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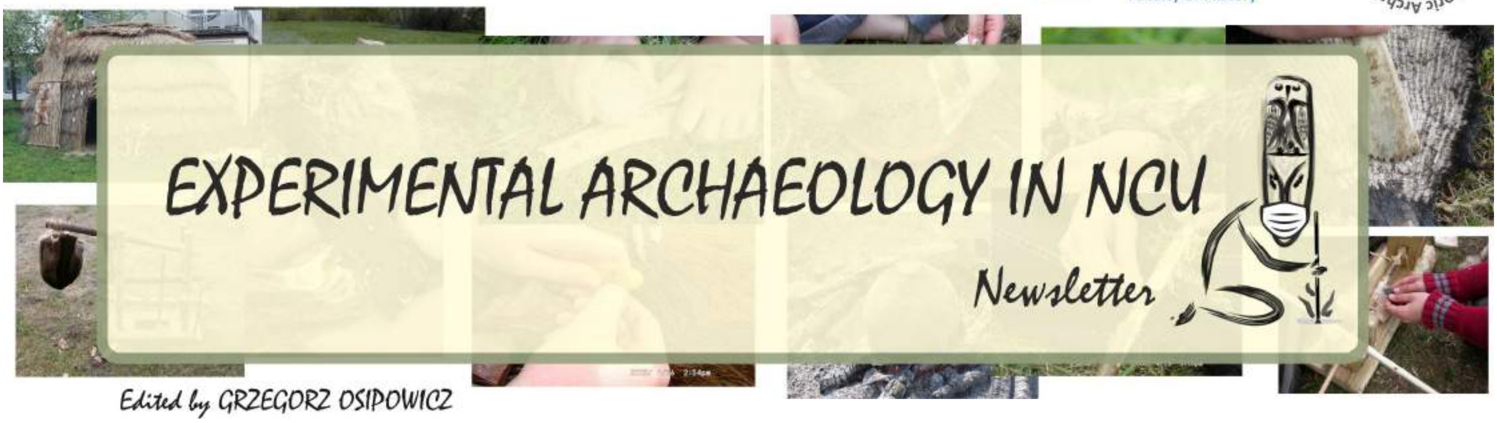
NICOLAUS COPERNICUS UNIVERSITY IN TORUŃ
Faculty of History



Edited by GRZEGORZ OSIPOWICZ

EDITORIAL

Dear Readers! This issue covers the two standard issues of our Newsletter and is devoted entirely to the International Camp of Experimental Archeology, which we organized last summer. Each experiment has its own rules, so unfortunately not everything that was planned for the Camp was implemented. However, thanks to the wonderful and maximally committed team of participants (thank You very much :-)), we managed to conduct two main experiments :-)! We invite everyone to read this relation from the works and of course, to participate in our next Camp, about which information will be available soon :-)

International Camp of Experimental Archaeology

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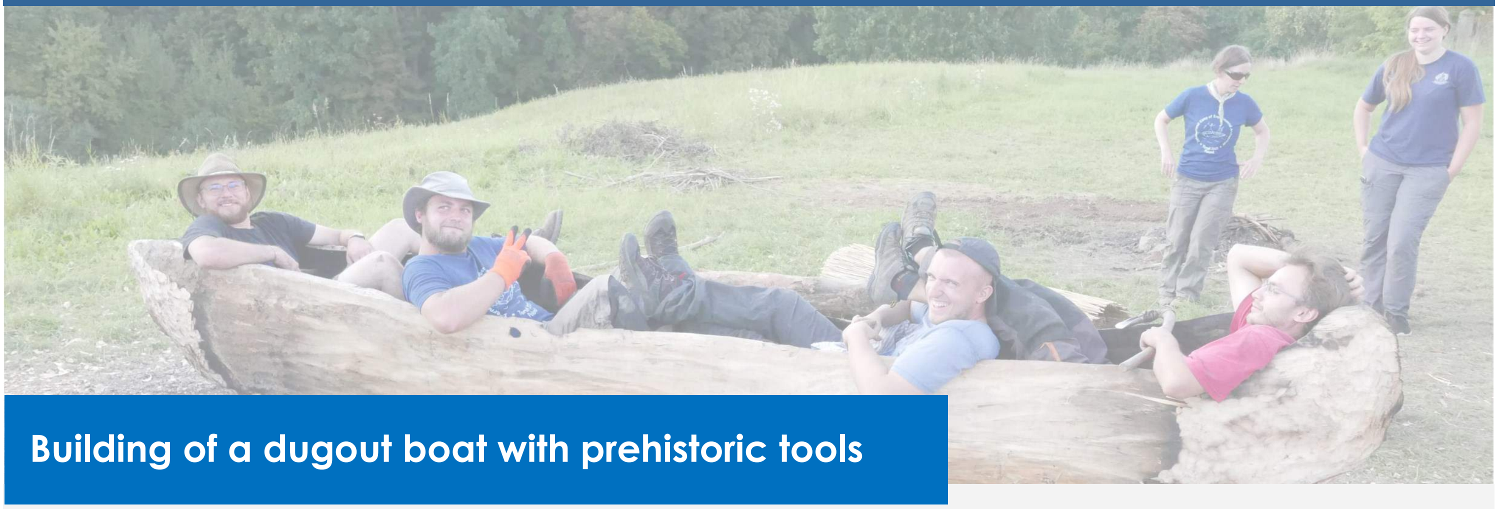

Building of a dugout boat with prehistoric tools

The main objective of works conducted was to test the burning technique and replicas of prehistoric tools made of flint, antler, and metal to make a dugout boat. However, the leading scientific goal of the experiment was to develop a base of the experimental tools used in the Institute of Archaeology NCU as a comparative material during the traceological analysis of the prehistoric artefacts. Using the occasion, we have also tested the efficacy of the applied tools preliminarily during the varied tasks while building the logboat.

Few words about the dugout boats in prehistory

Logboat's are units hollowed out in a large tree's whole or half-cut trunk. Ethnographic sources confirm their use in many regions of the world (Pydyn 2011, 251). The simplicity of this type of unit and the relatively complex set of tools necessary to make them made them one of the oldest types of boats used by man. Unlike many other types of simple water transport, dugouts are known for relatively numerous archaeological contexts dating to the Stone Age (Pydyn 2011, 251). The oldest European finds of this type is a logboat from the Pesse swamp in the Netherlands (Fig. 1; van Zeist 1957), dated to 8265 ± 275 BP. It is estimated that about 300 units of this type have been found in Poland. At the same time, only 5 of them are dated to the Neolithic and early Bronze Age (up to 1300 BC; Ossowski 1999, 177-211).

Fig. 1. The Pesse canoe is believed to be the world's oldest known boat. Source: https://en.wikipedia.org/wiki/Pesse_canoe

The construction method of dugouts depended primarily on their purpose, local tradition, and available material. Ethnographic sources show that both deciduous and coniferous trees were used to make them. Both hard and durable grades, e.g., oak, were chosen, as well as soft and easy to handle, e.g., poplars (Ossowski 1999, 50).

The experiment

Experimental tools

For the need of the project, we prepared 27 different tools, which are replicas of the artefacts known from prehistory. The set included (Fig. 2):

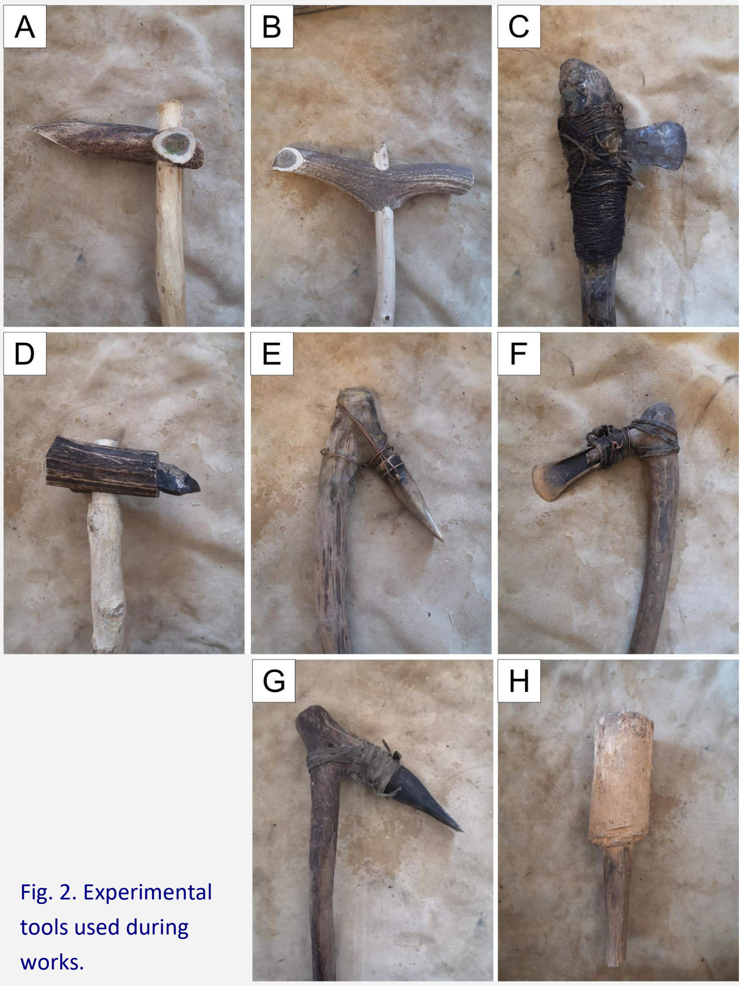

Fig. 2. Experimental tools used during works.

- 8 antler adzes (Fig.2A); Tools were made mainly from the proximal end of red deer antler beams. The working edges were cut to create characteristic bevelled blade oriented perpendicularly or slightly obliquely to the line of the haft. To settle the handle, the perforation, mostly 2–2.5 cm in diameter, was made in the butt part of the tools. All handles were made from deciduous wood.

- 2 T-shaped antler axes (Fig.2B); Tools were made from the central part of the red deer antler beam. The place after removed trez tine was the basis for a hole for the handle. Working edges were cut to create a characteristic bevelled blade that was set parallel to the line of the handle. All handles were made from deciduous wood.

- 2 polished flint axes (Fig.2C); The semi-products of the axes were made from Baltic-erratic flint by a skilled flintknapper. Their working edges were polished on a plate of sandstone. The shafts for axes were made from oak roots.

- 5 antler-sleeved flint tranchet axes (Fig.2D); Axes were prepared by a skilled flintknapper from Baltic- erratic flint. They were fixed in the sleeves made of red deer antler and mounted on handles made of deciduous wood.

- 2 bronze adzes (Fig.2E) and two bronze axes (Fig.2F); These tools were prepared especially for the needs of the Camp by a skilled caster. They are the replicas of Bronze Age socketed and flanged axes/adzes. All tools were mounted in handles made of an oak tree.

- iron adze (Fig.2G); Similarly to the tools described above, this one was also prepared especially for the need of the Camp by a skilled blacksmith. It is a replica of Iron Age socketed adze. It was mounted in a handle made of an oak tree.

- 4 wooden wedges; These tools were made from pine wood. They had a bevelled working edge and blunt end.

- 2 wooden mallets (Fig.2H); Mallets were made of a beech tree.

Raw material for making the dugout

As the possible raw material for our dugout boat, we have prepared two tree trunks: European ash and poplar. The trunk of the poplar was about 8 meters long and 90 cm in diameter. It was cut four years before the Camp started. During this time, it was exposed to changing weather conditions. The second trunk (about 6 meters long and 80 cm in diameter) was ash. Unfortunately, due to the large knot in the middle, which was a remnant of one of the tree's main branches, it was not perfectly straight. This trunk was aged for two years.

Description of the experiment

Day 1 (16.08.2021)

We started work at 9 am. In the beginning, we chose the poplar trunk for the dugout, which has much better properties, i.e. straightness, uniform thickness, considerable length and, above all, less hardness of the wood. We started the work on the trunk by removing the rotten parts of the wood and checking its general condition (the bark was removed earlier). For these activities, wooden wedges and antler adzes, hitten with wooden mallets, were used (Fig. 3, 4).

Fig. 3. Removing the rotten parts of the wood and checking its general with help of wooden wedges.

Fig. 4. Removing the wood with wooden wedges and antler adzes, hitten with wooden mallets. Unfortunatelly, the poplar trunk wasn`t good preserved...

Unfortunately, after removing a few layers of decaying wood, we realized that the trunk is no longer suitable for constructing a dugout ..., time and weather conditions did their job... Therefore, after about an hour, we finished working on this trunk.

Around noon we started debarking the second ash tree trunk. The same tools as for the processing of the first trunk, i.e. wooden wedges and antler adzes, were still used for this activity. The work was effective, and the undermined bark came down in long patches (Figs. 5, 6). The trunk turned out to be well preserved.

Fig. 5. Debarking of the second tree trunk prepared for the need of the Camp.

Fig. 6. Debarking with wooden wedges and antler adzes.

Fig. 7. Chiselling a groove along the axe of the trunk to create space for the fire.

Fig. 8. Chiselling and flattening of the trunk using a flint axe.

Day 2 (17.08.2021)

The morning of that day was devoted to continuing the debarking work. Once it was finished, it was time to prepare the top of the trunk for the firing process. To do this, first, we flattened it and then we chiselled a groove along the entire length of the trunk. We performed these activities using a flint axe (Fig. 8) and the antler adze, that was used as a chisel/wedge (Fig. 7). This stage took about 2 hours.

After the initial burning in the middle part of the trunk, it was necessary to protect its external parts, which were to form the sides of our boat in the future. For this purpose, we used clay dug in the surrounding field, which we mixed with sand and water (Fig. 9). When everything was ready, we started firing. Initially, we lit the fire only in the central part of the trunk, where there was a large knot, the remain of one of the tree branches (Fig. 10). We spread the heat created here along the length of the trunk, using the pine and beech wood chopped into small pieces as fuel (Fig. 11).

Fig. 9. Securing the external sides of the dugout with clay.

Fig. 10. The initial fire was started in the central part of the trunk, where was a large knot.

Fig. 11. The heat was spread along the length of the trunk. We used pine and beech wood chopped into small pieces as fuel.

The first "burning" lasted about 1 hour 30 minutes. After this time, the coals and the remains of fuel were removed (they were moved to a nearby fire for re-use). When the fired surface had cooled down a bit, we proceeded to remove the charred layer of wood with flint tranchet and antler adzes (Fig. 12). We found the work of roughly chiselling the burnt raw material and then removing its remains by scraping as more effective. The process of "cleaning" the trunk in this way took about 20 minutes. After its completion, we started firing anew. During the first day, we performed the described activities three more times (burning, removing the charred surface, protecting the boat walls with clay).

Fig. 12. Removing the charred layer of wood with flint tranchet and antler adzes.

We conducted our experiments in a very windy place (deforested edge of a large river valley). It had a significant impact on the firing process as we initially thought and made the fire more difficult to control. We decided to construct a windscreen taking this belief into account and fearing that fire could be accidentally transferred to nearby buildings. The windscreen was made of wooden poles stuck into the ground at a certain distance from each other, and reed mats stretched between them (Fig. 13).

Fig. 13. Building of the windscreen (visible behind the dugout).

Day 3 (18.08.2021)

We started work at 9:00 am. We performed the same activities as the day before (Fig. 14 and 15). We have noticed that we should wait at least 10-15 minutes before removing the burnt material after each firing. Performing this action too early had a very destructive effect on the working edges of the antler tools used. They overheat quickly, and as a result, they become very brittle. Thus, we destroyed one of the tools we used on the first day.

Fig. 14. Remowing charred wood from the inside of the boat with flint tranchets.

On that day, we also made the first attempts to work with axes and adzes, which were replicas of tools from the Bronze Age and the early Iron Age (Fig. 16). Working with them turned out to be very effective. They allowed, among other things, deeper penetration of the fired raw material and making precise cuts and chamfers in it, which, as it turned out, was extremely important because it allowed for easier penetration "into" by fire. We decided to permanently include the tools mentioned above in our works due to the high hardness of ash wood and the associated firing efficiency lower than expected (on average, after 1 hour 30 minutes of burning process, it was possible to remove only approximately 2 cm of the burnt wood layer).

Day 4 - 5 (19-20.08.2021)

Our work schedule was similar to the one described above during the next two days. We started the day around 9:00 am by lighting a fire inside the trunk, which usually lasted about half an hour. Then a 1.5-hour firing period (Fig. 17) began, followed by: (1) removing the heat and unburnt logs, (2) a 15-20 minute break for the entire surface to cool down, and (3) removing (trimming and scraping) burned wood (Fig. 18).

Fig. 15. Firing the inside of the dugout.

Fig. 16. Remowing charred wood with help of the replicas of tools from the Bronze Age and the early Iron Age.

The last of these activities usually took about 20-30 minutes, with the involvement of 2 to 4 people. Every day, we were able to carry out 3 to 4 such cycles, which resulted in the removal of approx. 6-8 cm of a wood layer. We finished the work every day around 18:00.

Fig. 17. The next stage of the firing. We`re almost done!

Fig. 18. Removing (trimming and scraping)) of the burned wood.

Day 6 (21.08.2021)

Day 6 of our work, which was also the end of the first week of the Camp, was a very important day for the described experiment. We realized then that the firing of the trunk takes place much slower than we assumed, which generated the risk that we would not be able to make our dugout before the end of the Camp. The reason for the delay was the much greater hardness of the ash wood compared with the poplar, which was originally to be used during the experiment and under which we planned the schedule of our work. For this reason, we decided to shorten the processed trunk by about 1.5 m. This decision was difficult, but unfortunately, necessary for the boat to be finished on time.

Day 7 (22.08.2021)

On that day, camp participants took part in a scientific tour of the most important nearby archaeological sites (Fig. 19). However, one of the volunteers, who did not participate in the trip, decided to carry out the firing, thanks to which trunk was prepared to remove the charred raw material for the next day.

Fig. 19. Participants of the Camp during the trip to Biskupin.

Day 8 (23.08.2021)

Unfortunately, it was raining all day, which made it impossible to work on the dugout :-(

Day 9 (24.08.2021)

At the beginning of the second week, the trunk was half hollow (Fig. 20). That day, we decided to remove the windshield, because wind blowing turned out to be invaluable for the firing at this level. We managed to make three firings, which resulted in the removal of approximately 6 cm of burnt wood from the interior of the dugout.

Fig. 20. View at the dugout at the beginning of the second week.

Day 10 (25.08.2021)

This day we continued work inside the trunk. At the same time, we started shaping our dugout's beak and stern parts. To this end, we lit two small fires at both ends of the trunk (Fig. 21). The firing took about an hour, after which we started to hew the burnt material. Similarly to the previous day, we made three cycles of burning inside the dugout.

Fig. 21. Shaping dugout's beak and stern parts with two help of small fires at both ends of the trunk.

Day 11 (26.08.2021)

The work-related to firing the interior of the dugout was completed on that day. Ultimately, the bottom of our boat was 5 to 8 cm thick (depending on the location). We also continued shaping the stern and beak. This process consisted in firing them several times for about an hour and then hewing the burnt area with bronze axes (Fig. 22). At the same time, we have hewn some bottom and side elements to give them a more streamlined shape and to level the boat's curvature (Fig. 23).

Day 12 (27.08.2021)

The last day of work on the dugout. We finally shaped its beak and stern with the bronze axes, and thus it was finished (Fig. 24, 25). Work that day lasted about 3 hours.

Final remarks and comments

Our work lasted 11 days, with at least four people working seven to eight hours each day. The finished dugout is 415 cm long, with average 50 cm wide, 60 cm high and 50 cm depth. It was necessary to use approx. 8 m3 of wood as firing fuel to its completion.

Fig. 22. Hewing the burnt area of the boat with bronze axes.

Fig. 23. Hewing the bottom of the boat with bronze axe.

Fig. 24. Decorating the finished boat by the participants.

During the works, it was observed that presence of large knots, which were characterized by the greater softness of the raw material (which facilitated penetration "into the wood" both by fire and tools), was a factor conducive to increasing work efficiency. It was also extremely important to properly protect the dugout walls with clay. In principle, after each firing, the layer of previously applied clay had to be removed and replaced with a new one. The reason was a free space formed under the dry and fired clay, which was penetrated by the fire. We ignored this in the initial stages of firing. As a result, one of the sides of the boat burned in the upper part.

Working with many different tools allowed us to classify them in terms of effectiveness initially and assess their advantages and disadvantages. The bronze tools are undoubtedly considered the most useful, although they were not without downsides. The tools tended to twist and fall out (despite the use of ties, ropes and copper wire, which were intertwined through their ears and attached to the handles) during the entire project. Antler adzes also proved to be very useful as scrapers of charred wood. Flint axes, on the other hand, were excellent for splitting firewood.

The described experiment is our first attempt at making a dugout. We learned a lot about both the tools and the process itself during the entire project. We will certainly use this knowledge in future projects that we are already planning. We have now much work to do with the microscopic analysis of the experimental tools used and thus the more scientific side of the described project. We sincerely hope that the results of this work will prove to be important for our traceological analyzes of archaeological materials and for other studies on prehistoric technology that we are conducting.

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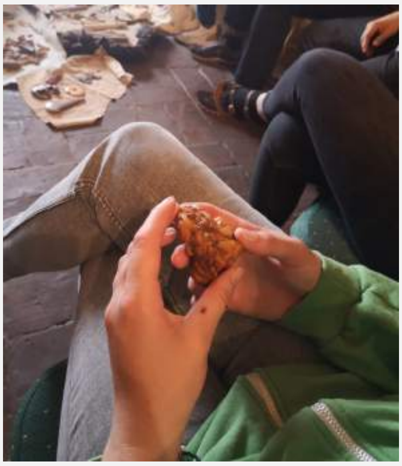
Fig. 25. Happy Camp participants after finished work:)

Workshops

In addition to the main experimental works carried out during the Camp, its participants had the opportunity to take part in the workshops related, among others to flint knapping and amber processing. We had the great pleasure to host Witold Migal from the State Archaeological Museum in Warsaw (flint knapping specialist) and Eryk Popkiewicz (amber processing specialist) who presented various processing techniques of these materials and told our participants a bit about the secrets of their work.



Sticks, hides and bone needles – a few words about building a leather boat

During the two-week International Camp of Experimental Archaeology, its participants undertook the complex archaeological experiment, the purpose of which was to create and test a replica of archaic leather-covered boat known more from ethnographic contexts, as the so-called skin-on-frame canoe. This experiment required the use of a wide variety of raw materials and tools, which made it possible to conduct several small experiments, the results of which will be used, among others in the later use-wear analysis of prehistoric flint and bone tools.

Leather boats in prehistory

Besides rafts, leather boats are one of the oldest means of water transport. Archaeological sources, however, do not provide much data on the methods of building and operating units of this type; hence the reconstruction of them is often based on ethnographic data and more modern finds. However, this does not change the fact that it is believed that they were probably used at the end of the Pleistocene (Pydyn 2011, 236). In terms of construction, leather boats refer to bark, cane, or wicker units. They could be built as skeletal, and shell units; the first of these techniques is better confirmed by sources (Pydyn 2011, 237). The most numerous categories of leather boats include small round, oval, elliptical and square or rectangular units. They were common in various geographical regions. The skins of many animal species were used to make their plating, e.g. in the United Kingdom and Ireland, they were primarily cowhides, while in the Arctic zone, deer, caribou, whale, seal and sea lion skins (McGrail 1987, 176).

The experiment

Stage 1 - Making a boat frame

The boat's construction began with a frame, on which later leather sheathing was supposed to be stretched. In the first stage of producing a leather boat, preparing the necessary wooden raw material in the form of straight branches was very important. To make the skeleton of our boat, we used willow (*Salix L.)* branches, which are very easy to shape. For their cutting, replicas of Neolithic flint axes (two tools), stone axe (one tool) and two bronze axes (one sleeve type with a handle and one with raised edges) were used, which were replicas of forms known from the Bronze Age. Initially, due to the people's lack of skill in the experiment, the work with these tools was difficult and ineffective. The difficulties resulted, among others, from the fact that the branches were cut at some distance from the ground, which resulted in "bouncing" the axe due to the high elasticity of willow branches. However, as time passed, the process became more effective and enjoyable as the participants become more experienced (Figs. 1, 2).

Fig. 1. Cutting tha branches with bronze axe.

Fig. 2. Shortening tha branches with flint axe.

The average working time of the bronze axes was from 1 to 2.5 hour. Flint axes were used for about 1 hour 20 minutes. In the case of the stone axe, its working edge was broken after almost 2 hours which resulted in the termination of work. It was not without blood sacrifices in the form of injured fingers, and some of us felt the true primal call ;-)

During this stage, the wood needed for the construction of the frames used later to clean of deer hides was also collected (Fig. 3). All branches were cleaned of leaves by hand. A flint knife mounted in a wooden handle, which was used occasionally to incise the bark, also proved to be helpful in this operation. The result of this stage of work was the acquisition of about 80 large willow branches with a diameter of 3 to 5 cm and numerous twigs for plait.

Fig. 3. Collecting branches for the deer hides cleaning frames.

After obtaining the materials necessary to build the boat's skeleton, we proceeded to delineate its shape on the ground. The procedure aimed to enable the most precise positioning of the wooden poles constituting the basis for the skeleton of the future boat. The works started with drilling (Fig. 4) two holes in a straight line at a distance of 4 m where two larger branches

Fig. 4. Drilling holes to stabilize the branches off the skeleton.

(aprox 2,5 meter long) were placed, constituting the future keel (Fig. 5 - marked with red line).

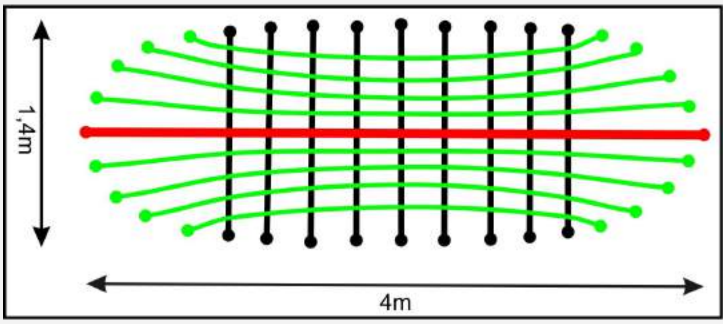


Fig. 5. Boat skeleton diagram.

With the help of a string, the main axis of the boat's hull was marked out. In its middle point, the maximum width of the hull was measured, which was 1.4 m. At the widest place, in the symmetrically drilled holes, two about 1.8 m long branches were placed. In this way, two perpendicular axes of symmetry were obtained. Then, symmetrically every 25-28 cm around the entire perimeter of the future boat holes were drilled, where branches building the boat frames were placed (Fig. 6).

Fig. 6. Outline of the future skeleton during the construction.

There were 17 branches on each side - 34 branches in total on both sides. The sides of the boat were woven to a height of about 28 cm along its entire circumference with willow twigs (Fig. 7).

Fig. 7. The skeleton during construction - bending branches.

In the next step, the two largest branches forming the keel were tied and connected to the woven parts of the boat sides. On each side of the keel, eight branches were used to form four 4 longitudinal "boat frames" of the skeleton (cf. Fig. 5 - marked on green; Fig. 8).

Fig. 8. The skeleton is almost finished!

Both, the bow and the stern of the boat were secured with poplar bast, and their structure was strengthened by tying a series of willow twigs so that the plating would not be broken in the future when reaching the shore (Fig. 9).

Fig. 9. The bow and the stern of the boat were secured with poplar bast and strengthened with willow twigs.

The skeleton constructed this way was turned inside out. Then the braided lines on the sides were completed, strengthened, and finished by tying them with a poplar bast (Fig. 10).

Fig. 10. Finishing the sides of the boat with a poplar bast.

From the bow and stern sides, two beams 1.5 m long and approx. 3 cm thick were added to strengthen the frame (Fig. 11). Later, 17 branches long for about 70-100 cm and 2cm thick were attached to the bottom part of the boat to create the frame of the boat floor. The frame was covered with two mats created of the willow twigs (Fig. 12).

Fig. 11. A wooden kiln blocking the branch used for strengthening the shape of the frame.

Fig. 12. Mats made of for securing the boats floor.

Stage 2 - Preparation of hides necessary to cover the boat

To cover the skeleton of the boat, eight deer hides were needed. Due to the limited time we had we had for our camp, we have decided to prepare six of them in advance. The participants prepared the remaining two hides during the course of the experiment. Two frames were constructed from previously cut willow trunks, on which fresh deer hides were stretched (Fig. 13).

Fig. 13. Streching the hides on the wooden frames.

These hides had to be cleaned of the remains of flesh (Fig. 14). One bifacial knife was used for this task, two endscrapers (one in a wooden handle, the other without a handle, wrapped in leather), three knives made of flint blades in wooden handles, and four bone tools: the so-called bevell ended tools made of long deer bones (two from fresh bones, two from bones aged about a year).

In a case of the flint tools, the work involved cutting off the remains of flesh (knives) and scraping the surfaces of the taut hides (endscrapers) (Fig. 15).

Fig. 14. Cleaning the hide with flint knife.

Fig. 15. Defleshing the hide with flint tool.

In turn, the work with bone bevel ended tools consisted of hitting the taut hide from top to bottom at approximately 45 degrees, allowed to the flesh and its systematic removal (Fig. 16).

Fig. 16. Cleaning the hides with bone bevel ended tool.

For hafted flint knives, the average working time was 2 hours, and for a bifacial knife, 2 hours and 30 minutes. What is worth noticing, in the case of two bevell ended tools made of old bones, a significant blunting of the working edges was noticed after 2 hours of work. The blunting hindered the effectiveness of cleaning the hides. Therefore, it was decided to cut them off (these fragments were saved for traceological analysis) and prepare the new ones on the sandstone. Then, processing was continued. Working with these tools lasted for about 1 hour. Two replicas of bevell ended tools made of fresh bone were used for 4 hours and 20 minutes, respectively. Notably, there was a difference in the durability of the working edge between tools made of old bones and the one made of fresh bone, where, despite 4 hours of working, no blunting of the edge was noticed. The end scraper with a wooden handle was used for 1 hour and 25 minutes and the second tool of this type (wrapped in leather) worked for 30 minutes.

After the hides had been completely cleaned from the remains of fat and flesh, they were put into lye (a mixture of water and ash) for three days. Then, the hides were thoroughly rinsed and stretched on debarked poplar trunk, where they were de-haired with the use of a deer rib with flint inserts and two flint endscrapers (Fig. 17). The work consisted in scraping the skin with the abovementioned tools (with and against the grain), which loosened the hair. The tool made from rib created some problems during the work because one of the inserts placed inside him was slightly higher. It resulted in a not equal way of removing the hair by different parts of the working edge. To fix this problem the insert had to be retouched. After 3 hours of work, one of the inserts cracked and was replaced. The work with the tool was finished after another 40 minutes. Removing the hair wasn't an easy process because in some places they still were "seated" hard in the hides. It was probably related to the insufficient alkalinity of the lye solution that we have used. Unfortunately, due to the limited time that we had at the camp, it was not possible to repeat the leaching process.

Fig. 17. Removing hair with tool made of bone rib with flint insets.

Stage 3 - Covering the frame of the boat with hides

The first aim of this stage was to sew together previously prepared hides. They were tried on to the skeleton in pairs (Fig. 18, 19).

Fig. 18. Matching hides on the skeleton.

Fig. 19. Sewn hides on the skeleton.

To obtain the proper shape of the plating, hides were cut with a flint knife. Holes in the hides used to connect them together were made with awls and bone needles along their edges, in a distance approximately 1 cm one from each other and from the edge of the hide. A total of 12 tools were used for this porpose (Fig. 20).

Fig. 20. Making holes in the hides with a bone needle.

Significant differences between the tools used in this activity were noticed during the works. The most effective were tools with a thick base/handle and a small, thin point, while long needles and awls broke very quickly at the tip of the point or in the middle of its length and had to be repaired many times by grinding on sandstone. The working time of the tools ranged usually from 2 to 35 minutes. In a case of 2 tools, the working time was 1 and 2 hours. Their working edges had to be sharpened (ground on the sandstone) every 5-15 minutes of use. The two most effective tools (characterized by thick bases and small blades) worked for 3 and 6 hours without significant repairs. It is worth noting here that the small size and shape of these two tools made it possible to make holes using a combined piercing and drilling technique. For the others, only drilling was possible, due to the way that tools were kept in the hand (making it impossible to apply the higher pressure force).

After the holes were made, the hides were sewn together using dried and twisted pig intestines (Fig 21). Sewing began with two hides forming the bow plating to which other parts were sewn, keeping one direction of the central seam. Sometimes it was necessary to enlarge the hole while sewing. Dried and well twisted intestines were relatively easy to thread through the holes by hand without the use of needles (Fig. 22), but there were situations when the intestines got wet from the hides and required the tip to be trimmed with a flint knife.

Fig. 21. Twisting the dried pig intestines.

Fig. 22. Sawing the hides with a string made of intestines.

Eight hides sew together have resulted in a seam with a total length of 11.5 m. Its creation was exhausting and required the work of a few people. Sheathing prepared in this way was stretched on the boat's skeleton and connected to it with a string. Then, it was left to dry (Fig. 23).

Fig. 23. Finished leather boat during drying.

Stage 4 - Impregnation

Due to the limited duration of the camp, impregnation of the boat was not possible at the place, however, we are going to do it very soon. It is planned to seal the boat's seams with tar and to impregnate it with animal oil. For now, the boat is kept dry, which prevents its destruction.

Final remarks

Due to the complexity of the experiment, it was necessary to divide the work, so the steps described above were sometimes performed at the same time. After "decompressing" the skeleton, the boat has the dimensions 4,2 m length by 1,75 m width and 70 cm depth. The whole structure is relatively light, and three people can carry it. All conducted works were precisely documented. The experimental tools used during the camp and all related documentation are now a part of a collection of tools stored in the Traceological Laboratory of the Nicolaus Copernicus University in Toruń and used as comparative material during microscopic analyses of prehistoric artefacts. Building a leather boat was definitely worth the hard work, sweat and pain in the fingers. For the Camp participants, it was an opportunity to expand their knowledge on the processing of various raw materials and replicas of many types of tools known from prehistoric contexts (Fig. 24). We hope that the boat, built during the International Camp of Experimental Archaeology, will go to the National Maritime Museum in Gdańsk and become a permanent element of the local exhibition, thus spreading knowledge about experimental archaeology among a wider audience.

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Fig. 24. Happy Camp participants after finished work:)

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