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Zagreb, 3rd – 4th December 2020

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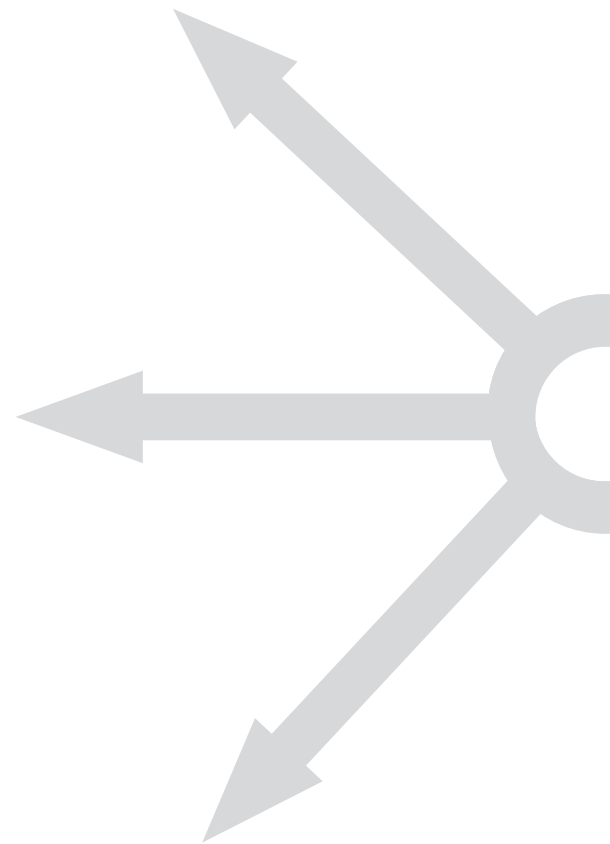
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Content

07	Ina Miloglav Preface
09	Ivor Kranjec, Jelena Behaim New Considerations on Spatial Analysis in the Research of Early Medieval Landscape: the Case Study of Bale region in Istria (Croatia)
25	Andrej Janeš The use of archaeological structural survey and the analysis of standing structures on mediaeval castles
37	Miroslav Vuković, Mirjana Sanader, Ina Miloglav, Domagoj Tončinić, Joško Zaninović, Vinka Matijević, Mirna Cvetko, Domagoj Bužanić Archaeological surveying in karstic fields: the site of Balina Glavica
47	Igor Medarić Project MagIstra – magnetic mapping of archaeological structures in soils on flysch: case studies from Slovenian Istria
65	Dinko Tresić Pavičić, Željka Bedić, Filomena Sirovica Skeletor: system for recording and analysing articulated human skeletal remains
75	Miroslav Marić, Nemanja Marković, Jelena Bulatović, Ivana Pantović, Regional Absolute Chronologies of the Late Neolithic in Serbia. The case study of At near Vršac
93	Mario Novak, Dragana Rajković The Late Neolithic human burials from Kotlina – Szuzai Hegy, Baranja: the first results of the anthropological analysis
107	Rajna Šošić Klindžić “If its quacks like a duck” – interpretation of Late Neolithic site Gorjani Kremenjača, Eastern Croatia
121	Katarina Šprem, Uroš Barudžija Micropetrographic analysis as a tool for the determination of limestone sources in Istria - applications and limitations
131	Petra Nikšić Volume density and spatial analysis of a Late Antique settlement – preliminary results
143	Mykhailo Klymovych Few experiments of log-boats making
153	Bojana Plemić, Jelena Anđelković Grašar We do need an education: youth participation programmes as a method in archaeology dissemination

Few experiments of log-boats making

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Several dozen log-boats, which can be classified as medieval ones, were found on the territory of Ukraine. Most of these findings are not well-researched and were found by accident. The number of discoveries and interest in their studies has increased over the past few years. However, the data of the already discovered findings are not complete and poorly introduced into the scientific environment, and the medieval written sources are fragmentary, and therefore don't give a complete picture of the features of log-boats construction in mentioned lands. The most effective method for studying the traditions of making log-boats is to carry out experiments on their studies by comparing the archaeological and ethnographic materials.

Keywords: *log-boat, experimental archaeology, log-boat making technology, Ukraine.*

Introduction

The main type of water transport of the population of Medieval Rus' was a log-boat, also known by the Byzantine name "monoxyll" (De Administrando Imperio 1967: 57-59). In ethnography, the following names of boats of this type have been preserved: dovbanka, struh, dub. This type of vessel was made of a solid piece of wood, by hollowing out the middle (forming a gutter). This technology is

called subtractive and is one of the oldest in the world (Дубровин 2000: 63). All the archaeological findings of log-boats in Rus' are accidental (Журавлева and Чубур 2010: 38). Researchers are recording the external features of the structure of this type of vessel, trying to consider some characteristics, but the whole process of making log-boats has not yet been carried out.



Figure 1. Small log-boat with two sections. (Archive of the project *Medieval Shipyard*).

From the written source *Rus'ka Pravda* (code of law in Medieval Rus' in 11th – 14th century) we know about the existence of at least four types of boats: *cheln*, *struh*, *naboyna ladia*, and *morska ladia* (Юшков 1935: 137-144). This source indicates the cost of compensation for theft and damage to: for *morska ladia* - 3 hryvnias, for *naboyna ladia* - 2 hryvnias, for *struh* - 1 hryvnia, for *cheln* - 8 kunas (1 hryvnia is about 200 grams of silver or a little more than 60 kunas). We can read about 60 kunas boat compensation in *Zvenugorod birch bark manuscript* (a document written on pieces of the birch bark and dated between 1110 – 1137), probably it is a compensation for *struh* boat (Толочко 2008: 276-278).

However, it is difficult to define each of these types based only on archaeological data. At the moment, we can accurately identify the *cheln* and the *struh*. These



Figure 2. Log-boat with wooden frames (fragment of the boat from Vshchizhchiv). (Archive of the project *Medieval Shipyard*).



Figure 3. Unfinished boat from Starosillya. (Archive of the project *Medieval Shipyard*).

are the most common types of river vessels, made of a single piece of wood, are low-board, and do not have strakes.

During March-April and September 2019, the project «*Medieval Shipyard*» (Ivano-Frankivsk) conducted two experiments on log-boats making. We used the prototype boats from Starosillya and Vshchizhchiv. The project set several goals: 1) to investigate the methods and techniques of making a log-boat based on the above-mentioned archaeological sources; 2) identify the stages of construction of the boats; 3) determine the optimal number of workers who could be involved in this type of work; 4) to model and reproduce the appearance of a boat from Starosillya and Vshchizhchiv at final stage of construction, using ethnological data and archaeological evidence.



Figure 4. Grooves of unknown purpose on Starosillya. (Archive of the project *Medieval Shipyard*).



Figure 5. Log-boat form Vshchyzhchyv. (Archive of the project *Medieval Shipyard*).

Log-boats in archaeology

The cheln was a log-boat that had several sections left during the hollowing out of the middle to give the structure rigidity. This type of log-boat is small-sized (between 2-6 m.; low and rough sides) (Fig. 1). Struh is an evolution of the previous type of log-boats (Fig. 2). The main difference is in the process of steaming the sides and replacing the hollowed section with frames (transverse ribs). This made it possible to make the ship larg-



Figure 6. Frame and wooden nails connection. (Archive of the project *Medieval Shipyard*).



Figure 7. First boat-making experience. (Archive of the project *Medieval Shipyard*).

er and more capacious. These two types of boats can be considered purely river transport, they were used mainly for the purpose of local trade and fishing. About 90% of the boats found are made of oak, the remaining 10% are boats made of poplar, linden, willow, and other types of wood.

In the northern lands of Rus' (Novgorod, Ladoga) we could see the influence of Scandinavian tradition in combination with local and Finnish (the most characteristic features of which may be the use of metal rivets and wooden nails and at the same time flexible fastenings with use of a face or roots of pine) and log-boats with obviously Finnish influence (use of flexible fastening) (Дубровин 2002: 109-122).



Figure 8. Rotation of the log using human power and wooden lowers. (Archive of the project *Medieval Shipyard*).



Figure 9. Wooden pegs were used to achieve a uniform thickness of the boats. (Archive of the project *Medieval Shipyard*).

As for the south-western lands of Rus', the vessels that can be characterized as a cheln or a struh are about 100% of all found here.

A log-boat was found in August 2015 on the river Styr, near the village Starosillya (Volyn region, Ukraine) (Fig. 3). The length of the artifact is 12.2 m, the diameter is 1.15m, the height is 0.95 m, and the width of the sides is 0.75 m. The find is hollowed log, the distance between the sides is approximately 0.75 m, the edges of the sides are bent to the middle due to the drying of the wood and the reduction in the size of its fibers, which causes «compression (convergence) of the sides» Material oak according to the analysis of Ukrainian laboratories (this laboratory made radiocarbon dating analysis, and boat was dated between 1300 – 1410) and white willow according to the analysis of the laboratory in Klaipeda (Lithuania), (also C14 dating showed results between



Figure 10. First steaming by using the “finish” method. (Archive of the project *Medieval Shipyard*).



Figure 11. Results of steaming. (Archive of the project *Medieval Shipyard*).

1223- 1295 with 95 % probability and 1261-1268 with 68% probability), (Мазурик and Хомич 2015; 2016).

Grooves (rectangular, square and trapezoidal) were found on both sides of the ship, C14 dating analysis showed results between 1260-1274 (68% probability) and 1247-1279 (95% probability) (Fig. 4). Most likely, they were intended for joining several boat blanks and their subsequent, to the place of further work (Гайдук et al. 2020: 416-418). This conclusion is based on the message of the Byzantine emperor Constantine VII that the Slavs made their boats in one place and in the spring with floods floated them to Kyiv, where the boats were completed and made suitable for trade and navigation on the sea (De Administrando Imperio 1967: 57-59). This also confirms the fact that the boat is incomplete, it shows traces of axes and adzes.



Figure 12. Completed boat. (Archive of the project *Medieval Shipyard*).



Figure 13. The second boat. (Archive of the project *Medieval Shipyard*).

In 2001, a fragment of log-boat 8.8 meters was found near Vshchyzhchiv (near Bryansk, Russia), the total length of the boat was about 12 m (Fig. 5). The material is oak. Boat with expanded sides and frames (composite frames, consisting of two parts and fastened with wooden pegs (nails) (Fig. 6). Diameter of boat is 1 m. The thickness of the walls of the sides is 8 cm sides, and 14 cm for the bottom of the boat. In general, a boat of this type could take 6 pairs of oarsmen (Чубур 2004; 2008).

The experiments

The first experiment was made in March and April 2019. A boat was made of poplar. The boat had a length 6 m, a diameter 0.55 m, and width, after spreading the sides, of 1.10 m. The prototype of the boat was the already mentioned finding from Starosillya on a scale of 1:2. We used tools such as axes, adzes, and hand drills. Typologically, the tools compare to archaeological finds from the territory of Rus', however, modern steel is used instead of low-quality iron (wrought iron) made of bog ore. The work on this boat involved 8 people, which created some discomfort associated with a large number of workers compared to the rather small size of the boat. With so many people, the work took 6 days (Fig. 7).

Human power and wooden levers were used to overturn the boat (Fig. 8). The weight of the log was about 4000 kg, and after hollowing become about - 450 kg (wet wood). The thickness of the sides of the boat was 2 cm, increasing to 3-4 cm in the direction of the bottom. Wooden pegs were used to achieve a uniform thickness of the boats (Fig. 9), which were driven across the entire

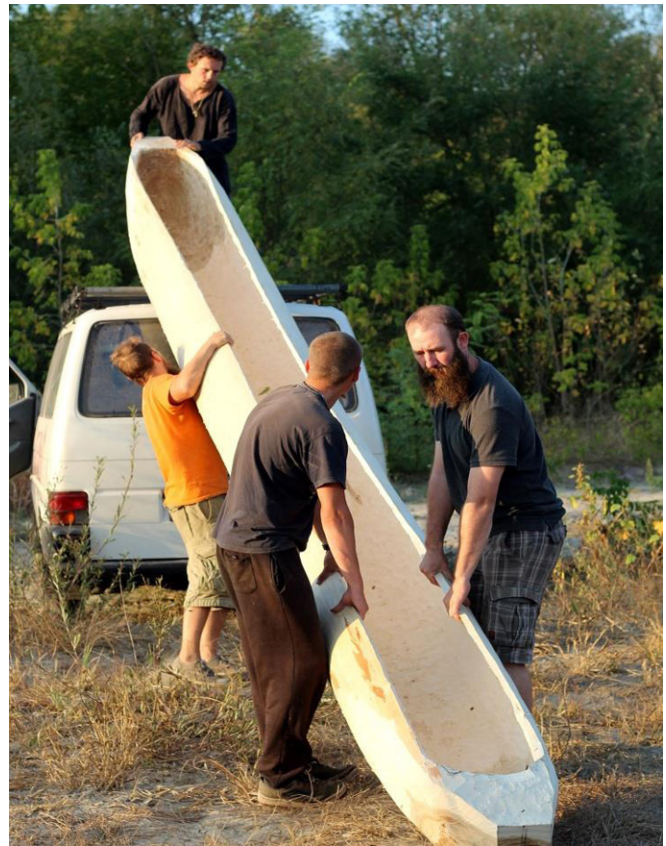


Figure 14. The third boat. (Archive of the project *Medieval Shipyard*).



Figure 15. Only four of us and 7000 kg of wood. (Archive of the project *Medieval Shipyard*).

plane of the boat at a distance of 15 cm from each other. For pegs used branches of wolfberries, which after pre-soaking in water darken and become clearly visible on the plane of the sides. This method has archaeological analogies, in particular, on boards of the boat from Vchyzhshchiv and in the ethnographic technology of making boats in the north of Ukraine in the 19th - first half of the 20th century (Онищук 1929: 7-24).

Since the boat from Starosillya is not finished, and its size is quite large, it was suggested that it could be spread on its sides and sewn an additional row of strakes, which would make the boat wider and more stable on the water. This decision was based on ethnographic data (in the absence of archaeological detections) and reports from written sources in Rus' about the existence of a *naboyna ladia*, which can be translated as a boat with a row of boards (but we don't have archaeological evidence for it, only one fragment with pine sewn board from Novgorod (Дубровин 2000: 118).

We used "Finnish" technology to spread the sides (Fig. 10). Before the process, the boat was immersed in water so that it gained 100% moisture for about a week. Then a fire was lit which corresponded to the size of the boat. The boat itself was placed upside down over a fire at a height of about 0.50 m from the ground. When the boat warmed up to the appropriate temperature and began to steam, its sides began to bend when pressed. Fresh willow branches were used to spread the boards, they are quite elastic and grow in large numbers near rivers. The boat heats up and its sides are spread by the branches, at the same time the boat is turned from side to side, and constantly moistened with water, as the dry sides of the boat can break. It is important in this process not to apply too much force; the pliability of the boards is felt during their spreading. Since the greatest load falls on both ends of the boat, they were pre-tightened with a rope.

The boat managed to spread to a width of 1.20 m. in the central part, with 40 cm of starting width. However, at the final stage of the process, during the installation of the control crossbars so that the sides do not close in the opposite direction, a crack formed at one end of the boat, which was the result of excessive drying of the sides. Therefore, the final width was 1.10 m. in the central part (Fig. 11). After the boat dried, composite frames were installed, which were attached to metal rivets. The boat was covered with birch tar. The first attempt to test the boat on the water took place in June. Since the weight of the boat is quite low 300 kg, it felt insecure on



Figure 16. Another way to steam the boats. (Archive of the project *Medieval Shipyard*).



Figure 17. It was not a pleasurable process. (Archive of the project *Medieval Shipyard*).



Figure 18. Few minutes before the boat has cracked. (Archive of the project *Medieval Shipyard*).



Figure 19. Repair. (Archive of the project *Medieval Shipyard*).

the water - it staggered, to correct this situation, ballast in the form of stones was used, which made it possible to feel confident on the water (Fig. 12). The boat can take 5 people, 3 oarsmen, and one helmsman, and overseer.

In September 2019, another experiment was conducted to make two boats, based on a prototype artefact from Starosillya. Poplar wood was also used. The length of the first boat was 11.5 meters, with a diameter of 1.10 m (Fig. 13). The weight of the log was approximately 7000 kg. The length of the second boat was 9.40 m. The diameter was 80 cm (Fig. 14). The weight of the workpiece was about 5000 kg.

During these experiments, we used the work of four people. We have spent one-month hollowing out and spreading the sides. This number of people was the most optimal for the manufacture of boats of this size.

This time we used the same methods and tools as in the previous experiment but changed the technology of rotation of the log, and the technology of spreading of the boards.

Since 4 people are not able to turn a log weighing 7000 kg by using only physical force and wooden levers, we faced the problem of how to solve this task. In the absence of information in written sources and ethnography, we used a technique that continues to exist in Central Africa.

To do this we made a flat plane on the deck on one side, to which a wooden lever is attached with ropes, at the free end of which is tied a rope, which performs the main work. This technique allows you to rotate the log with a lot of weight with minimal physical effort (Fig. 15)¹.

In the north of Ukraine in the last century, the technology of spreading boards was different from that which we used in the previous experiment (Онищук 1929: 7-24). For the duration of carving the gutter, a large amount of waste can be used in the process of steaming the boards. To do this we had to dig a shallow pit (approximately 40-45 cm) by the size of the boat in which the fire shall be lit (Fig 16). After the flame burns evenly and reaches a high temperature, it is covered with wet shavings left after hollowing the gutter. When it is heated and the shavings emit steam we covered the pit by the boat, and then we waited until the walls of the boat become flexible and pliable (Figs 17, 18). The possibility of such a

¹ Follow this link to see the video of the process - <https://www.facebook.com/watch/?v=231528837972370>



technology of spreading the sides can be confirmed by the fact that there are traces of soot on the sides of the boat found in Vshchizhchyv.

In this experiment, taking into account the previous experience two different options were made. On the first boat, to reduce the possibility of cracks and breakage, it was decided to cut the sides at both ends of the boat by about 40 cm, which reduced the load on these parts during spreading. In the second boat, both ends of the boat were wrapped with ropes, but this did not save them from cracking (along the entire length of one of the sides).

This crack was later repaired by applying a wooden bar and "stitching" it to the main side with pine roots (Fig. 19). The width of the first boat was 1.80 m in the central part and the second one was 1.60 m. At the moment, the first boat is not completed. The boat №2 was completed, its length is 11 m. (including added stem and stern-post which are nose and back part of boat) width in the central part of 2 m. Two rows of strakes that are 30 cm each were added, which were attached to the sides with frames by wooden nails, metal rivets used to attach the front and rear (stem and stern-post). The boat hull was covered with pine tar. The boat can take a crew of 14 oarsmen and one helmsman.

Conclusion

After several experiments, the main problem we encountered is the weak archaeological base of the log-boats, and the partial or complete lack of quality dating of the found samples. The main sources, in addition to archaeological ones in this study, were ethnological data and information from written sources, which do not yet allow to open a complete picture of the process of building log-boats. In the future, we plan to continue working in this area and involve in our research archaeological findings from neighbouring lands.

References

- De Administrando Imperio*. By Constantine VII Porphyrogenitus. Greek text edited by Gy. Moravcsik with English translation by R. J. H. Jenkins. Washington, D. C.: Dumbarton Oaks, 1967, revised edition, 57-59.
- Гайдук, С., Петраускас, А. and Смагін, І. 2020. Експериментальні дослідження стародавніх водних транспортних засобів і водних шляхів, *Археологічні дослідження в Україні 2019*, 416-418.
- Дубровин, Г. 2000. *Водный и сухопутный транспорт средневекового Новгорода X-XV вв*, Москва.
- Дубровин, Г. 2002. Находки с Федоровского раскопа в Новгороде, связанные с водным транспортом, *Краткие сообщения Института археологии РАН. Вып. 213*, 109-122.
- Журавлева, Ю. and Чубур, А. 2010. Средневековое судостроение в Юго-Восточной Руси (бассейны Десны и Оки) по археологическим источникам, *Вопросы подводной археологии*. 25-44.
- Мазурик, Ю. and Хомич, П. 2015. Підводна археологічна знахідка біля с. Старосілля Маневицького району: давній човен-довбанка знайдений під крутим берегом річки Стир, *Минуле і сучасне Волині та Полісся. Місто Володимир-Волинський та Побужжя у світовій та українській історії. Успенський собор в історії міста Володимира-Волинського та України. Науковий збірник. Випуск 55. Матеріали 55 Всеукраїнської наукової історико-краєзнавчої конференції*, 393-398.
- Мазурик, Ю. and Хомич, П. 2016. Знахідка човна-довбанка на річці Стир на Волині, *Археологічні дослідження в Україні 2015*, 22-24
- Онищук, А. 1929. Виріб човна в с. Старосілля Остерського повіту на Чернігівщині, *Матеріали до етнології й антропології*, Том XXI-XXII, частина I, 7-24.
- Толочко, О. 2008. «Правда руская» и звенигородская берестяная грамота №2, *Palaeoslavica XVI/1*, 276-278.
- Чубур, А. 2004. Древнерусская ладья-однодревка из летописного Вщижа, *Российская археология №3*, 171-174.
- Чубур, А. 2008. О предполагаемом парусном вооружении Вщижской ладьи, *Деснинские древности V*, 152-156.
- Юшков, С. 1935. *Правда руська*, ВУАН, Київ.