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MUZEUM HISTORII POLSKI

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Introduction

Since 1995 I have participated in archaeological excavations at Ożarów Mazowiecki near Warsaw, Poland (Fig.1). These have been work proceeding a construction of a residential area, divided into small allotments and excavated only in the actual places of future constructions, according to the building plan. Because of that, each trench has been recorded as a separate archaeological site, often explored by different archaeologists from diverse institutions. In reality the entire area is a quite homogenous culturally and chronologically – a large Roman Period settlement. It is dated on the 1st and the 1st half of the 2nd century A.D. by the abundant finds of ceramics and metal objects such as an eye – brooch. During our excavations many waste pits were encountered, together with iron smelting areas and a well. However, only one house was discovered.

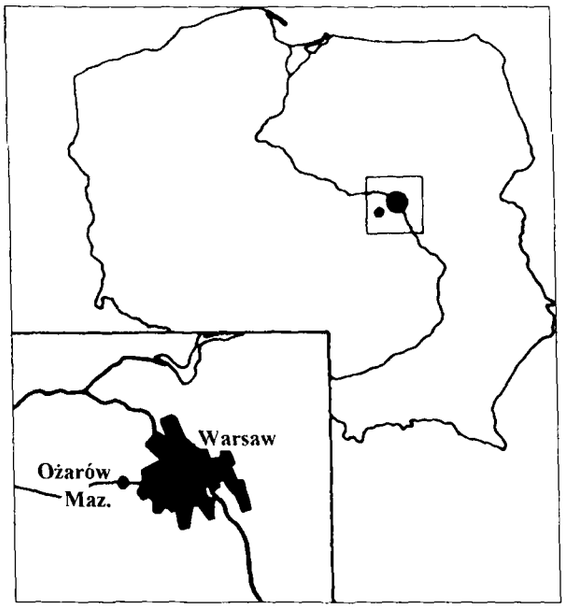

Fig. 1. Ożarów Mazowiecki, Poland. *Drawn by: A. Potoczny.*

In 1997 on site no. XXIII, we observed a large oblong shape, slightly darker than the surrounding occupation level, measuring 5 by 6m, orientated South – North. This particular find became the reason for the present article, for it contained 28 or 29 loom weights in characteristic alignment (Fig. 2). Such a find has not been made in Poland before, although scattered or deposited loom weights are quite common on settlements and together with spindle whorls are found in most ancient dwellings.

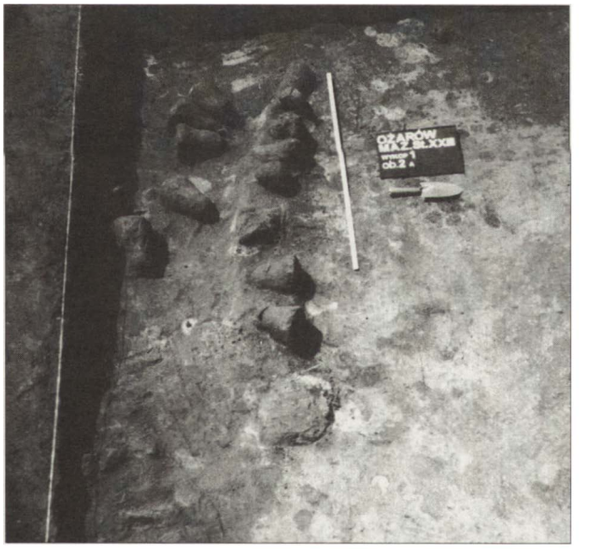

Fig. 2. Remains of the loom, as found by the archaeologists. Ożarów Mazowiecki, Poland. *Photo: K. Barska.*

As is commonly known, weights such as these, belong to a warp – weighted loom, positioned upright, leaning upon a wall or roof-beam rather than free-standing. They are tied to the ends of the warp yarns in order to tighten the warp. They should alternate front and back threads. This is why Marta Hoffman observed Norwegian women weighing the weights in order to group them as equally balanced as possible for evens and odds, sometimes using a few smaller ones on one side to alternate with one heavy on the other [Hoffman 1964: 42]. Such an approach seems to be true for 2/2 twill, although it would not confirm when 2/1 twill is being woven. She also remarked that the weight of the loom weights must have had some

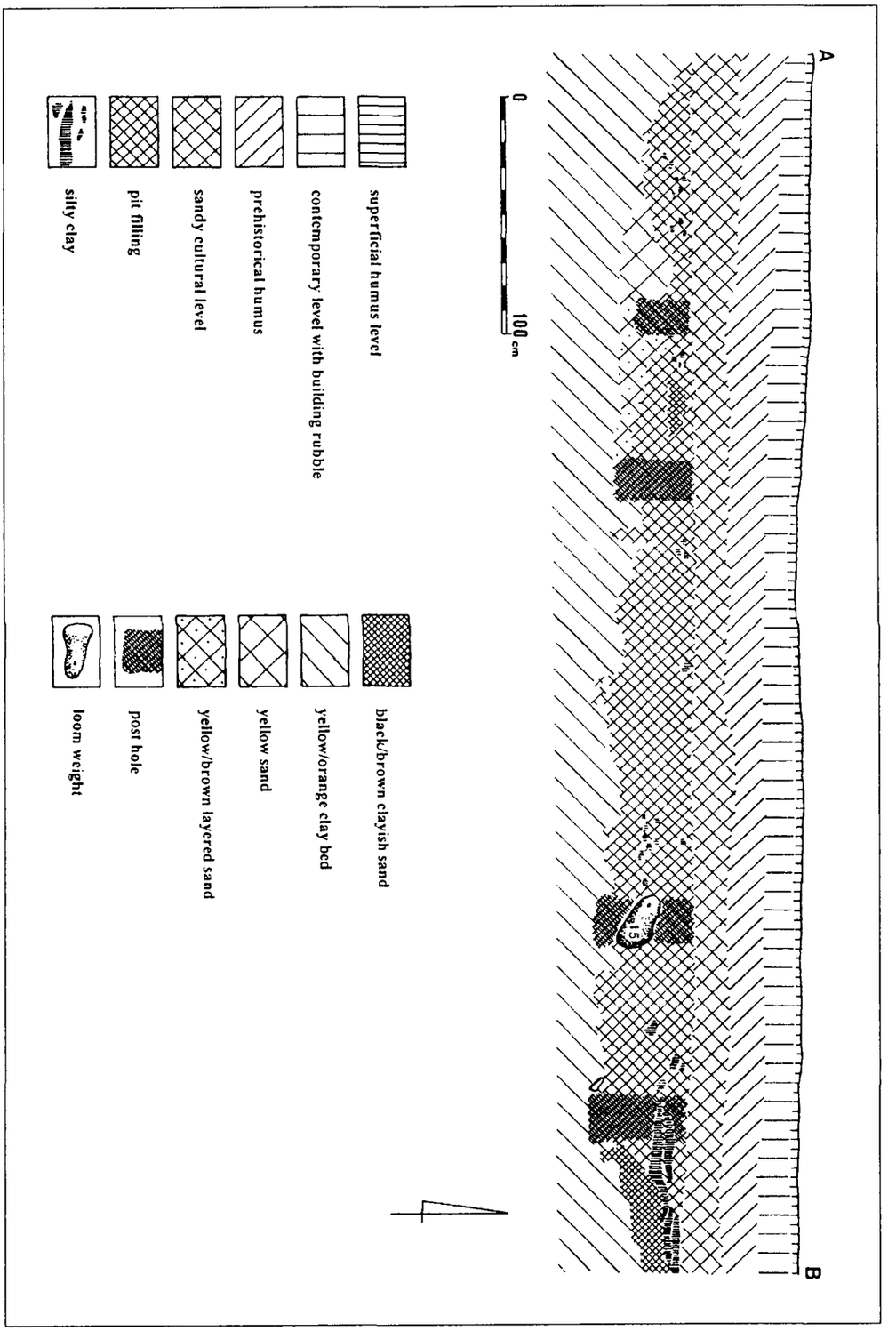

Fig. 3. West-East profile of the semi-subterranean dwelling in Ożarów Mazowiecki, Poland. *Drawn by: K. Barska, A. Potoczny.*

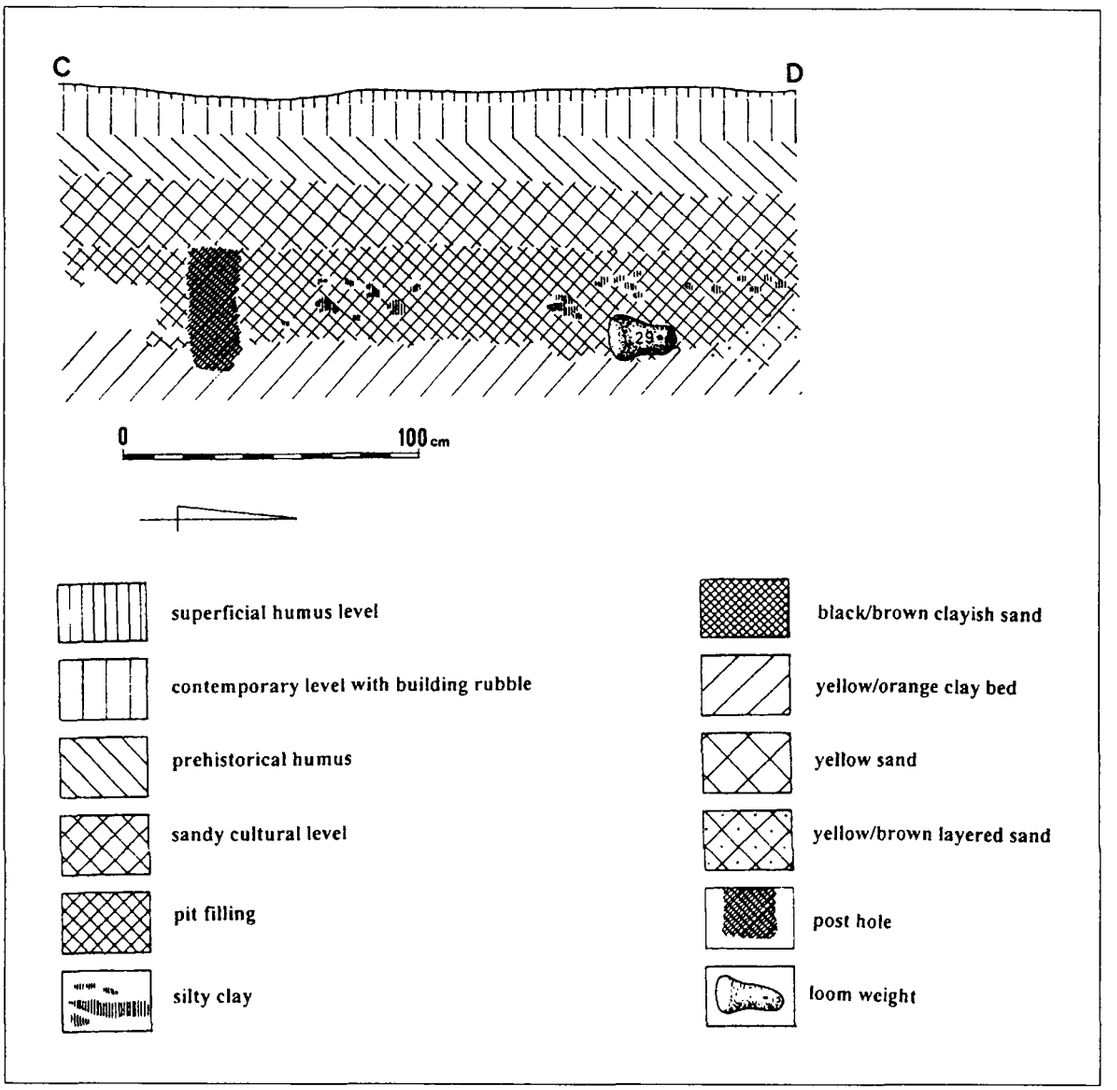

Fig. 4. South-North profile of the semi-subterranean dwelling in Ożarów Mazowiecki, Poland. *Drawn by: K. Barska, A. Potoczny.*

effect on both the weaving process and the product [Hoffman 1964: 21]. It helped in regulating the tension on the warp threads, as did calculating the number of threads attached to one weight. As weavers confirm, this is particularly important to consider, otherwise bulging and other faults will appear on in the product, when the difference in weight on a single thread is greater than 15% [Nørgård 1999: 2].

When the cloth has a small number of warp threads however, the excessive weight put on them will not necessarily appear in the finished fabric. Finally Marta Hoffman has reminded us, by using a Færoes loom from Copenhagen as an example, that heavy weights do not necessarily mean the weaving of a coarse cloth of thick yarn.

Various conclusions can be drawn from the loom weights' size and alignment. However everything depends on an initial concept of what particular type of weaving is being carried out, which is illusory for an archaeologist if the cloth is not found. So my own conclusions regarding the weights might not go far in this direction, for I think that the Ożarów find is insufficient in itself to lead any study of how the cloth varies depending on whether light or heavy weights are used. On the other hand the weights from O¿arów are very large and heavy. In this case, more data can be obtained about the size of a loom and the organisation of work as such.

The find

The *Grubenhaus*, as the semi-subterranean dwellings of the period are termed, is a type of building which occurs frequently on Roman Period sites in Poland. In the archaeological record it can be distinguished as a sub – rectangular pit dug into the ground and, as its upper structure is usually based on two, four or six upright posts placed in the middle of the

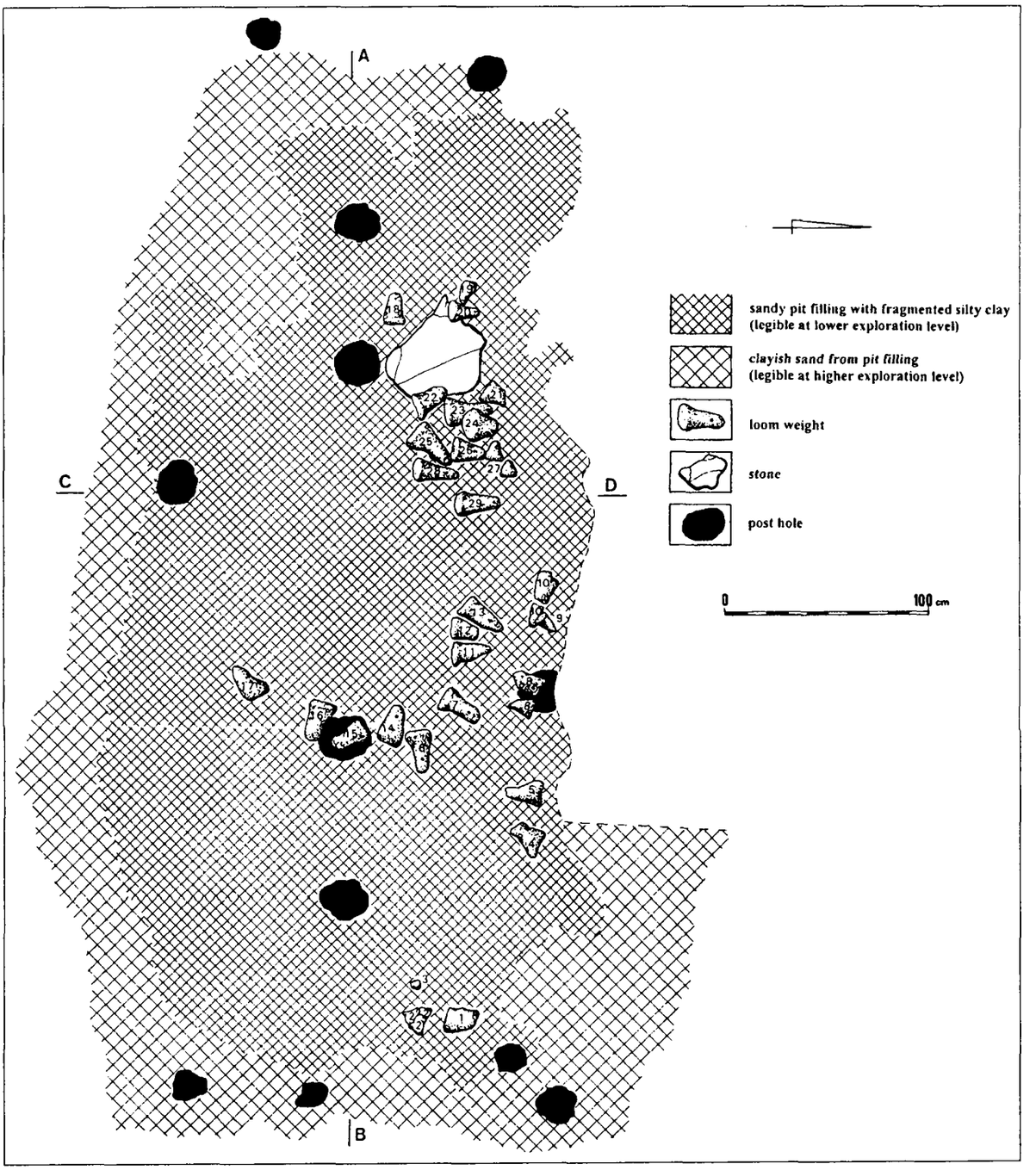

Fig. 5. Plan of the semi-subterranean dwelling in Ożarów Mazowiecki, Poland. *Drawn by: K. Barska, A. Potoczny.*

building, and also by the postholes in the base of the pit. In case of Ożarów Mazowiecki house the pit depth varied from 20 cm below the occupation level at the Western end to 50 cm at the Southern (Fig. 3, 4). It featured steeply cut sides and a flat bottom, sub-rectangular in shape. The differences in depth might be the result of an uneven state of preservation rather than an actual construction feature. The pit was 550 cm long and 220 cm wide, the longer axis being orientated East-West. Post holes were situated within the pit, three in a line along the shorter wall, and four on the central axis of the house. The western edge of the dwelling was marked by two post holes, and only one post hole each was preserved in both the South and North walls. The apparent irregularity of alignment seems to be caused by more severe erosion of those edges (Fig. 5). All post holes were about 10 cm deeper than the pit bottom. The pit was filled with brown sandy sediment mixed with fragmented silty clay and charcoals, easily distinguishable from the yellow and orange clay bed in which it was dug. Silty clay domi-

Fig. 6. Preserved loom weights. Ożarów Mazowiecki, Poland. *Photo: K. Barska.*

nated in the eastern part of the pit, while there was a large stone in the western part, about 50 cm wide. An important feature of the find was that at first sight it did not bear any signs of a fire or any such disaster, and the fill of the pit was only slightly darker than the occupation level above it.

It was rather unusual, therefore, to find well preserved, large, conical or rather bell – shaped loom weights, lying 5 to 10 cm from the pit bottom. Starting in the North-East the weights formed two rows, all with their narrow ends turned northwards, while in North-West part they were turned towards one another with the narrow ends in two almost parallel rows, divided by a 20 cm gap in between. One of the rows seemed more scattered towards the South. In the other row the weights were only partially preserved, which made it difficult to establish their precise number (Fig. 5). Generally they looked as if they had fallen from the loom while it was in use.

According to the literature, original loom-weights alignments are only preserved when some kind of a disaster strikes the house or workshop. Partially, because the loom was only set up when someone needed to work on it, and taken down after the cloth was finished (if used inside a house not in a workshop). The weights seemed lightly fired, but not burnt, and most of them were partially black (that is interpreted as a difference in oxygen access while firing clay objects) (Fig. 6).

I tried to reconsider various possibilities which might have resulted in the loom weights coming to lie in rows, to find out what actually had happened in Ożarów. There seem to be the following choices:

– A fire – roof gets burnt, it collapses on a loom with a product on it, the cloth and the warp are the first to burn, then the loom weights drop down, might get a little scattered, turned by the falling wood or might remain vertically in lines. Problem – in Ożarów there are no signs of a fire, and the house even lacks a fireplace.

– Tying the loom weights after warping – somehow interrupted, the weights lay down prepared to be tied , already divided into groups and alternating pairs, turned to each other with their narrow ends with holes – to make the tying more convenient. Problem – in Ożarów – some weights keep this alignment while other lean to South in just one row.

– Taking down weights after rolling a woven cloth on a beam (as Norwegian women) or prolonging a warp (as the Lapps). Problem – the weights are not taken down all at the same time, but in pairs (groups) and then retied at the correct distance from the ground.

– Work termination – all weights rest on the ground, after unrolling the fabric from a beam or cutting out the warp. This also seems most unlikely, because after weaving a lot of final work and additional corrections have to be performed and the weights would stay on the way. Usually they are picked up right away and grouped, bundled or stored aside to leave the weaver more space to finish off the cloth.

The answer emerged after a more detailed analysis of the finds. Although the soil bore no signs of fire, the silty clay from the pit fill turned out to be fired, which should not had happened naturally. It has also preserved some construction details of the house, showing that walls were plaited of willow wattles, occasionally in – filled with clay.

Another clue was given by the weights themselves. As I mentioned some of them were partially black. Initially they might have been just sun-dried, and became fired only during the disaster, partially covered by glowing embers. This, as has been established by experiments with firing clay objects, could explain their dark sides and the fact that they were not burnt, as we fine for example in burnt ceramics.

So, the house was actually burnt down, which is common for such finds. The loom might have rested upon a roof beam. During the catastrophe it only partially collapsed, dragging some weights southwards and the rest fell onto the North wall of the house.

Other questions arising from the Ożarów Mazowiecki loom find are connected with the organisation of work.

First of all the lack of a fireplace suggests that the house was not an actual dwelling. Some ceramics and spindle whorls have, however, been preserved in moderate quantities inside the pit fill. The loom weights stretched for 375 cm along North wall, while the house was 550 cm long and only 220 cm wide. This would have left very little living space when the loom was set up.

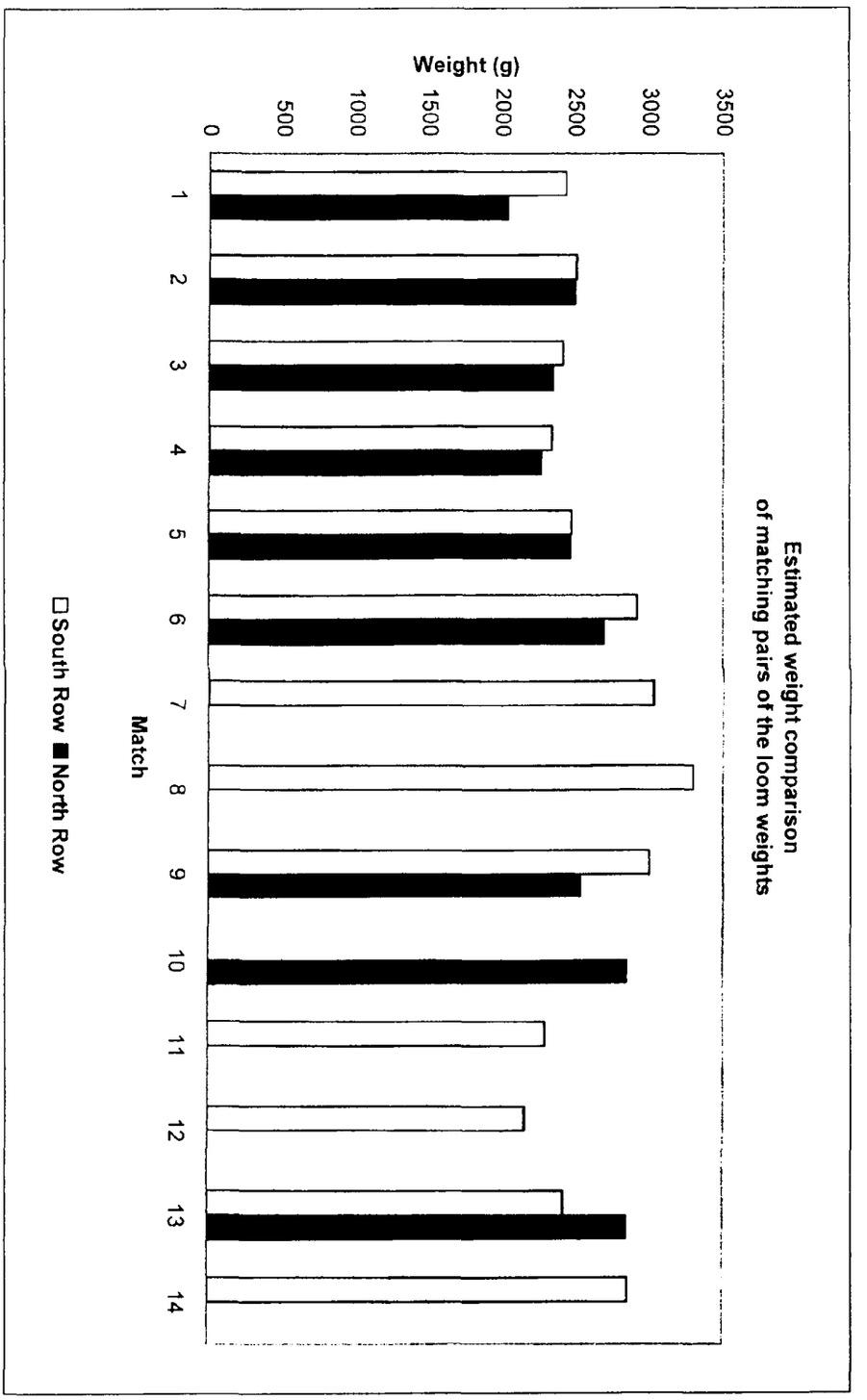

Fig. 7. Estimated weight diagram of the individual loom weights, as seen in rows. Ożarów Mazowiecki, Poland.

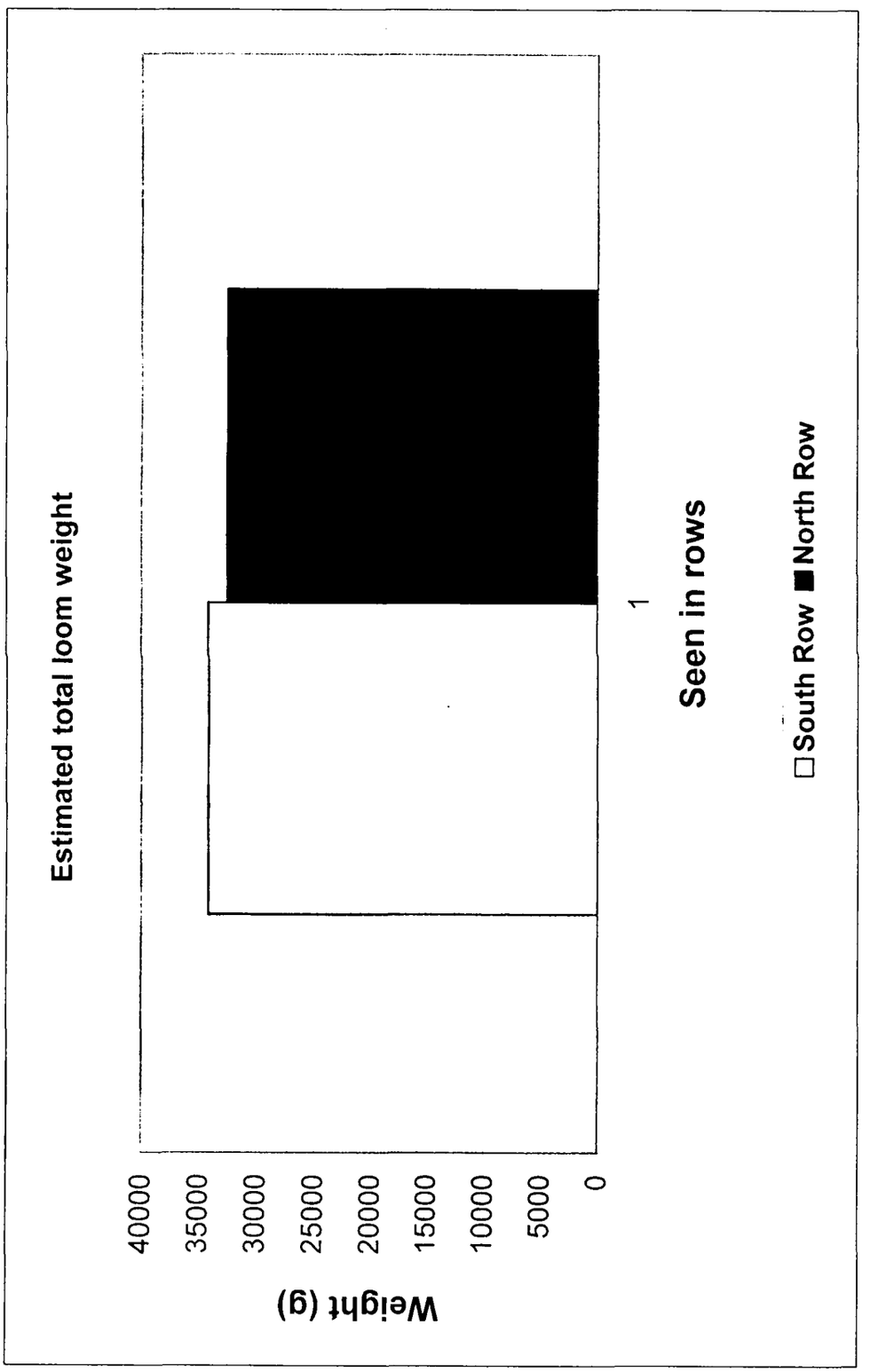

Fig. 8. Estimated cumulative weight diagram of the loom weights, as seen in rows. Ożarów Mazowiecki, Poland.

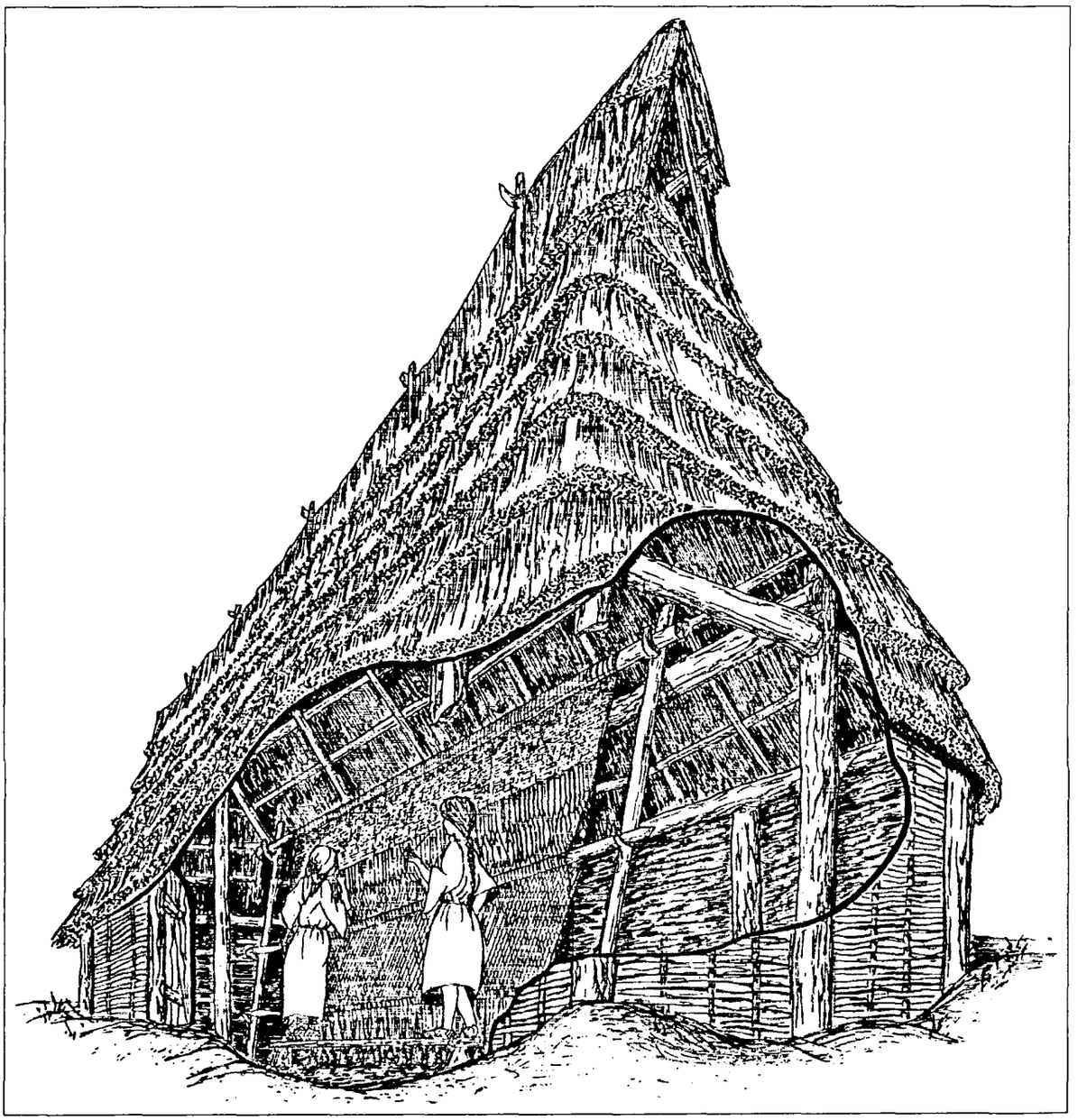

Fig. 9. Reconstruction of the Ożarów Mazowiecki workshop. *Drawn by: P. Wilczyński, A. Potoczny.*

The house orientation, with the long walls oriented exactly South-North is also very interesting. It might have had this orientation to maximize the access of light during weaving, if the door was placed in the South wall. Unfortunately no signs of an entrance have been preserved. In the absence of any original well-defined ground surface, the position of the entrance is hard to detect archaeologically, unless any cuttings have been have been preserved within the pit which could be associated with a ladder or steps.

Additionally the walls were made of wattle-and-daub, which seems more typical for temporary shelters or workshops.

Analogies for weaving workshops located in wattled semi-subterranean dwellings come from Germany and Scandinavia [Zimmerman 1982: 123; Mortensen 1998: 193]. These are common finds because, as is commonly known, flax weaving requires a damp atmosphere which such houses provide.

The widespread use of flax for weaving during the Roman Period in Poland, although previously suspected, has found recent confirmation in spectacular finds from Karczyn and Głojków in the Kujavia region. At these sites archaeologists have discovered large baskets containing flax and hemp, in its initial stage of preparation for fibre extraction [Bednarczyk 1998: 73-74].

Difficulties would be encountered when weaving on such a huge loom inside a single room house. For example limitations would be placed on the length of any piece of weaving carried out. This question would be difficult to resolve on the basis of the preserved finds. Once one accepts the hypothesis that the building is a workshop, however, one can set aside such questions.

Modern experimental weavers estimate that weaving on a warp-weighted loom of a 70 cm wide, 2/1 twill woollen fabric, with 8 warp ends per cm, takes an average of 25 weft shots per hour. So about 20 hours of weaving are needed to produce one running metre of such a cloth [Nørgård 1999: 8, 11-12]. Such calculations of the time consumed in order to produce a finished cloth do not include the time taken in shearing the wool, spinning the yarn, setting up the loom and fulling the cloth [Nørgård 1999: 8]. Possibly the weaving of a similar fabric in flax would have taken even longer, because of the nature of the yarn.

Such simple statistics show that working in a workshop is very profitable for the weaver, for weaving is usually a long lasting process taking up both time and space. Finally, the presence of spindle whorls indicates that not only weaving, but also spinning had been performed within the Ożarów Mazowiecki workshop. It marks the joint execution of both tasks within the same workshop.

The weights

I would now like to attempt to evaluate the size of the loom and the number of persons working on it, based on the loom weights.

There seem to be 28 or 29 loom weights in total, forming 14 groups of alternating pairs. For the purposes of description I have named them the South and North row (Fig. 4). The weights form the South row are very well preserved, almost 8 of the 14 were completely preserved, unlike the North row, where only 3 weights remained in a fairly complete state. This may be due to loom and roof collapse, when the North row could have been smashed by falling beams. Apart from the weights' alignment within the workshop, they can be also divided into two groups by size: large and small weights. The large ones are quite homogeneous; between 18 and 21 cm high, they measure 17 to 20.5 cm in base width, and have a small hole 1.5 – 2 cm in diameter about 12 to 13.5 cm from the base. They weigh between 2,300 g and 3,300 g. The small ones are far more differentiated. Two of them are not conical, but rather pyramidal in shape, the smaller weighs around 500 g and the larger less than 1800g; the third one is conical and weighs 1600g. Because of the size and style differences, the small weights seem to be picked up additionally to compensate weight variations in rows. The first three weights at the East end of the lines forming a group. There is a 2,440 g weight in South row and two small weights of 500 g and 1,600 g in the North one.

The hole size and its location in the weight are also interesting. The holes are rather small when compared to the weights' size, which suggests that the warp threads were not tied directly to the weights, but rather attached through some sort of cords, loops or small pegs. The same type of attachment must have been applied when more than one weight was tied to the warp. Otherwise the excessive weight of the small bunches would have tightened the warp yarns at the bottom, and spoiled the fabric.

Is there any relation between the location of the hole and the distance at which the weight had to hang from the ground? Only experiment might solve this problem.

Another feature of the weights is the presence of shallow, finger-sized hollows on the top of the cones. They might have arisen during the weights' manufacturing process, or their drying out, or may have been arisen from the way in which the warp was attached, assuming that the clay used had not dried out so much so as to resist all pressure applied to it.

The total preserved weight of the South row is 27,890 g, and the estimated original complete weight seems to have been about 34,185 g. The North row weighs 20.383g, although the original complete weight would have been about 32,560 g (Fig. 7). The total weight of the loom-weights which have been preserved is 48,273 g, but the original weight would have been about 66,745 g – in other words some 67 kg (Fig. 8). Hypothetically, the largest weight must have weighed almost 3.300 g, but the heaviest entirely preserved one weighed no more than 2,510 g.

According to information from weavers, the maximum amount of weight which can be applied to a single woollen warp thread suitable for weaving, is about 12-20 g for thinner threads and 30-50 g for thicker ones. These weights should probably be slightly heavier for flax yarns.

If we hypothetically assume that a linen tabby cloth was being made in the Ożarów Mazowiecki workshop, with 8 warp threads per cm, and 50 g of weight on each thread, then a total weight of almost 67 kg distributes on 1.335 warp yarns and allows a fabric width of 167 cm. This estimate has only been presented in order to visualize the possible scale of production of the Ożarów workshop.

To continue, the loom with a size over 3 m and with an estimated weight of 67 kg must have been operated by more than two weavers while, for example, rolling the cloth on the beam, even if a relatively

delicate yarn was being woven on it (Fig. 9). The way in which the weights were distributed on the warp is very interesting, and one wonders if any special method of division or some other calculation was applied. Moreover, there remains the question of why such huge weights were applied to a single product. Unfortunately, I don't think this can be established in the case of the Ożarów Mazowiecki loom, since even the precise loom size is unknown, as we lack the dimensions of the upright members of the loom.

Finally, I trust that more evidence on prehistoric weaving comes to light and experimental activities lead us to a more profound understanding of the craft itself.

Summary

The Ożarów Mazowiecki warp-weighted loom was located within a wattle-and-daub *Grubenhaus* workshop and might have been used for flax weaving. More than two women must have worked on it in the same time, as its 29 weights alone weighed almost 67 kg. No traces of the uprights have been preserved, and the loom rested on a roof beam rather than on the wattle wall. The alignment of the North row of loom weights implies a loom length of over 3m. The weights have been tied to a warp using additional cords, loops or small pegs and have been quite carefully balanced in two rows. Initially they were only sun-dried and only became fired during the catastrophe. The loom fell on the North wall, smashing and destroying the North row of loom weights. The fire could not have lasted long, for it left very little evidence in the archaeological remains. Experimental archaeology might help in understanding the significance of the weights' spacing, and the role of the weights in weaving and regulating warp tension.

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