Baltic and beyond
Change and continuity in shipbuilding

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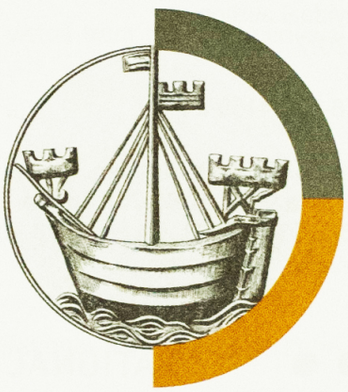

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41. The *'Baidak'* Vessel from the Desna River

Field survey

In May 2010 we received information about an ancient vessel that had been found on the right bank of the Desna river. Specialists from Kyiv National University inspected the artefact, measured and took the first pictures of it. The archaeologists gave a preliminary estimate of the age of the vessel: according to them it referred to the 1st half of the 20th century.

According to our data the vessel design was archaic. It had a lot to do with flat-bottom river cargo vessels. In 18th–19th centuries such vessels had various names, e.g. *berlinas*, *barkas*, *budaras*, *baidaks* in Ukraine, *dubases*, *galars* in Poland (Ossowski, 2010: p. 16). Irrespective of the age, the artefact was interesting both for history and for exhibition.

In July 26–28, 2010 a team from the National Reserve "Khortitsa" (a historical and cultural reserve in Ukraine) made their first trip to the Desna. A primary inspection showed the flat-bottom vessel made of planks was located 2 km eastward of Suvid village on the right bank of the Desna. As we found out, the wooden hull was washed out of the soil during a flood, floated to the surface and then downstream and appeared on one of the sandbanks on the right-hand side of the river.

The *baidak* hull was not preserved intact. On both sides the third upper planking strake was missing, and only half of the second strake on the starboard was preserved on the side of the stern. The planking edge bore new traces of an axe. The vessel stem was missing. As a result, the medium strake along the portside had become unbent. Besides, the lower strake had a crack near its end. There was also bad damage to the starboard futtocks. The second and the third one were missing. Some wooden pins were also missing. During two months ashore the hull dried and deformed. The wood was covered with longitudinal and transverse hairline cracks. Most of the futtocks on the portside were deformed (Fig. 1).

According to recollections of a local resident P. Kachkan, such vessels were used on the Desna up to the 1970s for cargo transportation. Each village had one or two such boats. Its condition enabled restoration and turning it into one of the central exhibits of a future maritime museum on the Dnieper. It should be noted that the vessel design maintained traditional features typical for European river shipbuilding of the 17th–19th centuries. During second trip to the Desna in October 2010 the wreck was transported to Zaporozhye (Fig. 2) (Kobaliia and Denysenko, 2015: p. 64).

Design and condition

This is a flat-bottomed vessel with 11.47 m length and 2.55 m width. The side is 1.2 m high. Sides were attached to the outer ends of the bottom planks with wooden pins nailed through the planking. Each side had three strakes, starting from a transom and running to a stem. Joints between the strakes and bottom were caulked with a special composition based on moss. The joints on the outer sides were tapered; on the bottom the wedge tapered down. The joints could be as wide as 30 mm, therefore they were covered with a thin pine plank on the top, nailed with many iron clamps. A joint between the bottom and side planks was covered not with a strip of board, but with a small bar.

The foremost stem beam was missing by the time the vessel was found. The planks were attached to the stem with pine pins, while the latter was fastened with round oak wedges. The wedges were inserted into the holes that had been previously drilled in the planking and pins. The stem diameter reached 400–470 mm.

On the portside two pine strakes survived. The lower strake is a one-piece pine plank 100 mm thick; its width near the seventh frame is 280 mm. The second strake of the same thickness was 400 mm wide. Each of these planks was fixed to the frame lateral sections with two pins, where the lowest one was nailed to the side edge of the second bottom strake.

The starboard side is the worst preserved. Here the second and the first strake pine planks were also found, the lower one is almost intact, while the upper one is partially destroyed and consists of three parts. A large fragment of the upper plank was found separately in the river bed. Only the lower plank fragment of this strake from the middle part to the transom is preserved. The width of the planks is as follows: in frame No. 6 it is 320 mm on the lower one, while the upper one is partially destroyed; in frame No. 3 it is 370 mm on the upper one and the same on the lower one.

Two planks made up the transom but only the bottom one survived.. The plank is 100 mm thick and 400 mm wide. The part joined with the last transverse section of the floor timber and *botias* (L-shaped timbers which could have the function of standing knees), mounted outside. It is fixed to the planking with pins.

The bottom planks consist of two strakes on each side of the keel. Outer planks are hewed in accordance with the vessel shape. The planks are of different width. Thickness of the bottom planks near the transom is 120 to 130 mm. The keel here is about 100 mm. Joints between the strakes on the top are wide, about 30 mm.

Figure 1: Preparation for crossing the vessel through Desna river

Figure 2: Loading a baidak on the trailer

An athwart set included floors and so-called *botias* mounted above in special incuts. The boat has totally seven athwart sections somewhat different in design. In its narrow part the framing is made of oak. The first three prow sections were made of the whole timber with a part of a tree branch shaped as a frame joining the strakes. Each frame had a rounded inner side and a flat outer side. On the other side the section top surface had an incut to receive oak *botias* similar to the opposite side. Section 4 and the following ones were made in a different way. The floor here was made of a normal square pine beam with grooves on the top at the sides. These grooves on both sides had already received two oak *botias* each. The last seventh section was located not on the inner, but on the outer side of the transom. The floor is made of pine. The right-hand botia is preserved in its bottom part. The left-hand one is preserved completely. The botias at the stern differ from the others with availability of additional pins that join them not only with the side and bottom planking but also with the transom (Fig. 3).

Clamp types and evidences of repair

The principal fasteners of the pine planks were flattened forged clamps, and the secondary ones were forged. All in all there were 6 clamp types and subtypes (Fig. 4).

Type 1. It includes wide flat clamps of irregular width, 96 to 130 mm long and 1 to 2 mm thick. Characteristic features of this type are as follows: maximum extension of a clamp width (from 13 to 17 mm) in its middle part, irregular tapering towards the clamp ends, and irregular shape. Regarding Type 1, 52 clamps out of 79 are partially destroyed, while 27 clamps are completely preserved.

Type 1.1. It almost completely follows the shape of the 1st type (maximum extension in the middle part), but differs much in its length (up to 145 mm) and thickness (4 to 5 mm). These clamps are more solid. Survivability of Type 1.1 clamps is much higher: 16 clamps out of 27 are completely preserved, metal corrosion and destruction degree is much lower.

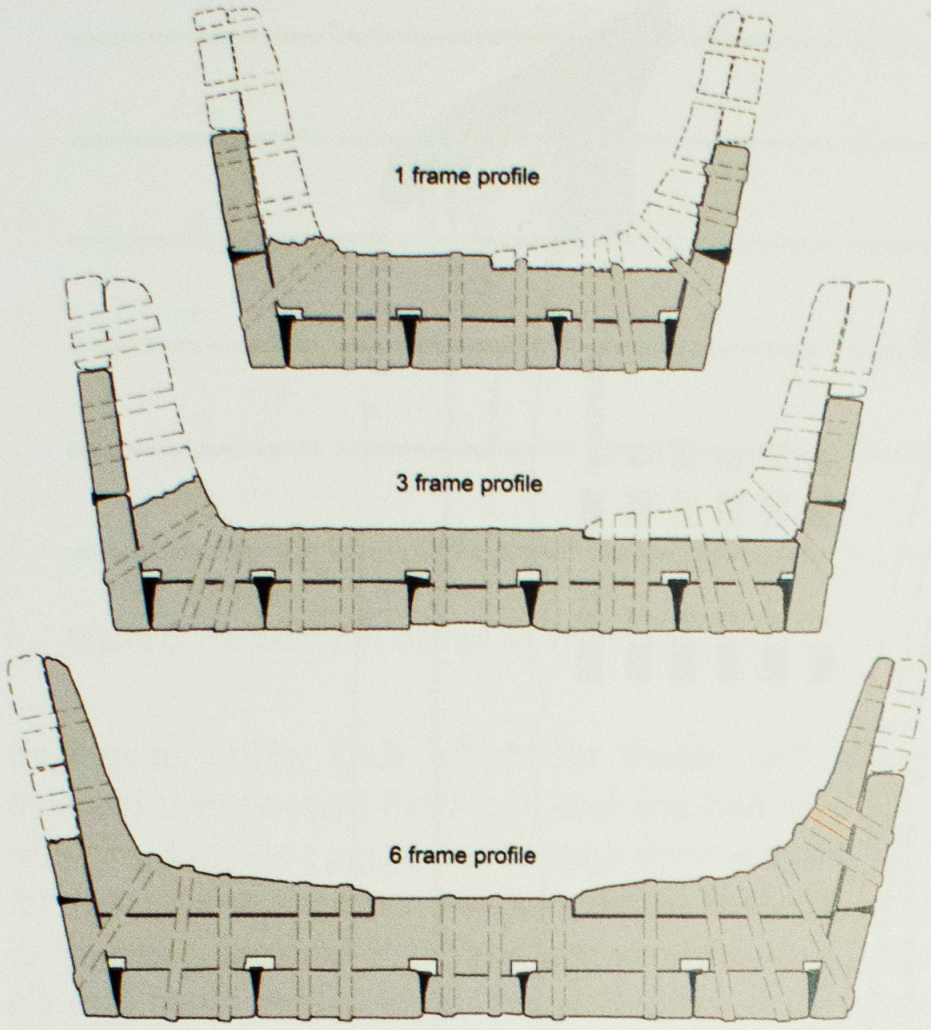

Figure 3: The frame profiles

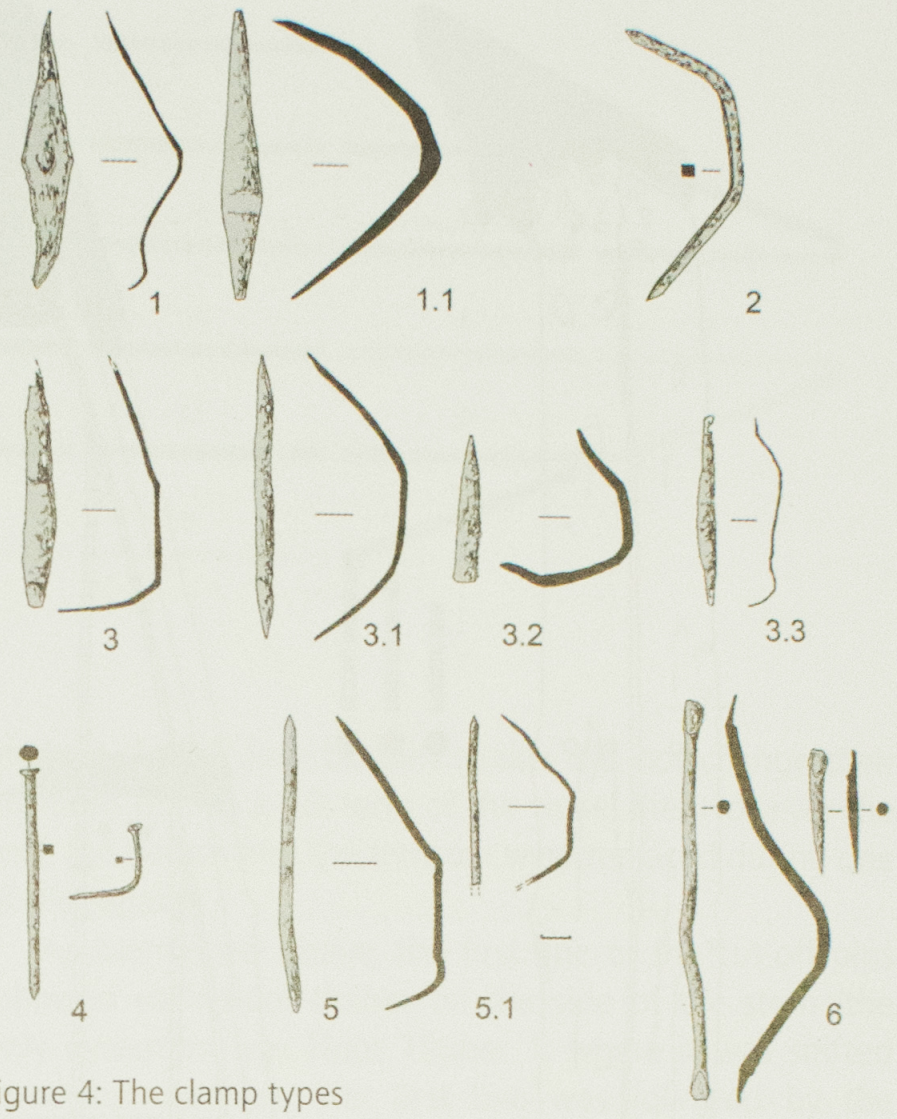

Figure 4: The clamp types

Type 2. It includes forged nails of a regular square section 4 by 4 mm, with a cut-off head and later sharpened on both ends (7 pieces.). Such nails after head removal were arch-shaped and used as clamps driven in planks on both ends (probably during a cruising with a lack of repair set).

Type 3. It is the most numerous type, and it can be observed both on the bottom planks and on planking. This type includes flat clamps 7 to 10 mm wide, 2 to 3 mm thick, 100 to 150 mm long, similar to those of Type 1 (irregular shape, uneven width). But unlike Type 1, clamps of Type 2 have no maximum extension in their middle part and narrowing towards the ends is smoother.

Types 3.1. (39 pieces) and **3.2** (45 pieces) are similar in shape with clamp Type 3, and may be different batches of the same type of hardware with a minor change in the process during their fabrication. Visually Type 3.1. clamps differ from Type 3 clamps by smaller (5 to 10 mm) and more uniform width and larger thickness (3 to 4 mm). Type 3.2 clamps are much shorter than those of Type 3. Their average length is 80 to 96 mm (in individual cases 110 and 120 mm) with the thickness 3 to 4 mm (the clamp length decrease with the thickness increase made the clamp stronger – this accounts for the better integrity of Type 3.2 clamps).

Type 3.3. It is observed in individual cases and looks like a reduced copy of Type 3 reduplicating its shape and proportions. It looks, that there was not enough material to manufacture the said clamps, therefore remained iron was used for the clamps fabrication.

Type 4. Forged nails of a regular square section 3 by 3 mm, 76 to 77 mm long, with a suboval head 6 mm in diameter. As well as the nails with cut-off heads, these nails were used in individual cases.

Type 5. It differs considerably in shape (and consequently by the method of manufacture) from the claps of the above types. It includes pin-clamps of even width 4 to 5 mm, regular rectangular cross-section 2 to 3 by 5 mm and 105 to 120 mm in length. The pin ends are distinctly sharpened by 2 abrupt cuts with the angle 45°. The shape accuracy was most probably achieved by cutting plain strips of a flat evenly forged metal plate without consequent hammering (as in above cases). The pin-bending angle for planks fastening approximates a right angle. In total there are 84 clamps includes 46 partially destroyed clamps of Type 5, metal preservation is similar to Type 3.2.

Type 5.1 Most probably it is an independent type (similar to Type 3.3), and it includes clamps that are reduced copies of pins (3 to 2 mm wide and 1 to 2 mm thick). In total there 15 pieces. The clamps of such size could not bear big load, and probably they served as a back-up.

Type 6. It is observed only in planking and includes clamps made of forged wire of a round section 4 mm in diameter with hammered ends. Out of 121 clamps of this type, 70 pieces are preserved completely and 51 pieces are partially destroyed. The degree of iron corrosion determines them as "the latest". The length of Type 6 clamps is worth consideration: a whole scope of intact wire clamps is distinguished by the length increment by 5 mm, i.e. from 120 mm to 175 mm. It looks as if the clamp size was adapted to the sweep of the planking where a plank was to be attached.

A scrutiny of the *baidak* hull revealed signs of multiple repair works. It was proved by a variety of hardware and replacement of frames and their parts. We tried to retrace the sequence of those operations. Despite a bad condition of the cross framing, signs of its mounting and replacement

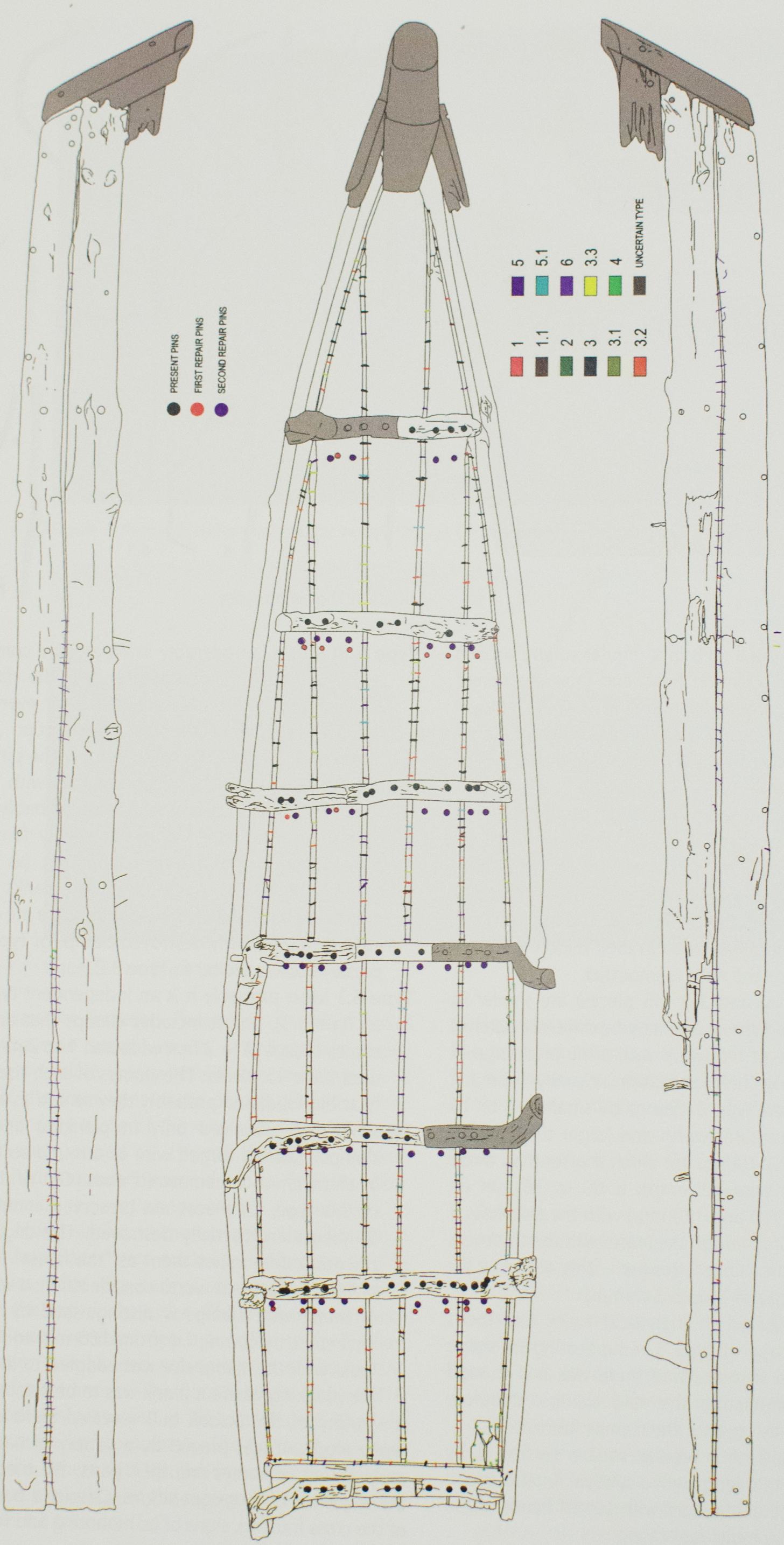

Figure 5: Types of pins and clamps

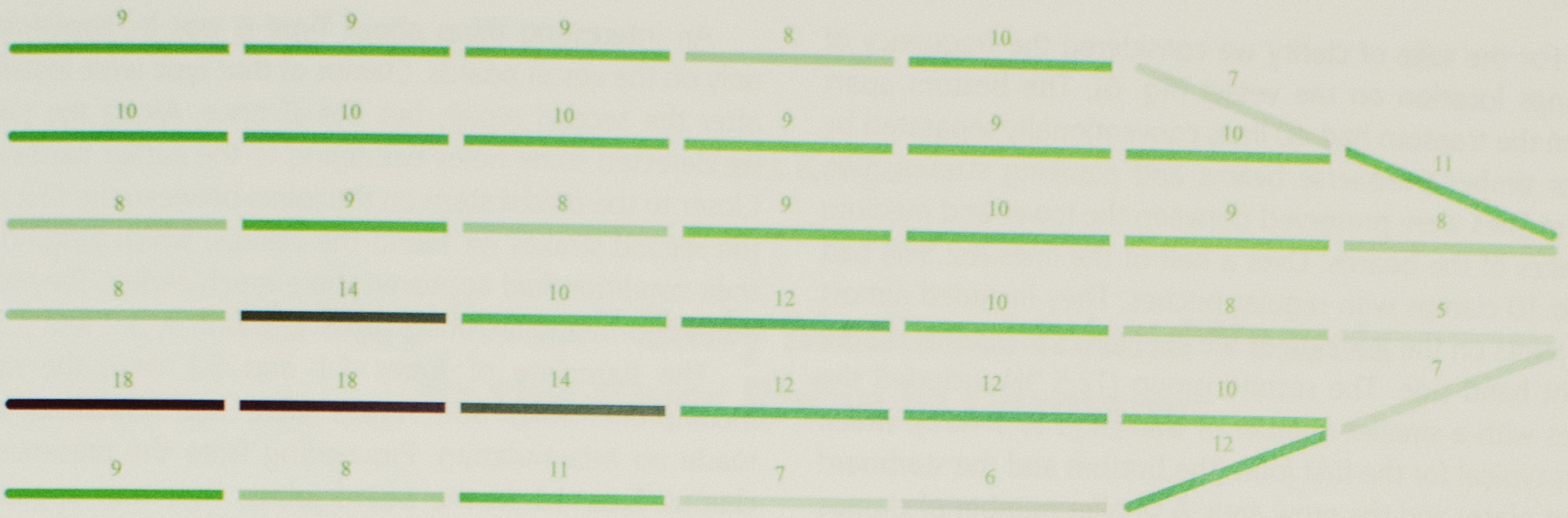

Figure 6: Frequency of clamps location on vessel

were quite visible. Each *botia* floor timber and frames mounted thereon were fixed to a keel and bottom planks with pins. As a rule a pin passed through them vertically, and for that purpose a through hole was drilled at the place of its mounting. The holes in the end bottom strakes and in the places of board and frame juncture were drilled at the angle perpendicular to the outer surface of the part. In most cases floor timbers were fixed to the bottom planks with two pins. If a plank was sufficiently wide, as for instance in Section 7, there could be three pins. If a plank, on the contrary, was narrow and tapered off, one pin could be used, as was the case at the end bottom planks in sections 2 and 3. Thus the holes were drilled in straight lines across the hull.

Just after bringing the artefact to the restoration site we saw that near each floor timber there were lines of pins that had been nailed earlier. However, the number of lines varied (Fig. 5). At the first floor timber there were two lines, one of them under the preserved timber, while the second one was shifted towards the stern. The second floor timber had three lines, one of them functional and two other antecedent, Floor Timbers 3 to 5 also had two lines each, while Floor Timber 6 had three lines. Non-functional antecedent lines were preserved in a form of holes closed with pins that were cut flush with planks. Just as with the first timber, all re-nailing lines were shifted towards the *baidak* stern. Evidently, in the course of repair antecedent pins were not removed, but cut off directly under a timber so that it could be separated from the bottom. The only place that bore no evidence of the former nailing was the last timber (#7) at the transom.

All this points to two major repairs of the hull followed by frames and planking replacement. The further examination determined that the pin diameter in nearby parallel lines varied. Also, the pattern of their cutting-off differed. In the line next to the preserved timber the pins were of a larger diameter and as a rule were cut off evenly. In the next line the pins were of a smaller diameter with ragged edges that sometimes projected above the surface. That difference in a pattern of the hardware fixing and replacement was rather useful, as it gave us an opportunity to retrace a succession and nature of repair procedures.

The transverse lines of re-nailing were detected only in the bottom planks; neither a keel nor planking had any of them. So, all four bottom strakes did not change their positions during a full term of the vessel life. However the keel, the boards and the transom were replaced during one of the repairs.

As mentioned above, the first line of the cut-off pins followed each floor timber on the side of the stern (the only exception was Floor Timber 1, where it was shifted somewhat further). The first line was followed by the second one that consisted of thin pins. The second line was not observed everywhere, but only at Floor Timbers 2 and 6. At Floor Timber 3 both lines merged; besides, the thin pins were nailed not along the whole length, but only on the side of the portside. That allowed us to presume that the second lines of thin pins had appeared later, i.e. during the first repair of the hull, when re-nailing had not been provided everywhere, but only on Floor Timbers 2 and 6, on *botia* frames mounted on Timber 3 and probably on Timber 1 at the portside. The rest of the pins remained in their places. The next repair resulted in replacement of all floor timbers and the most of the frames, besides all of them were shifted somewhat further. Most of the parts were replaced with new ones, as all of them except for Frame 6 on the portside did not bear the traces of previous holes. Thus a new cross framing in some way overlapped old lines. At the same time the board planks and the transom were replaced, and the bottom planks, proceeding from the lack of old holes behind the transom, were cut off, which resulted in shortening of the total length of the *baidak*.

Another sign of multiple minor repairs, that witnessed a long operation life of the vessel, was variety of clamps. In the course of restoration we distinguished 6 types and 4 subtypes of the clamps. A presence of different clamps was the evidence of subsequent updating and substitution of old types for the new ones. Such substitutions could be both local at the separate sections of the vessel and interspersed in the whole area. A difference in the number of hardware types and the hull frame re-nailing 6 to 2 indicated that joint sealing had been carried out rather frequently. Indeed, two repairs of the hull were also followed by joint sealing and naturally by clamp replacement at locking rails. At that, clamp types available at the vessel jumbled, but the clamps were driven with a uniform pitch.

For the sake of clarity we considered the frequency of clamps location on the vessel (fig. 6). The bottom apart from the transom had 40 lines conventionally separated by floor timber transverse beams and planking strakes. Two more lines were preserved between the lower and medium strakes of the boards. Over a half of the lines (62.5%) had 8 to 10 clamps with regular pitches. They included almost all joints on the left side of the keel and some joints on the right hand side. The second group (12.5 %) included the lines with a smaller number of clamps (5 to 7 nos.), which was typical for the first joint (the bottom and the starboard joint place) and the prow area. A smaller number of clamps apparently could be explained by losses due to the hull destruction, i.e. the board separation from the bottom and the loss of the stem. Points of rupture with apparently lost clamps added up to this suggestion. Most probably here as well as in the first group the original number of clamps had to be 8 to 10. The remaining part of the lines had a larger number of clamps (11 to 18 in number.). Most of them were located in the third, and even more so in the second line on the portside. The number of clamps in the second line permanently increased towards the stern. Thus we record the evidence of repair in the second and the third joints closer to the stern. In other cases, a repair, if any, was of a local nature. Let us consider this issue in more detail.

As expected, different clamp types were distributed on the hull unevenly. While studying their location we took into consideration a distribution degree and a possible relation to the lines where the density of pin nailing was high.

The most numerous type (Type 3) had no distinctive accumulation and no relation to the uneven distribution of clamps in lines. We admitted that that very type was the oldest. No wonder that that very type appeared in the most cases where an old clamp had been replaced with a new one.

A similar phenomenon was observed with the clamps Type 5. Most probably they appeared on the vessel due to the second repair and expanded on Group 1.

In contrast with them, clamps of Type 1 are well associated with joints where a number of hardware was larger (12 to 18 nos. per line). The second and the third joints included approximately half of the total number. So the reason for their appearance could be a repair of locking rails on the bottom on the right hand side. In such cases old clamps remained in their position and new ones were driven in between.

The following several types appeared on the *baidak* due to minor repairs. Thus Type 2 was concentrated in Section 2 between the first and the second strakes on the starboard where those clamps expanded on Type 3 and probably Type 1. Clamps of Type 4 were located in a similar way. Morphologically well distinguished they were observed along the joint of the bottom and the starboard and also on the stern where they had been used to fix a wooden patch on the bottom. From all appearance clamps of Type 4 appeared on the vessel later than the others.

Subtypes 3.1, 3.2, 3.3, and particularly the first of them, could be used for replacement after two repairs of the hull but before the appearance of clamps Type 1. They were not associated with the traces of the second and the third joints repair but appeared there on a regular basis.

An interesting thing about Type 6 was its appearance only on the vessel boards. Clamps of that type were installed after the second repair, but not at once. Along the joints we detected some holes belonging to the earlier hardware. Closer to the *baidak* stern on the joints between the first and the second strakes we found the clamps, which judging by their condition had appeared there much earlier. They were non-uniform and included Types 1, 1.1, 2, 3, 3.2 and 3.3.

The hardware of Types 1.1 and 5.1 were the most incomprehensible. Both types were not numerous and made no accumulation. Proceeding from the presence of clamps Type 1.1 in the board joints, they had appeared earlier than Types 4 and 6.

In summary, the sequence of repair works on the *baidak* was as follows:

1. After some uncertain term of operation some parts on the vessel were replaced. That included Floor Timbers 2 and 6 as well as Frames 1 and 3 on the portside. At the same time original clamps of Type 3 could be expanded with clamps of other types, e.g. 1.1 and 5.1.
2. The second repair was much more significant. It included replacement of all floor timbers, boards and the keel. New floor timbers in contrast with the first repair, were shifted not backwards, but forwards. At the same very time the vessel length was shortened due to planks cutting off at the stern. At that time a large number of clamps type 5 appeared on the hull and mingled with the previous ones. All joints between the strakes were caulked over again.
3. A number of current repairs of the locking rails were carried out. Probably they were followed by additional joint sealing. Types 3.1, 3.2, 3.3 were associated with that period.
4. Two joints between the bottom planks on the starboard were repaired. Planks located closer to the transom were expanded with Type 1 clamps. Such clamps were installed also in other sections including boards but in much smaller amount.
5. Another small repair at the prow resulted in appearance of Type 2 clamps.
6. Board joints in the medium and front part of the vessel were covered with new planks fastened with Type 6 clamps. Some old clamps remained at their places near the stern.
7. The last repair included the joint between the bottom and the starboard and resulted in appearance of Type 4 clamps, that were also used for fixing a wooden patch at the transom on the starboard side.

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