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Reviewed Article:

Two Reconstructions of Prehistoric Houses from Torun (Poland)

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In 1998 the Society for Experimental Primeval Archaeology (SEPA) was founded at the Institute of Archaeology at the Nicolaus Copernicus University (NCU) in Toruń. Since its beginnings, SEPA members have dedicated a great effort to engaging in numerous scientific experiments with the aim to present human lifestyle in prehistoric times in general. One of the indisputable successes of SEPA is the reconstruction of one of the supposed prehistoric birch tar and pitch production methods without the use of ceramics (Osipowicz 2005a), as well as the recreation of a Neolithic technique for making holes in stone axes (Osipowicz 2005b) and successful experiments with various techniques for bone and antler softening (Osipowicz 2007). At present, papers on the findings of further experiments in these fields are being prepared for publishing, as well as results of new experiments with use of, for example, ranged weapons, axes made of bone and antler and trampling. Moreover, the SEPA members also conduct wide-raging promoting activities by organising numerous archaeology fairs and presentations for schoolchildren.

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Over the several years of SEPA functioning, it has organised several one- or two-week experimental camps where experiments that require more time and resources were conducted. During one such camp, in 2001, an attempt to reconstruct a Stone Age shallow pit-house was made. Last year works on an experimental construction of a Mesolithic shelter was completed. In both experiments replicas of prehistoric flint, stone and antler tools made with use of techniques available at that time were used (almost exclusively). This paper covers findings of both these experiments.

Experimental construction of the shallow pit-house

The shallow pit-house construction was based on an hypothetical interpretation of this type of building remains encountered on Stone Age sites in the Central European area, as in Poland: Witów (Chmielewska 1957, 1961), Rydno (Schild 1967; Schild, Królik 1981; Schild, Królik, Tomaszewski, Ciepielewska 2011), Krzekotówek 8, Siedlnica 6 and Siedlisko 16 (Bagniewski 1977). The dwelling structure was designed to comprise two parts: a main room and an L-shaped entrance hallway. Unfortunately, due to limited time constraints in this experiment, a smaller-scale reconstruction had to be made.

The construction works started with digging the underground part of the structure, that is, a rectangular pit measuring 2.5 m by 3.5 m and foundation trenches to hold walls and the entrance hallway. In the execution of this part of the project two adzes were used: a deer antler adze (a replica of the Lyngby type adze) and a ground stone adze. These were used mostly for breaking up the soil, which was later removed by hand or with use of a wooden shovel and a deer hide (See Figure 1A). The digging of a 0.6 m deep trench took two people 14 man-hours. The foundation trench was up to approximately 1 m high in the main room area and 0.3-0.6 m high in the entrance hallway area (See Figure 1B).

The next stage of construction works concerned building the walls, which was a multi-step process. First, with use of a ground stone axe, 20 straight poles approximately 5 cm thick and

1.5 m long were cut. These were driven into the foundation trench every 0.5 m to serve as a wall frame, extending 60 cm above the ground level (the external wall height). Next, several thinner poles were cut (approximately 2 cm in diameter) and stuck into the foundation trench in-between the thicker poles, every 10 cm. The spaces between the poles were filled with a wattle made of thin birch saplings cut with flint knives (See Figure 1C). The use of wattle substantially increased the strength and rigidity of the wall construction. The elements located below the ground level, as well as some above the ground level were additionally interwoven with grass, which aimed to improve the impermeability of the structure. Contrary to expectations, the wattle-making process proved a relatively big challenge for the researchers who were carrying out the experiment, as it required much intuition and expertise in tool use. Any act of carelessness could have resulted in skewed walls or wattle-supporting rods being pulled out. The second step of the shallow pit-house wall construction process was plastering clay daub over the walls. The clay (collected with use of an antler adze) was dissolved in water and mixed (1:1 ratio) with the soil from the shallow pit-house excavation. About 600 kg of clay daub were used to cover the walls, including all the soil excavated during digging the underground part of the structure.

The construction of the roof started with cutting 18 pine poles 2.5-3 m long and 7-15 cm thick (See Figure 1D). These were situated in a way to make a rectangle pyramid above the pit-house with its highest point in the central part of the building. The poles were supported by cross beams (10-15 cm in diameter) laid directly on walls and additionally dug approximately 10 cm into the ground. The poles thus formed a frame on which a thatch-supporting structure was later placed. The roof above the central room of the shallow pit-house was hipped (in general shape). The frame above the entrance hallway was built in a different way. It comprised short (0.7 m long) sticks about 3 cm thick, which were placed above the hallway in sets of two, fastened to the wall on one end and on the other end tied together, forming a sort of 'rafter'. The sticks were situated at 20 cm spacing, additionally strengthened with a kind of transom bar, acting as a 'beam'(in this case: several sticks fastened together) that linked all 'rafters'at the top of the roof. The roof above the entrance hallway was gable-ended.

The thatch-supporting structure was built from several tens of rods (birch, mainly) different in length (from 1 m to 2.5 m), most of them were about 1-2 cm in diameter. Firstly, the roof framework was covered with a series of rods lashed to the framework poles arranged in 'levels', each situated 20 cm up from the level below. The lowest level of rods was situated 20 cm below cross beams supporting the roof and the highest one was approximately 30 cm below the place where the poles crossed each other. Next, several tens of sticks around 3 cm in diameter were fastened vertically to the elements of the created level, each of them at a distance of about 0.5 m. This formed a frame to which another layer of horizontal rods surrounding the roof was secured. These were situated directly above the first layer of rods every second level, that is, the lowest (the first) level was single (comprised only the first layer rods), the subsequent one was double (made by the first and the second layer rods), the third one was again single, and so on. The same strategy was used for constructing a thatch-supporting structure above the entrance hallway of the shallow pit-house (See Figure 1E).

The thatch was made of grass cut with use of two sickles with flint insets. Both dried grass and fresh grass was used. The factor that determined grass usefulness for construction was its length of more than 0.5 m. The grass for covering the entire roof of the shallow pit-house was collected in about 60 man-hours. The thatch was made by interweaving the grass material between the sticks of the 'double-rod'level, supporting it both from the top and the bottom on the sticks of the 'single-rod'level (See Figures 1E, F). What proved important was sticking as much grass as possible between the sticks of the 'double-rod'level. In places where too little grass was stuck in, it fell after the thatch dried. This was of particular significance in the areas of the roof where fresh grass was used. After completing construction of each layer of the thatch, the grass was trimmed to obtain a step-like shaped thatch. At the top part of the roof a smoke hole was left (See Figure 1G). Additionally, two window openings fitted with shutters constructed similarly to the thatch were made. In order to ensure water tightness, roof corners were additionally covered with birch bark tiles and the space between cross beams and the thatch was plastered with clay (See Figure 1H). Work on the experiment was conducted by four people for 16 days.

Experimental construction of the shelter

In contrast to the above described Sąsieczno shallow pit-house, a Mesolithic shelter, construction on which started in spring 2013 at the premises of the Institute of Archaeology at NCU in Toruń, was intended to be a full-size reconstruction. The base was a 5 m by 4 m rectangular with rounded sides. Such dimensions are characteristic of flint scatters interpreted as the remains of Mesolithic dwelling structures. These structures are interpreted as an 'on ground' shelter of very light construction, that with exception of occasional postholes leave very little information in the archaeological context (for example Marciniak 1993, 10, fig. 2). Along the sides of the rectangular base a 30 cm-deep foundation trench was created in order to anchor vertical poles intended to support wattle that made up walls and the roof framework beams. The trench was dug with use of deer antler diggers (single bevel tools), replicas of implements used in Mesolithic, known from such sites in Poland as KrzyżWielkopolski site 7 (Kabaciński, David, Makowiecki, Schild, Sobkowiak-Tabaka, Winiarska-Kabacińska 2008), Pobiel site 10 (Diakowski 2011), Dąbki site 9 (Kabaciński, Terberger, Ilkiewicz 2007), Dudka site 1 (Gumiński 1995). The framework on which the wattle was constructed was made of guilder rose and black locust rods about 5 cm wide and 1 m long. These were cut down and divided with use of antler adzes analogous to those employed during the excavation of the foundation trench (See Figure 2A). The rods were driven into the trench at about 50 cm intervals and, additionally, fixed with stones where necessary. In the central part of one of the longer walls, a free space of 80 cm was left for the doorway. Finally, the wall was covered with wattle up to 60-70 cm high. As for the wattle itself, it was made from willow saplings up to 1cm thick (See Figure 2B). About 12.5 $m^2$of saplings were used to make all the wattle, which is approximately 1250 lm of saplings.

Another step in the shelter construction process was the preparation of the roof framework. In contrast to the Sąsieczno shallow pit-house, here the framework was laid on support arches and a series of semi-circular rafters, giving the entire structure a dome. The first series arches (situated at the ground level) were made of guilder rose and black locust rods with diameter of 2-3 cm and mean length of about 3.8 m (when fastening in sets of two). Both ends of each arch were stuck into the foundation trench about 2 m apart, which made each of them (when situated vertically) 130 cm high. Adjacent arches were fastened together at about 80 cm (See Figure 2B). All structural elements were initially tied to each other with use of viburnum and black locust bast fibres, as well as willow rods collected on site with use of flint tools. Nevertheless, the quantity of required materials has soon made application of modern-day hemp cord inevitable. This was the sole exception to the techniques and materials available to humans in Mesolithic made during the construction process.

The next step in the construction of the shelter was erecting the main arch/the transom bar supporting the roof framework and main arches/rafters. The transom bar was made of three guilder rose rods fastened together, 3-5 cm in diameter and 10 m in total length (when fixed together). These rods were bent along the longest axis of the shelter, with its ends located at a distance of about 15 cm from walls (they were anchored in the ground with use of wedges). The height of the transom bar at the highest point was estimated at 3.20 m. The first set of two rafters was fixed at right angle to the main arch prepared as described above. Both rafters were made of two guilder rose rods lashed together, of total length of 8 m. The rafters were bent at each side of the doorway, about 1.8 m apart. Next, the second series of support arches was constructed in the same way as the first one; however, here the arches were not held up by the ground, but by the last 10cm of the vertical poles of the wattle wall (to which they were fastened), located more or less below the highest point of each arch of the first series. This construction method allowed to fix them firmly not only to the wattle wall of the shelter/hut (and, thus, to the ground), but also to the first series arches, to which they were fastened at their highest points. On average, the maximum height of the second series arches was about 2-2.10 m (when bent to form a dome).

Next, the remaining arches/rafters were made in order to provide support for the thatch and to form the overall shape of the shelter dome (See Figure 2C). Firstly, two central arches were bent by situating their ends at both sides of the doorway and at corresponding locations on the opposite side of the structure. These arches were made of the thickest rods (up to 6 cm) fastened in sets of two, 8.60 m in total length. They were bent in a way that enabled them to cross-sect in the central (top) point of the transom bar, forming a kind of groin vault that stretched and strengthened the entire framework. Next, the remaining four rafters were made, located perpendicularly to the transom bar, two at each side of the doorway, 50-80 cm apart and supported by the arches, which stretched the entire structure. These were made analogously to the tallest rafter of this kind, measuring 5.6 m in length (in case of the shortest arches) and 7 m (in case of 'mean'-length arches). Additionally, one central rafter was made, stretching from above the doorway, under the groin vault to the corresponding point in the central part of the opposite wall of the shelter. Lastly, the remaining two parallel rafters of 9.40 m in length were attached. All roof framework elements were tightly fixed together at the places where they crossed each other. At certain places (where necessary) additional rods were attached to form a dome or to strengthen the dome structure. After the work was completed, the framework was tested by suspending a weight of 90 kg from its top.

The process of constructing the thatch started with placing rods onto the roof framework to provide support for the thatch. For that purpose sticks of 1.5-2 cm thick were used, fastened around at nine levels, each 30-40 cm up from the level below, 'covering'the shelter frame (as in the case of the Sąsieczno shallow pit-house) (See Figure 2C). The thatch was made of dry reed cut with use of sickles with flint insets (See Figure 2D).Three types of this implement were used in this experiment (all with wooden handles): cutting/foldable (insets attached askew to the handle axis), cutting with a single blade and parallel handle, and a blade tool swung against the material to be collected.

The thatch was fixed to the roof in a way slightly different to the one used in case of the Sąsieczno shallow pit-house (See Figures 2E and F). The laying of thatch started from the ground level by pressing a 5-10 cm thick layer of reed (the thickness depended on the shape and flexibility of rods supporting the structure) with sticks covering the second series of roof-framework rods around the structure. The reed was placed very tightly and the two rows of sticks were fastened to the rods every 30 cm (approximately). The lower part of thatch was placed onthe first series rods and the upper one was pressed with use of another 'layer'of sticks around the structure, situated about 0.5 m above the lower level. Another layer of thatch was secured to this 'layer'. This was repeated seven times, thus forming seven layers of the 'step-like'thatch (See Figures 2G and H). According to the calculations, covering the entire roof required cutting of nearly a hectare of reeds. In total, taking the average number of people working on the project, the construction of the shelter has taken five people approximately 30 days.

The scientific side of the conducted reconstructions

Undoubtedly, the two conducted experiments gave provided results in form of numerous observations and conclusions regarding usefulness of particular techniques, materials and tools in ventures of this sort. Obviously, these observations and conclusions are purely subjective, and can be translated into the prehistoric reality only to a limited extent. As for the more significant observations pertaining to implements applied in the experiments, the effectivity of the antler products used can be indicated. First of all, the single bevel tools employed during the Mesolithic shelter reconstruction for cutting down wood proved highly ineffective and soon became blunt, thus requiring frequent repairs. This is probably the reason behind quite numerous degraded forms of such tools (probably due to repeated modifications corrections) being found in prehistoric sites. The Lyngby type adze used for digging the pit for the shallow pit-house turned out to be useful mainly for sward removal. As for the deeper layers, in a greater part composed of sandy soil, its effectiveness drastically decreased and here the stone implement proved considerably more useful. Similar conclusions can be drawn concerning the effectiveness of flint tools. No significant differences in this regard were observed in items used for woodworking, regardless of whether the working edge was retouched or not (this especially pertains to saws). Sickles with flint insets turned out to be perfect both for grass and reed cutting, though the tools used for working the former material were substantially more long-lasting. From a scientific view, the most useful conclusions stem from the conducted use-wear analyses. All stone implements employed in the course of both experiences (several tens in total) were subject to use-wear analyses and on most of them clear traces of use have been observed (See Figure 3). The mentioned items were included in the collection of experimental tools at the Institute of Archaeology, NCU which at present comprises over 500 items. This collection is used as a comparative material in use-wear analyses of prehistoric artefacts. The antler implements employed have much the same significance, as in this case clear traces of use were observed, too (See Figure 4). Here, particularly interesting conclusions were drawn from analyses of items with a single bevel blade, which were used in independently conducted tests that aimed at interpreting the methods of use of such forms in the middle Stone Age. The findings shall be published in the near future.

The experiment carried out in Sąsieczno had a second stage which, unfortunately, could not be executed. At the moment the construction works were completed, observation and documentation of the structure decay began. Unfortunately, four years later it was devastated by the inhabitants of a nearby farm. Until that moment, the shallow pit-house had been still inhabitable (after slight renovation). Excavation works are planned for the future with an aim to evaluate the effect of post-deposition processes on the preserved remains.

Summary

Building both of these dwelling structures was highly entertaining and, at the same time, an inspiring archaeological experiment, in which numerous tools made of stone, flint and horn were tested along with many techniques our ancestors might have applied. In the following years a storage pit and a smokehouse were built by the shallow pit-house in Sąsieczno with use of similar methods, thus creating a small-scale open-air museum eagerly visited by students of the nearby schools. The shelter/hut constructed by the Institute of Archaeology, NCU is used in a similar way. Apart from being used for experiments, it serves many educational events including, among others, the archaeology picnic organised during the Festival of Science and Culture in Toruń, which is attended by the locals and tourists in great numbers (See Figure 5). Further expansion of this open-air museum under an ongoing project named *Reconstruction of a Mesolithic Camp* and the planned construction of the Medieval part will undoubtedly enhance the attractiveness of this site and considerably contribute to broadening the knowledge of the citizens of Toruńconcerning the life of people in the prehistoric period and in later times.

Keywords (re)construction
construction of building
wood
thatching of roof
hut

Country Poland

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Gallery Image

FIG 1A. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.

FIG 1B. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.

FIG 1C. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.

FIG 1D. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.

FIG 1E. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.

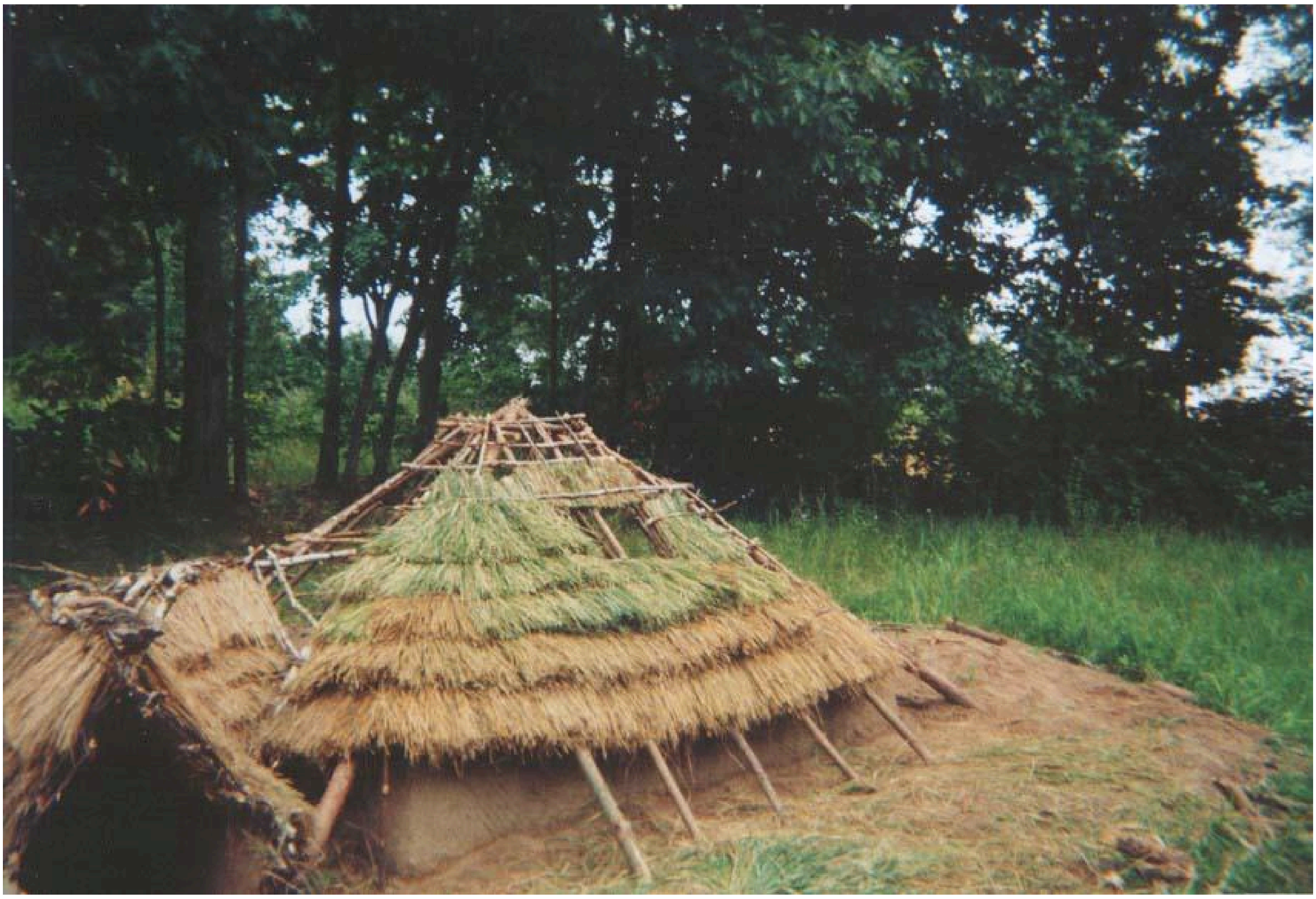

FIG 1F. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.


FIG 1G. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.


FIG 1H. CONSTRUCTION OF THE STONE AGES SHALLOW PIT-HOUSE – STAGES OF WORK.

FIG 2A. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

FIG 2B. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

FIG 2C. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

FIG 2D. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

FIG 2E. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

FIG 2F. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

FIG 2G. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

FIG 2H. CONSTRUCTION OF THE MESOLITHIC SHELTER - STAGES OF WORK.

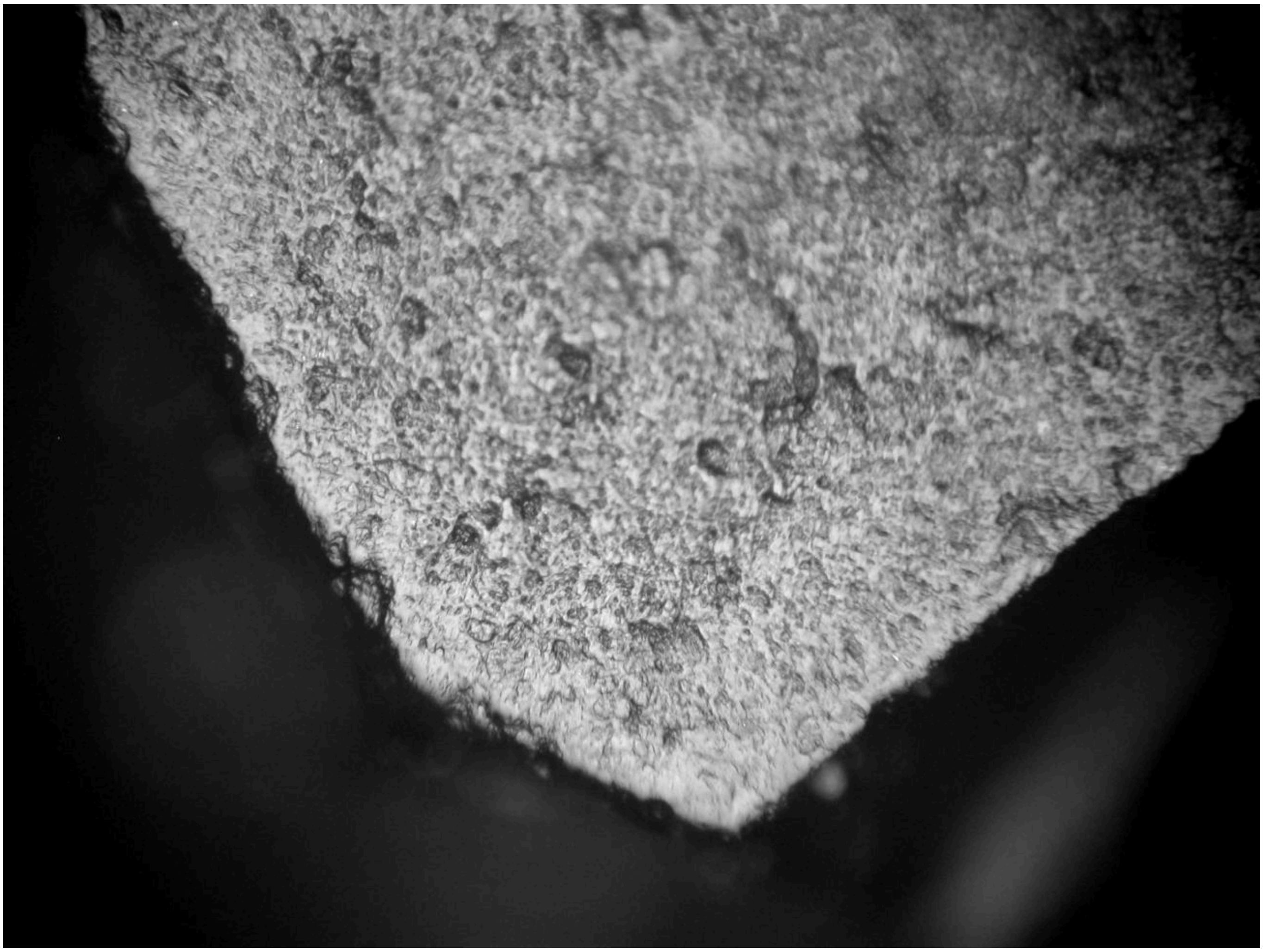

FIG 3. USE-WEAR TRACES CREATED ON THE SAW FOR WOOD PROCESSING USED DURING THE EXPERIMENTS (X250, OB. X20).

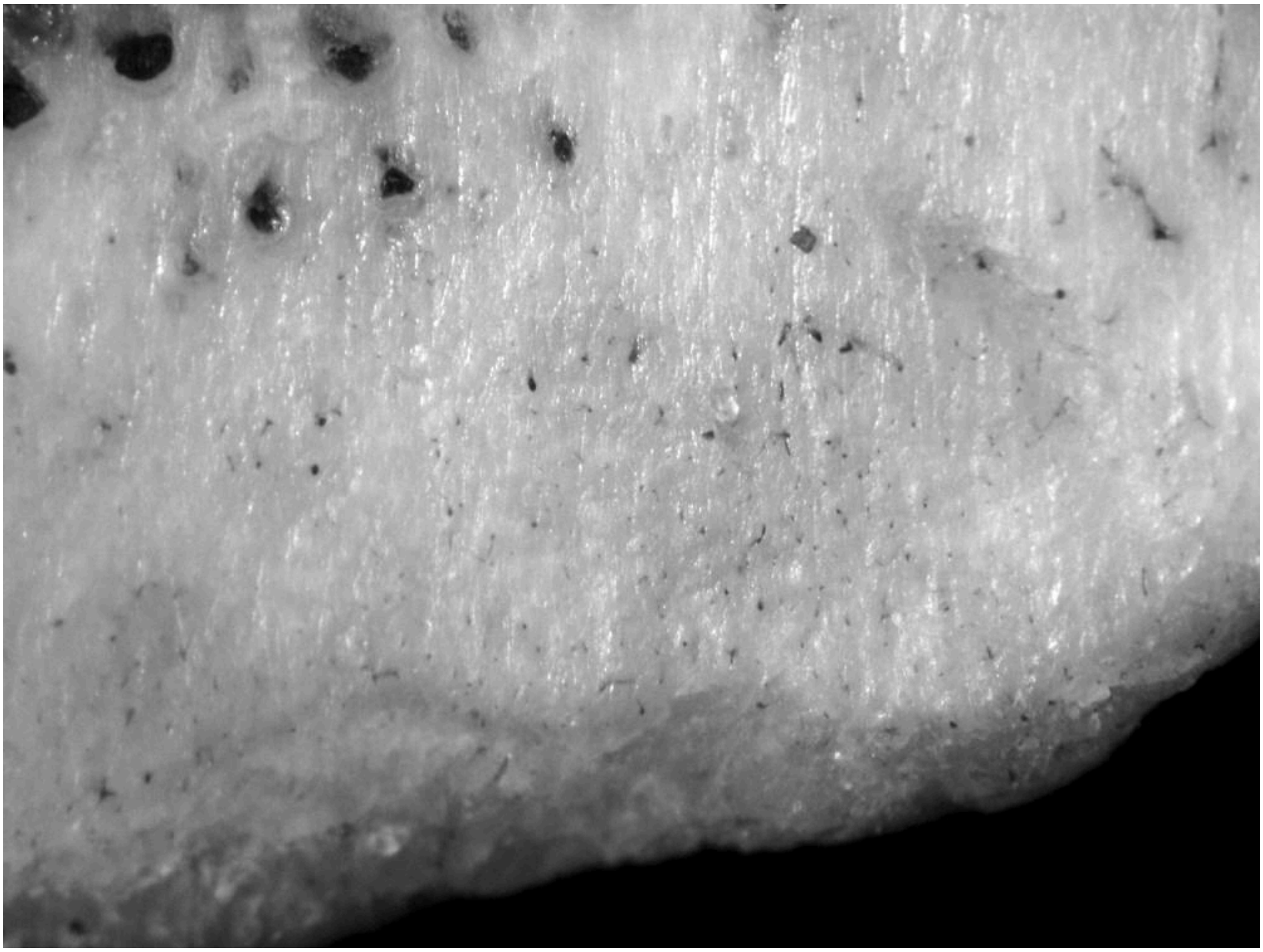

FIG 4. USE-WEAR TRACES CREATED ON THE ANTLER ADZE USED DURING THE WORK IN SOIL (X20, OB. 10).

FIG 5. FESTIVAL OF SCIENCE AND CULTURE IN TORUŃ, SPRING 2014.