásti. Je sice časově limitováno, avšak vyžaduje v určité fázi topení intenzivnější. Údaje nám v tomto směru poskytl další pokus s obýváním slovanského domu, kdy se za den jen k přípravě jídel spotřebovalo 0,05 $m^3$. Jaká byla ve slovanském období skutečná praxe topení, zda se i v zimě omezovala jen na tepelnou přípravu potravy nebo zda podle okolností bylo topení prodlužováno, nevíme. Z etnografie se totiž dovídáme, že vesnické domy v určitých oblastech ještě v minulém století nebyly v zimě vytápěny. Topilo se jen v souvislosti s přípravou pokrmů. Kdybychom vycházeli z minimálního předpokladu, totiž množství paliva nutného k vaření a pečení, znamenalo by to celoročně asi 18 $m^3$.

Při vytápění byly potíže s cirkulací kouře. V domě 5 mohl dým odcházet jak oběma větracími otvory při vrcholech štítů, tak střechou, a to i při sněhovém pokryvu (obr. 31), v domě 69 pouze větracími otvory, takže zadýmení prostoru bylo větší. Po zatopení, které vyvinulo nejvíce kouře, začal dým stoupat, a to obvykle do výše 1—1,20 m nad úroveň podlahy a tam se udržoval jako souvislé pásmo a jen zčásti odcházel (obr. 32). Za příznivých okolností (jasné počasí, suché a kvalitní dřevo) stoupal výš, rychleji se rozptyloval a odcházel buď jedním nebo druhým otvorem, případně oběma současně. Zatímco podmínky pro dosažení vyšších teplot byly v domě 69 příznivější, byly v něm horší cirkulace a odchod kouře ve srovnání s domem 5. V podstatě bylo nutné v obou příbytcích přenést provoz do jejich spodních partií pod kouřovou clonu, jinými slovy, bylo nutno pracovat vsedě, vkleče, v podřepu. Odpovídá to tomu, co víme z etnografie, kdy za podobných podmínek je příbytek vybaven jen nízkým nábytkem, sedátky, lavicemi a lidé se pohybují sehnuti se skloněnou hlavou. Nepodařilo se nám postihnout způsob regulace odchodu kouře, i když určité náznaky se v průběhu experimentů projevily při uzavření jednoho nebo druhého otvoru za určitého druhu počasí a směru větru.

## Pokus s obýváním slovanského domu

Třináctidenní pokus s obýváním proběhl v objektu 69 koncem jara 1984. Na malé rodině (v našem případě rodiče a 3 děti — věk 3, 8 a 13 let)[3], kterou pro slovanské období jako základní jednotku předpokládáme, mělo být vyzkoušeno, zda prostor obydlí je dostačující jak pro odpočinek, tak pro nutné pracovní úkony. S tím souviselo rozpoznání vhodných míst pro různé činnosti, dále míst pro uložení potřebného nářadí. Předpokladem pokusu bylo co nejpřesnější napodobení aktivity, která v domě probíhala; její základ tvořila příprava potravy. Chtěli jsme ověřit nejen potřebný manipulační prostor, ale i místo na skladování určitých druhů potravin, které musely být po ruce, dále pak obsahové kategorie nádob a jejich počet, nutný pro stravování takové skupiny. To muselo odpovídat nejpravděpodobnější skladbě potravy a její spotřebě. Předpokládali jsme, že podstatný podíl zabírala strava cereální, masitou jsme proto aplikovali jen ve dvou dnech pokusu. K základnímu zaměření experimentu na možnosti prostorového využití příbytku se přidružilo sledování dalších otázek — doba nutná k jednotlivým činnostem, frekvence poškození nářadí, množství odpadků atd.

Obydlí jsme vybavili nejnutnějším inventářem podle poznatků z archeologického výzkumu a podle národopisných analogií nejstarších dochovaných interiérů venkovských domů. Šlo o jednoduché nářadí dřevěné, sadu keramických nádob, několik železných nástrojů a rotační mlýnek (obr. 35, 36). V obydlí, které měřilo uvnitř 9,5 $m^3$, zbývala pro pohyb a pracovní využití plocha asi 6 $m^2$ ve střední a severní části. Rozdělení příbytků na sféru činnosti ženy a muže známe z národopisu (Ränk 1949, 1951). Při pokusu se jasně ukázala západní polovina domu 69 jako pracovní oblast ženy. Pro pohyb při práci to byly zhruba 2 $m^2$ ve střední části obydlí. Žena pracovala buď vkleče na zemi, někdy seděla na kraji lavice nebo používala malé nízké sedátko, které bylo jediným přenosným kusem nábytku. Na západní konec lavice byl ve dne umísťován mlýnek na obilí, na přilehlé lavičce byly nádoby na mouku a z části do země zapuštěná zásobnice na zrno u lavičky doplňovala soubor, související s mletím. Příprava jídel se soustředila na prostor před pecí, u záp. stěny tam stály na zemi nádoby na vaření a nádoba na vodu. Na stěně a na polenici byly v těchto místech zavěšeny další potřeby. U stěny v prostoru za pecí stály hrnce k příležitostnému uchování potravy, např. mléka (místo zůstávalo chladné, i když se topilo).

Při pokusu se v domě prováděly především základní činnosti — zakládání ohně, mletí obilí, vaření a pečení. Oheň se rozněcoval křesáním před ústím pece vkleče, neboť v poslední fázi bylo nejvýhodnější doutnající trávu přímo na zemi rozdmychat (obr. 37). Vaření v keramických nádobách na ohništi při ústí pece (obr. 38) i na venkovním ohništi, které jsme založili nedaleko sv. rohu obydlí, probíhalo bez nesnází, stejně jako pečení na mazanicové podlážce pece. Do varu se uvedla tekutina nebo pokrm během 10 min. Výhodné bylo, že keramika podržovala teplo i určitou dobu po odstavení z ohně a pokrm se ještě vařil.

Všechny uvedené základní činnosti jsou prací ženskou a odbývaly se v západní polovině domu. Pracovní oblast muže byla při pokusu doložena nepřímo a zabírala by východní polovinu obydlí, především při vstupní partii, což dobře odpovídá etnografickým analogiím (Bajburin 1983, 77, 78).

Pozorovali jsme i činnost mimo obydlí, související s provozem a životem v domě. Ukázalo se, že se soustřeďovala pouze na pás podél jeho dvou stran. Zejména to byla východní strana s vchodem, v menší míře pak strana jižní, a to blíže jv. rohu, takže celková inklinace k vstupní partii je zřejmá. Pás intenzivního využití přilehlého prostoru nepřesahoval šířku 2 m.

Poznatky z experimentu s obýváním jsou v souhlase s úvahami o rozdělení jednoprostorového slovanského domu, které jsem ve vztahu k etnografickým analogiím uvedla při rozboru časně slovanských obydlí z Března (Pleinerová 1975, 47, VII: 1—6). Při pokusném provozu se projevilo především rozdělení domu v delší ose na část ženskou a mužskou. Na základní činnost — vaření, včetně přípravných prací, uchovávání určitých potravin a podávání jídel — bylo možné vystačit se souborem nádobí, jímž jsme příbytek vybavili. Bylo to vcelku 11 keramických a 3 dřevěné nádoby. Nejčastěji byly používány nádoby o obsahu 1 litru (manipulační — přilévání vody během vaření, uchovávání mléka) a 3 litrů (na vaření polévek, kaší). Je to zajímavé zjištění, které by bylo třeba konfrontovat s obsahovými kategoriemi nádob, zastoupených na jednotlivých slovanských nalezištích. Jiný poznatek pokusu se týkal uskladnění a uchovávání potravin, které vyžadují nižší teplotu. Zčásti zahloubené obydlí poskytovalo samo příznivé podmínky, neboť na podlaze a v přízemní vrstvě byly podobné poměry jako ve sklípku.

## Opravy, dodatečné úpravy a současný stav experimentálních staveb

Na domě 5 bylo nutné provést opravu mazanicového pokryvu hřebene střechy, zhotovit nová dvířka, ohraničit pravoúhlé ohniště (obr. 40) a opravit praskliny v omazání stěn. Na domě 69 bylo zapotřebí opravit krytinu, zvětšit větrací otvory a před pokusem s obýváním zhotovit polenici.

Stav experimentálních staveb — domu 5 po 4 letech a domu 69 po 2 letech — je dobrý. (Dům 69 má však vady v krytině, neboť se nám ji nepodařilo vzhledem k nedostatku žitné slámy v plném rozsahu opravit.)

## Problémy stavebního pokusu

Problematika stavebního experimentu se neprojevuje jen v jeho výsledcích, ale tkví přímo již v jeho počátcích. Východiskem pokusu je rekonstrukce, která sama o sobě bývá zatížena mnoha nevyřešenými otázkami. I při důsledném postupu od detailní analýzy zjištěných archeologických pozůstatků k představě horní konstrukce (srov. např. Reynolds 1983) je výsledek jen alternativní, představuje jednu z možností. Při stavbě ve skutečné velikosti pak největší potíže přináší použití shodných pracovních postupů, o nichž víme jen málo. Pomoc etnografie je pro období před 9. stol. n. l. značně omezena. Kolísáme tak mezi dvěma extrémy, a to obavou, že pokládáme tehdejší stavebníky za příliš primitivní nebo že jim naopak připisujeme znalosti příliš vyspělé techniky. Vcelku se však domnívám, že ze strany historiků architektury a etnografů převažuje tendence považovat např. úroveň tesařství za nižší než ve skutečnosti byla. Na základě archeologických nálezů poukázal na rozpory s výsledky etnografického bádání *A. Zippelius (1954,* 50, 51).

Přes potíže, z nichž se při pokusech vychází, lze dospět k určitým pozitivním výsledkům. Nesporně přínosné jsou všeobecně poznatky o spotřebě materiálu. Pokud jde např. o dřevo, propočtená spotřeba na stavbu, pro domácnost a k výrobním účelům dává podnět k dalším úvahám, a to o struktuře osídlení, neboť nutí k zamyšlení, jak velké celky mohly sídlit na jednom místě, aniž by výrazně narušily přirozené ekologické podmínky. Jsme schopni posoudit technologickou obtížnost té které stavby. Naproti tomu velmi vágní jsou závěry o čase, potřebném k provedení různých úkonů, neboť ten je ovlivněn řadou faktorů, na něž bylo již vícekrát poukázáno. Pokus naopak může dát představu o postupu výstavby, při nejmenším v tom směru, že vyloučí to, co možné nebylo. Jeho prostřednictvím můžeme poznat charakter objektu. Např. dům 5 z Března lze považovat za obydlí, které mohlo být postaveno bez větší předběžné přípravy nově příchozími skupinami, zatímco dům 69 se projevuje jako stavba, vybudovaná obyvateli již usedlými na místě. Některé poznatky získané při pokusné stavbě objektů z určitého časově vymezeného období mají obecnou platnost a lze je aplikovat na pravěké stavebnictví vůbec. Výsledky, včetně problematických momentů experimentu dále pomáhají při archeologickém výzkumu, a to nejen tím, že dávají podnět ke snaze určité stopy konstrukce v terénu objevit a co nejpřesněji rozpoznat, ale pomáhají také interpretovat některé nálezové situace. Důležitým výsledkem je bezprostřední poznávání běžné životní praxe tehdejších lidí.

# РЕЗЮМЕ


В *1981* году в с. Бржезно близ г. Лоуны были начаты работы по проведению строительного эксперимента. Он представлял собой часть общей обработки длительных стационарных раскопок, при которых, кроме всего прочего, были установлены остатки селений различных периодов (*Pleinerová 1975*). Строительный эксперимент, направленный на сведения, вытекающие как из процесса работ, так и из функциональных свойств возводимого объекта, может служить одним из методов для решения вопросов заселения в доисторическом и ранне-историческом периодах.

Были построены два славянских дома, а именно жилища 6-го и 9-го столетий. Мы исходили из конкретных планов, использовали строительный материал, засвидетельствованный на памятнике в славянском периоде, старались применять соответствующие методы работы и использовали копии древнеславянских деревообрабатывающих орудий (рис. 1). Дом № 5 6-го века представляет собой прямоугольную полуземлянку с прямоугольным кострищем в северо-западном углу (рис. 2 : 3). Стены плетеные, обмазанные глиной, двухскатная крыша опирается о землю, вход с западной щитовой стороны (рис. 5; 6; 9). Дом № 69 9 века — более мелкая полуземлянка, в плане имеющая форму параллелограмма, с печкой из камней в сев-зап. углу и входом с восточной боковой стороны (рис. 11; 12), был построен с помощью угловых столбов с бороздками с приподнятой четырехскатной крышей (рис. 15; 16; 18; 20—25). Внутреннее убранство обоих домов было очень простым — кроме отопительного устройства, только ложе или лавка для спанья, прочно пристроенные к стенам жилища (рис. 35). На основные вопросы, поставленные перед опытом и касающиеся технической трудоемкости постройки, оптимального количества рабочих сил, времени, необходимого в славянском периоде для постройки и количества материала, мы получили следующие ответы. Техническая трудоемкость постройки № 5 была невелика, о чем свидетельствует факт, что за исключением работы на кровле, она была возведена не-специалистами в целом с хорошим результатом. Постройка дома № 69 по ремесленной линии была более сложной и здесь были необходимы, хотя бы на определенных этапах, участие и совет плотника. Но строительство нельзя считать трудоемким, поскольку после короткой инструктировки большая часть работников овладела необходимыми приемами, которые по существу ограничивались основными и простыми плотническими операциями.

Ответы на вопросы о количестве рабочих сил и времени, необходимом для строительства в славянском периоде дают только общее представление о тогдашней реальности. Надо исходить из минимального необходимого количества людей для работ на конструкции постройки. У обоих объектов это две рабочие силы. При проведении некоторых операций, при манипулировании с материалом, особенно в подготовительной фазе (рубка леса и транспортировка на место) выгоднее было использовать больше людей. По опыту на обеих постройках нам представляется оптимальным количество трех человек. Постройка дома № 5 заняла 860 часов чистого времени, что при количестве трех человек равнялось бы 287 час. Предположив, что в славянском периоде рабочее время могло быть 60—70 час. в неделю, а учитывая большую ловкость при работе с деревом и, очевидно, большую интенсивность труда, получим, что в 6-м веке для постройки дома № 5, включая получение и подготовку материала, тремя людьми было необходимо 3—4 недели. Постройка № 69 заняла у нас 1547 час. чистого времени, включая подготовку дерева, рубку, перевозку и т. п. Исходя из тех же предпосылок, как в случае дома № 5, время постройки в 9-м веке колебалось бы около 6 недель. Возможно произвести еще большее сокращение времени, потому что постройка стен и крыши могла быть более простой. Время постройки так приблизилось бы времени постройки дома № 5. Сведения о расходе материала объективные. Для дома № 5 было необходимо 2,5 $м^3$ дерева, на плетенку 1200 прутьев, глины для обмазки стен было около 3—4 $м^3$. На кров с трудом хватил камыш, собранный с 10 а. Для дома № 69 потребовалось почти 6 $м^3$ дерева, на кровлю такое же количество соломы, как и у дома № 5, глины для обмазки швов и обмазки внешней части печи и ее дна было нужно примерно 1$м^3$.

После постройки славянских жилищ был произведен опыт по их отоплению. Мы хотели установить, какая температура могла быть получена в зимних условиях и каков был расход топлива. Также мы хотели выяснить соотношение циркуляции и выхода дыма в этих домах без труб (рис. 31; 32). Изменение температур показывают соответствующие таблицы (1—2) и графики (рис. 27—30). Мы могли сосчитать общее потребление топлива в холодном периоде 5—6 месяцев, которое бы колебалось между 12—18 $м^3$, при условии, что вытапливание проводилось непрерывно, что, вероятно, нельзя предполагать в славянском периоде. Это количество только отчасти включает в себя расходы на приготовление пищи. Хотя эти расходы ограничены во времени, зато в определенной фазе требуют более интенсивного топления. Сведения этого направления нам предоставил опыт проживания в постройке, когда в течение дня для приготовления пищи было употреблено 0,05 $м^3$ топлива. Как практически отапливалось в славянском периоде, ограничивалось ли отопление и зимой только приготовлением пищи или, по обстоятельствам, было более продолжительным, неизвестно. Исходя из минимальных условий, т. е. количество топлива, необходимое для приготовления пищи, за год составляло 18 $м^3$.

Тринадцатидневный опыт проживания в объекте № 69 (9 в.) был проведен с небольшой семьей (родители с тремя детьми — 3, 8 и 13 лет). Мы хотели проверить, является ли жилище площадью 9,5 $м^3$ достаточным для отдыха и для необходимых трудовых операций. Жилище было заполнено самым необходимым инвентарем согласно сведениям, полученным на основе археологических раскопок и по этнографическим аналогиям (рис. 35, 36). Предпосылкой опыта было как можно более точное подражание деятельности, происходившей в доме; ее основой было приготовление пищи (рис. 38).

Разделение жилища на сферы деятельности женщины и мужчины известно из этнографии (*Ränk 1949; 1951; Bajburin 19 83,77, 78)* На протяжении опыта проявилось разделение по длиннейшей оси, а именно на западную часть, связанную с печью, являвшейся женской сферой, в то время как восточная часть, тяготеющая к пространству входа, была областью мужчины. Оказалось, что существование и в таком маленьком доме возможно без осложнений. Для варки, включая подготовительные работы, хранения продуктов и подачи еды хватил комплект посуды, предназначенный нами для опыта. Это было 11 керамических сосудов и 3 деревянных. Чаще всего использовались сосуды объемом 1 л (для манипуляций) и 3 л (для варки). Этот факт следовало бы сравнить с объемными категориями сосудов, представленных на славянских местонахождениях.

Несмотря на проблемы и трудности, заключенные как в исходных пунктах строительного опыта (вопросы реконструкции, применения соответствующих рабочих методов), так и в его результатах (прежде всего условность временных расчетов), можно достичь определенных позитивных результатов. Бесспорно важными и объективными являются общие сведения о расходе материала, опыт может дать представление о процессе постройки, по меньшей мере в том смысле, что поможет исключить невозможное. Некоторые сведения также можно применить на строительство в целом доисторическом периоде. Далее, результаты, включая проблематические моменты эксперимента, помогают при археологических исследованиях, причем не только тем, что дают импульс к стремлению обнаружить определенные следы конструкций, но и помогают интерпретировать некоторые ситуации. Важным результатом, принесенным опытом, непосредственное познание будничной жизненной практики тогдашнего человека.

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