THE RECONSTRUCTION OF WELLS AND LIME BARK BUCKETS FROM LIEPORIAI 1 SETTLEMENT

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Abstract

Unique findings, wells with wooden constructions and buckets made of lime bark in them, were detected recently in the Lieporiai 1 settlement near Šiauliai (in northern Lithuania). These objects were parts of an iron smelting site dated to the fourth to eighth centuries. Reconstructions of the well and the technique of producing lime bark buckets were made by B. Salatkienė and A. Šapaitė. A detailed description of the artefacts and their environment constitutes the first part of this paper, and the technique of reconstruction and producing lime bark buckets forms the second.

Key words: iron smelting site, well, wooden construction, log, plank, lime bark, bucket, reconstruction.

Introduction

Archaeological experimentation is still not practised in Lithuania, nor are many reconstructions of archaeological monuments or findings made. Some archaeologists have attended festivals of experimental archaeology, where they reconstructed ancient technologies and artefacts. Also, some reconstructions are shown in the new archaeological exhibitions of museums. Nevertheless, no Lithuanian archaeologists have documented and publicised their experiments, nor their aims, techniques or results.

The aim of this article is to provide exact descriptions of the wells and the buckets found in the Lieporiai 1 settlement, as well as to show the process of their reconstruction and the experience involved in it. The idea of reconstruction first arose when the author of this article was invited to be a member of the Lithuanian delegation that participated in the Days of Experimental Archaeology which took place at Biskupin in Poland. In the summer of 1998, an attempt was made to reconstruct the process of lime bark bucket production, starting with the selection of a tree and ending with the testing of the buckets. A report of this was presented at the second conference of the Lithuanian Museums Association in 1999 (Salatkienė 1999).

The first part of this article focuses on the circumstances and the interpretation of the discovery of the wells and buckets. Wooden wells, as well as lime bark buckets, are unique artefacts in Lithuania; therefore, the publication of all data attendant to their location, form, dimensions and function is essential for an understanding of the experiment. In the second part of the article, the process and the refining of the methodology are described consistently and in detail, focusing not on unsuccessful attempts, but, instead, looking for new possibilities and trying new buckets. Reconstruction drawings and photographs of the wells and buckets are also included.

The complex of archaeological monuments from the fourth to eighth centuries found in the southern outskirts of the town of Šiauliai, in the north of Lithuania, has been explored since 1987. Two settlements and a cemetery belong to this complex. It is one of few Lithuanian complexes of archaeological monuments which have not only remained in good condition, but have also been excavated for more than ten years. The Lieporiai complex was found when the limits of the town almost reached it. It remained undestroyed only because at that time, Lithuania gained its independence and Soviet construction stopped. The first cemetery was found in 1987. During the exploration of the cemetery, in 1990–1991, 95 graves and 450 findings were discovered. It was determined that Samogitians (Vaškevičiūtė 1988; Salatkienė 1992; Salatkienė 1993) were buried there in the fourth to seventh centuries (Fig. 1). When looking for the boundaries of the cemetery, the settlement, belonging to the same period, was found close to the cemetery (Salatkienė 1993a). In order to define the boundaries of the settlement more exactly, an aerial photograph of the locality was taken. In taking it, the second settlement, situated 800 metres from the first one, was found. After survey explorations were made, it was established that the second settlement also belonged to the fourth to seventh centuries (Salatkienė 1994; Salatkienė 1994a).

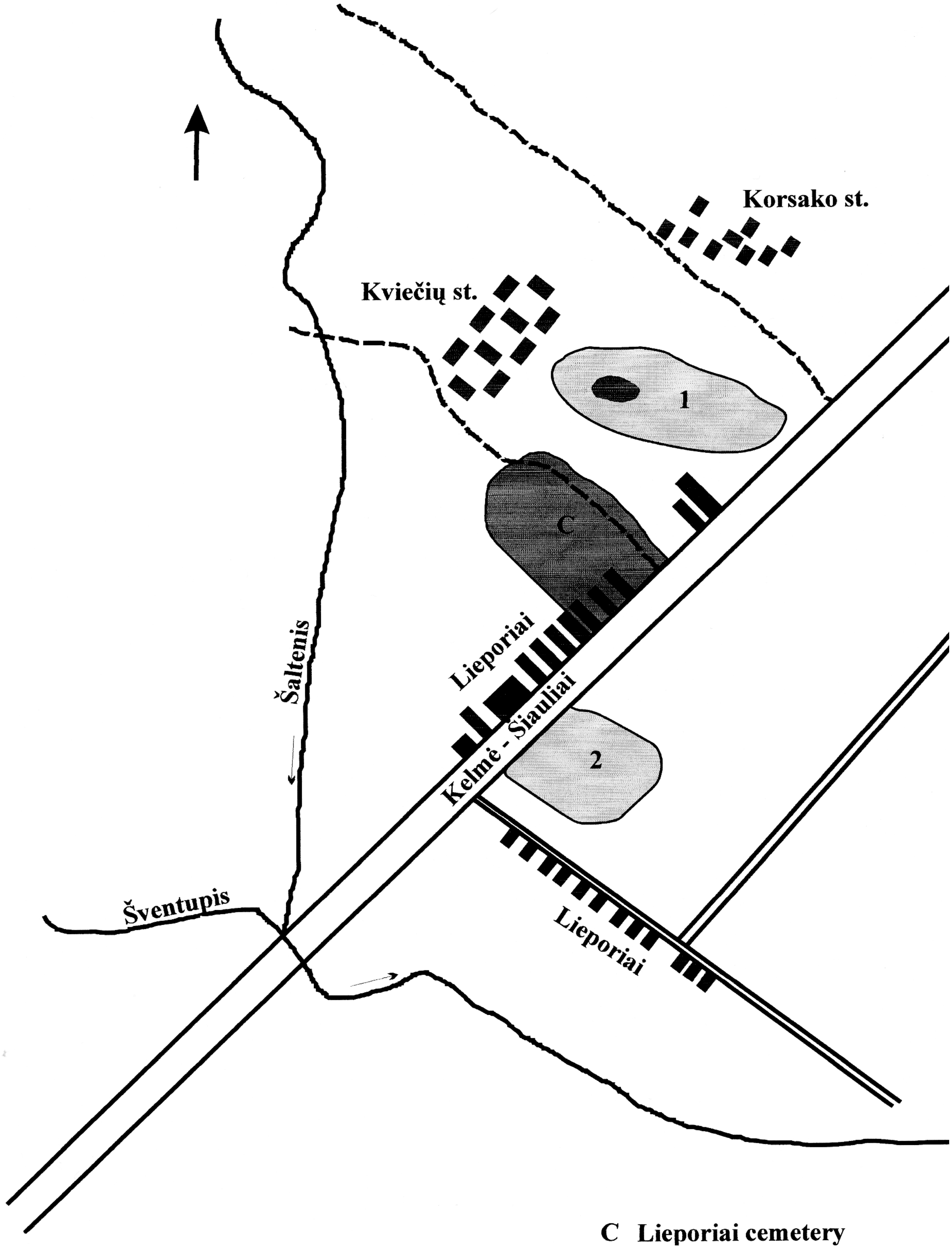

Fig. 1. The Lieporiai archaeological complex

During explorations in 1992–1997 and 2000–2001, three cultural layers were found in the first settlement of Lieporiai (Salatkienė 1996). In the earliest, layer A, Paleolithic findings, from the tenth to eighth millennia BC (Rimantienė 1996), were discovered (Salatkienė 1994). Layer B is dated to the fourth to fifth centuries, the period of iron smelting. In the latest, layer C, the charred logs of ten burnt buildings were found; therefore, it has become known as the period of buildings. It is believed that the buildings of the settlement had burned down during a fire at the turn of the seventh and the eighth centuries; therefore, this layer probably belongs to the sixth to seventh centuries. An area of 3,000 square metres in the first Lieporiai settlement was explored. About 3,000 clay potsherds, with even and rough surfaces, animal bones, iron-making trade tools,

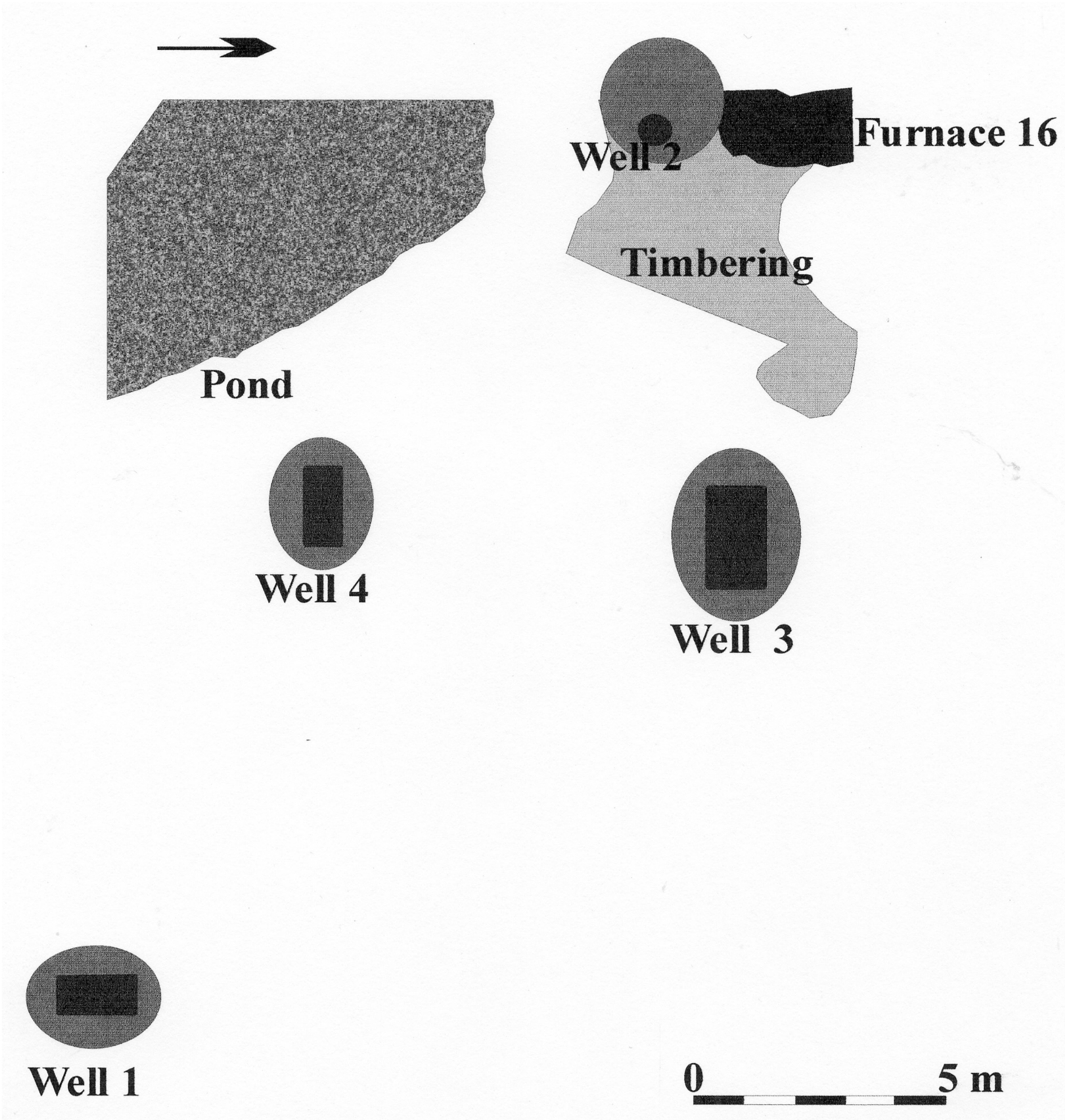

Fig. 2. The Lieporiai 1 settlement

amber and glass beads, as well as other similar things, were found in this settlement (Salatkienė 1993a, 1994, 1994a, 1996, 1996a, 1998, 2000, 2001, 2002).

In cultural layer B, the place of iron production was found (Salatkienė 1997). Numerous sedimentary ore excavation holes and hearths, four wells from which water was drawn to wash the ore, as well as parts of 20 furnaces and a smith's forge, were found. Moreover, 400 kilograms of slag was collected, as well as one bloom, a lot of pieces of the furnace's walls, and fragments of several nozzles. In addition to all this, several stone iron smelting tools and smith's tools (four anvils, two stone hammers to work the bloom and many polishing stones), were found.

The Lieporiai settlement provided much information about the iron smelting trade in Lithuania, as almost all the findings discovered in the settlement define iron smelting, as well as the smith's trade, and encompass the entire cycle of production from the extraction of the raw material to the made article (Salatkienė 2003). This has given other Lithuanian archaeologists and researchers into old metallurgy a reason to focus their attention on the Lieporiai settlement (Navasaitis 1996, 1997, 1999, 1999a; Stankus 2001).

One type of finding connected with the iron smelting trade, found in the first Lieporiai settlement, is unique in Lithuanian archaeological material. These findings include wells constructed from wood, and eight lime bark buckets which were used to draw water and were discovered in the wells (Fig. 2). The wooden parts of the wells were built according to the principle of column construction. These wells are the earliest findings of their kind in Lithuania so far. Moreover, the lime bark buckets have no parallels in Lithuania. Similar but not identical findings are known from much later periods. These are big lime bark crocks with plank bottoms, dated to the 12th to 15th centuries, and found during exploration of the medieval town of Kernavė (Kernavė 2002). Also, a similar but very disintegrated lime bark bucket, which had no bottom, was found by the archaeologist Daiva Luchtanienė during explorations of the Old Town of Vilnius. This finding is dated to the 16th century.

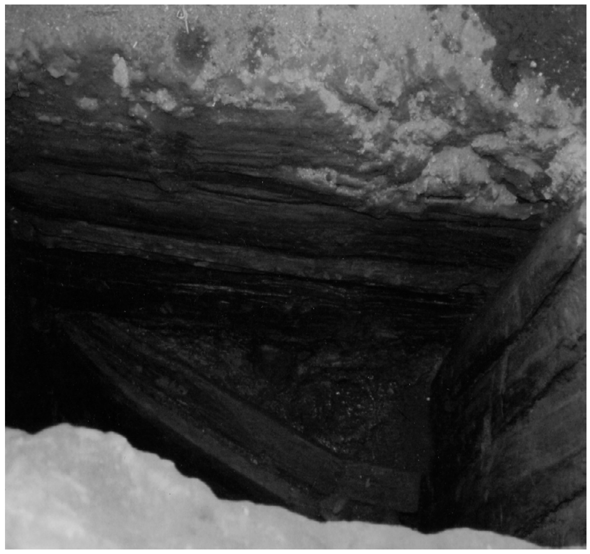

Fig. 3. The wooden construction of the first well

The wells

The first well was found in 1992 under a burnt house. A hole, almost round in shape, the diameter of which was 2.5 metres and the depth 3.65 metres, was found. The hole had vertical walls and a horizontal bottom. A wooden, oblong construction of 1.3 by 0.6 to 0.7 metres was found in the hole. The construction was broader at the northeast end. The northwest end of the well was supported with four split logs, which were 15 to 21 centimetres wide and five to eight centimetres thick. The height of the remaining parts of the logs was 2.45 metres, but their original height should have been about five metres. The inner sides of the split logs were trimmed. They were very well fitted, without any gaps. The fastening of the southwest end of the well consisted of a split log and a split, trimmed and slightly convex plank. The width of the log was 20 centimetres, while the plank was 40 centimetres wide and eight to ten centimetres thick. The log and the plank were fitted close to each other as well.

The long southeast and northwest walls of the well consisted of split planks, which were five to 12 centimetres thick, 25 to 35 centimetres wide, and 1.5 metres long. The planks were laid very close over the top of each other in a horizontal position. Eight planks have survived in the southeast wall, and nine in the northwest wall. The northwest wall had collapsed, but was fixed with three thinner, more smoothly trimmed planks, and with one four-centimetre-thick wooden cleat. The construction of the well was supported from the inside as well as from the outside. The end split logs, as they were overlapping by ten centimetres at both ends behind the vertical ones, held the side planks. At the southwest end, vertical stakes had been hammered into both corners of the well, one in each corner. In the western corner, the stake, the diameter of which was eight centimetres and the length 1.65 metres, was round; while the stake in the eastern corner was square, trimmed, eight centimetres thick and 1.95 metres long. At a depth of 3.7 metres, between these two stakes, a 12-centimetre transom was hammered in. On both ends of the transom, square mortises were chipped out. Both stakes were embedded into these mortises. The northeast end was supported only with vertical stakes, without a transom (Fig. 3). Two vertical stakes, 12 centimetres in diameter and 1.85 to two metres in length, supported the northwest wall, which had come down. From the outside, the northwest wall was supported with three vertical stakes, beside the corners of the well. Two stakes had been hammered into the bottom of the well, the bottom part of the third stake was at a

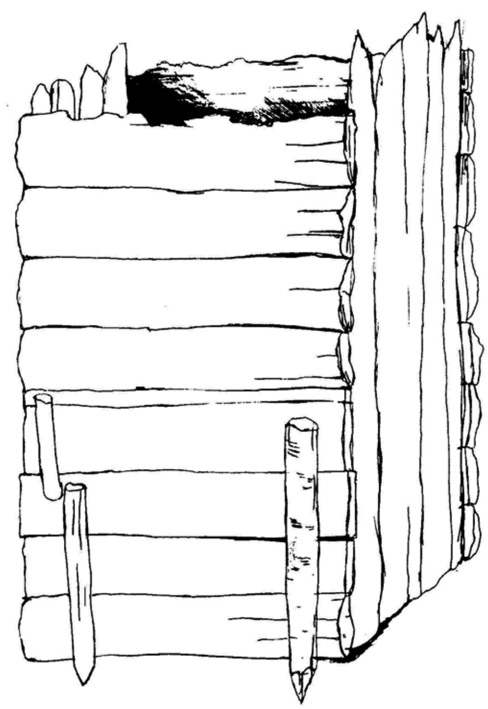

Fig. 4. A reconstruction of the first well

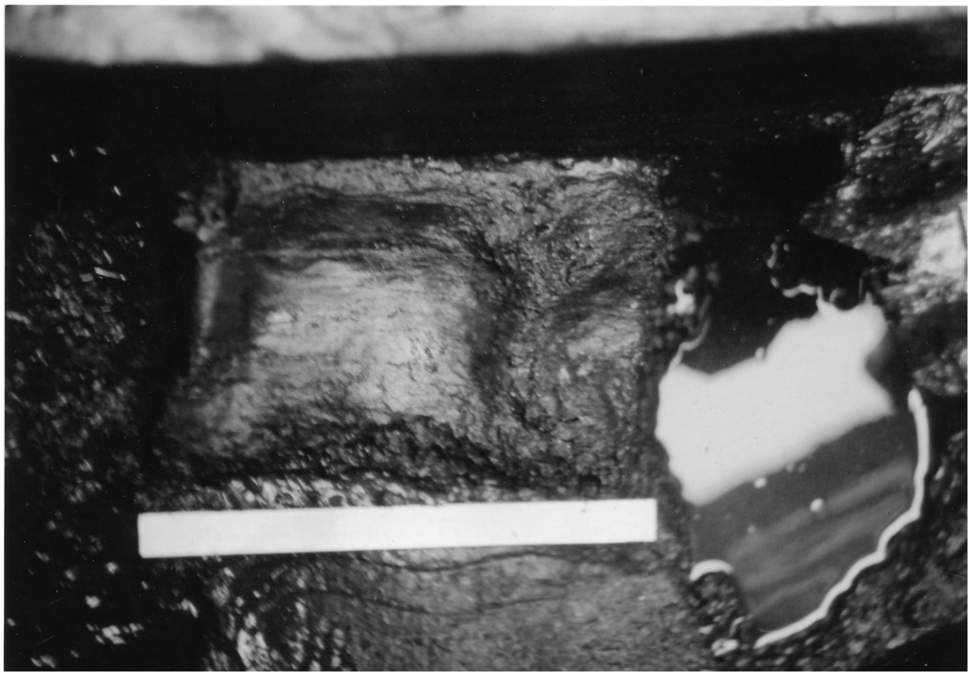

Fig. 5. The second bucket *in situ*

depth of 3.6 metres. Only behind the northeast wall of the well was sterile soil, a yellow sandy loam. Here the wall of the well hole coincided with the wall of the wooden construction. Behind the three other walls there were ten to 30-centimetre gaps, that were filled with a mixture of soil, ashes and charred logs (Fig. 4).

The well, as has been mentioned, had collapsed, and then it was repaired, but collapsed again, as the northwest wall was destroyed by a water course. This water course is still noticeable. When the wall collapsed for the second time, the well had already silted up, and filled with stones, logs and sticks. Four lime bark buckets were found in it. They were sunk in the west corner of the well, at depths of three to nine metres. The buckets lay one over the other; this indicates the gradual silting up of the well (Fig. 5).

The second well was excavated in 1996. The surface of the well hole appeared in the yellow sandy loam of the sterile soil, at a depth of 80 centimetres. The hole was very big, four, five by five, and four metres in size. However, this was only the contour of the collapsed edges of the hole. The original form of the hole emerged at a depth of 1.7 metres from the present surface of the ground. At this depth, in a southwest and northeast direction, the hole of the well is slightly oblong; the size is 1.5 by one metre. The edges of the hole are vertical and smooth, and its bottom is semicircular. It is comparatively shallow, just two metres deep from the present surface of the land. At the bottom of the hole is a 30 to 40-centimetre layer of silt, whereas in the walls there are small layers of sand and silt, such as can be found at the bottom of a water body (Fig. 6). The well had no surviving wooden constructions, which could have disappeared when the level of the ground water fell. Now the hole of the well is completely dry; however, signs of water having been there are very clear. These signs are silt and stratified sand. The walls of the well could have been supported with vertical stakes, and horizontally woven branches of trees.

The second well belongs to the period of the early iron trade. This conclusion can be drawn from the fact that the edge of the well hole was level with the ground, so that people could bring and put clay on the edge of the hole. The walls of the 16th furnace were modelled from this clay.

The hole of this well, as well as the holes of the other wells in Lieporiai, had been filled with soil, and its edges collapsed inwards. In the end, a fireplace was set up on the top of the hole.

The third well was found 30 metres northwest of the first well, and 5.5 metres east of the second. This, as well as the first one, was found under the charred logs of a burnt foundation. An oblong, 2.2 by 1.6 by 2.7-metre deep pit had been dug for this well. The hole had sloping walls and a pointed bottom. It is possible that the well was used for some time without any support. This can be presumed from the fact that a thin layer of silt could be seen at the very bottom of the well, and one sunken bucket was covered with sand from the walls. Moreover, from the bottom part of the wooden construction to the bottom of the well, there was a 40-centimetre gap with stratified silt from the well and sand from the walls in it. The entire hole of the well was not supported, just 2.3 centimetres of the upper part. A wooden support held the sloping walls of the well hole. Their upper parts have not survived (Fig. 7).

Fig. 6. The second well

Fig. 7. The third well

The southern wall of the well consisted of two planks, 46 to 50 centimetres wide, 1.8 metres long, and seven to eight centimetres thick. The planks were laid horizontally along the hole of the well, one over the other on the edges of the hole. The planks were split and trimmed, their ends were straight and well sanded. The support of the northern wall of the well also consisted of two planks, 20 to 37 centimetres wide, three to five centimetres thick, and 1.85 metres long. The planks were laid in the same way as in the southern wall. The eastern wall of the well was supported by three vertical planks and a round stake. The width of all three planks was 25 centimetres, their length was 50 centimetres, and they were seven centimetres thick. The transom, which was 80 centimetres long and five centimetres thick, held the planks and the stake from the inside. It was inserted between the side planks. The western wall of the well was supported in a very simple way. It consisted of two vertical planks that were 20 to 23 centimetres wide, 30 to 31 centimetres long and seven centimetres thick. Gaps of five to ten centimetres separated them from the side walls of the well. A 15-centimetre gap was left between the planks. Perhaps the wooden construction of this well should be called the support of the walls, and not the construction itself. As far as the lime bark buckets are concerned, four were found in the third well. One of them lay at the top of the well; the other three were below the first one, at the very bottom of the well (Fig. 8).

The third well had not been used very long, or at least for a considerably shorter period of time than the first well. First, it was quite shallow, poorly supported, and had quickly silted up. Secondly, all four buckets had sunk at the same depth to the very bottom of the well (Fig. 9). The abandoned well had filled up with stones and soil, in which animal bones, potsherds, sticks and lots of chips of wood were found. Finally, there was a fireplace on the top of the silted-up hole.

The fourth well was found six metres to the south of the third well. The place for the well had not been chosen accidentally, but perhaps knowing beforehand that a water course was there and that the groundwater was not deep. First of all, an oblong, rectangular, 1.9-metre-long and 1.1-metre-wide pit was dug from east to west. The depth of the hole was 1.7 metres from the

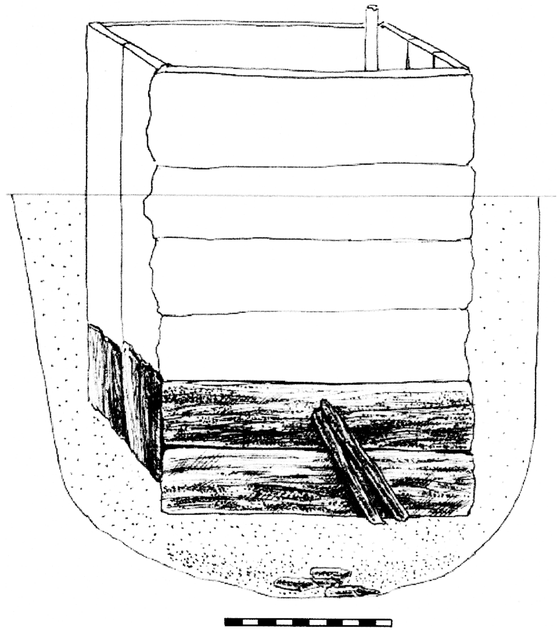

Fig. 8. A reconstruction of the third well

Fig. 9. The buckets at the bottom of the third well

Fig. 10. The fourth well

surface of the sterile soil (2.4 metres from the present surface of the ground). It is difficult to say what tools were used for the excavation of the hole. No digging tools were found in the Lieporiai cemetery or the settlement, but the four wells and 104 holes testify that tools existed. After digging the hole, the wooden walls of the well were constructed. Along the southern and northern walls of the hole, birch and poplar logs, 1.9 metres long and ten centimetres in diameter, and with bark, were laid one over the other. They were contiguous with both ends of the hole and were probably inserted very firmly. From within, the end walls held the sidewalls of the logs (Fig. 10). At the eastern and western ends of the well, on the edges, 18 centimetres from the western end and 12 centimetres from the eastern end of the hole, several planks were set. The planks were 50 to 52 centimetres long, 12 to 30 centimetres wide and four centimetres thick. From within, the western plank was held both by two vertical stakes with sharp ends, and by a transom. The stakes were hammered 40 centimetres into the bottom of the well, and an 82-centimetre-long and five-centimetre-thick transom was inserted between the side logs of the wall. The same type of transom, only 70 centimetres long, held the eastern planks as well, with a thin 42-centimetre-long, seven-centimetre-wide, and two-centimetre-thick smaller plank that was inserted between the planks and the transom. This is how the bottom of the construction of the ends of the well looked. The upper part of the construction consisted of vertical, split, 20-centimetre-wide and ten-centimetre-thick planks. At the western end there were three. They were closely set, side by side, further towards the western end of the hole, ten centimetres above the bottom, which was a cross plank. These vertical planks presumably touched the top of the construction. Therefore, they had to be about 2.5 centimetres long, and had to stick out at least 0.5 metres over the surface of the ground. The bottom parts, which were one metre long, survived only because they had collapsed into the mud of the well. The vertical planks of the edge rested upon the logs of the side walls. From within, the same type of transoms as the bottom ones could have held the planks, but they have not survived. At the eastern end, only fragments of the lower parts of two planks which were 30 centimetres tall were found, but it is possible that the construction of the eastern end of the well was the same as that of the western one, only it has not survived. The planks of the eastern end were set right above the bottom plank.

The walls of the hole dug for the well were not completely even and vertical. Ten to 25-centimetre gaps were left between the wooden construction of the well and the walls of the hole. They were filled with a greenish brown sand, which accumulated during the digging of the hole. In the sand there were sticks, small planks, bark and chips of wood.

The well was very shallow, and presumably that was the reason why it soon filled up with silt. During that time the wooden construction of the well disintegrated a little. The well was neglected. Oak beams and planks were thrown into it. It filled up with mud when its western wall fell down. Soon the hole of the well filled up with stones. The bottom of this layer of stones was at a depth of 1.8 metres, and the top was at a depth of 1.3 metres. Over a period of time the hole of the well became even with the surface of the ground. Finally, as in the case of the third well, in the filled-up hole of the well, another hole for a fireplace was dug. Attempts to determine the function of the fireplace have all failed (Fig. 11).

Black, thick mud, which is full of admixtures such as sand that had fallen from the walls, remnants of organic material, ash, charred logs, coal, stones, sticks and bark settled in the bottoms of all the wells. Poles, sharpened with axes, beams with trimmed ends, stumps, planks, and a large amount of chips of wood were thrown into them, especially into the third and the fourth ones. Some archaeological ware, such as clay pots and shards, stone grinders, whetstones, slag, pieces of clay, and also bones and animals' teeth were found in the soil which filled up the abandoned wells. All of the abandoned wells were filled with stones.

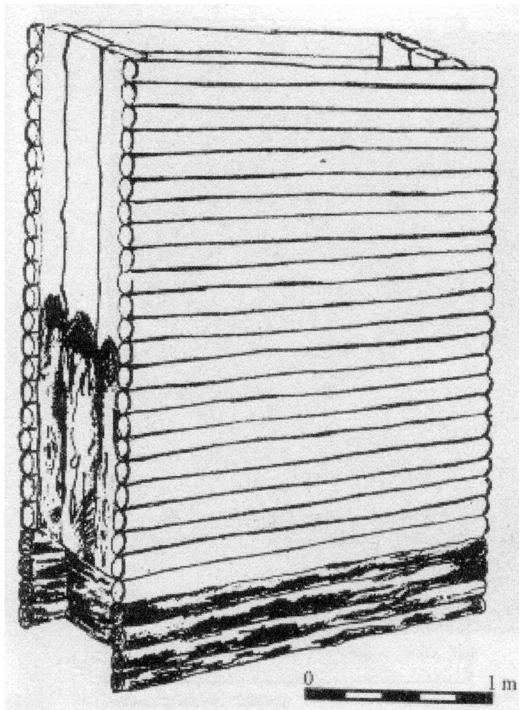

Fig. 11. A reconstruction of the fourth well

Later, buildings were built on the site of the wells. Domestic findings, such as shards, bones, clay and other objects were found in the soil which filled the silted-up wells; therefore, all these wells have been ascribed to layer B, the iron smelting period of the Lieporiai settlement. The second, third and fourth wells were dated using the carbon dating method and the dendrochronological method. It was determined that the first well appeared in about 318±38AD (Kairaitis 1997). The third well was dated to 374±50 AD, and the fourth was dated to 523±50 AD (Mažeika 1999). These were not drinking water wells, they were dug because there were no natural water bodies close to the location, and the water from the wells was used to wash the ore before smelting.

The author of this article noticed the similarity between the wells described above and the wooden wells in the Pruzskow (Poland) iron smelting museum, where a reconstruction of the Biskupce iron smelting trade of the first to the fourth centuries AD has been made. This monument has not been duplicated; therefore, the exhibition in this museum (muzeum Starozytnego Hutnictva w Pruszkowie. Wystawa-Czas Żelaza. Panorama mazowieckiej wsi hutniczej z pierwszych wiekow n.e.) must be considered analogous.

Although the wooden constructions of the wells were found to have significantly deteriorated, it was possible to determine what material they were built from. It consisted of pine, birch and poplar trees. Thin logs with bark (the fourth well), split logs, thick trimmed planks (the first, third and fourth wells) were used for

Fig. 12. A reconstruction of the fourth well in the Šiauliai Aušra museum

the construction. Oblong holes for all the wells had been dug, and later wooden supports were assembled in these holes. The shape of all the wooden constructions, except the ones in the second well, which was round, was rectangular. The types of constructions were also uniform: the sides were made from recumbent stumps, logs or planks, and the corners were made from vertical ones. The corners of the insides of the wells were supported with transoms. They could have been thick, trimmed, with cuts for stakes (the first well), or rather thin poles, the ends of which were inserted between the side logs or planks (the third and fourth wells). The original look of the wells can be roughly reconstructed from these facts (Fig. 12). Following a graphic reconstruction, the first well was renewed for the 2004 exhibition in the Aušra museum in Šiauliai.

The buckets

In two of the four wells, the first and the third, eight lime bark buckets (four buckets in each) were found. Even though they look alike and the circumstances of their discovery are similar, the conditions of the buckets differ; therefore, it is necessary to describe each bucket individually. The first, second, third and fourth buckets were found in the first well, while the fifth, sixth, seventh and eighth buckets were discovered in the third well.

The first bucket. At a depth of 3.2 metres, at the southwest end of the well, appeared a piece of bark, the size of which was 21 by 29 centimetres. During the process of its preparation, it turned out that this piece of bark could have been a box, stitched up with lime bast from bark, which was turned so that the bast was on the upper side. The box lay in such a way that its bottom faced the western corner of the well. It was flattened and deformed; there was only a five to ten-centimetre gap between its edges. A stone, the size of which was ten by 12 by six centimetres, and some wood chips were in the box. No one understood what kind of find the bucket was, so it was simply called “a box”. This bucket had almost completely deteriorated, only pieces of it remained.

The second bucket. At a depth of 3.4 metres, also at the southwest end of the well, 30 centimetres from the wall, lay the second bucket, the opening of which faced the western wall. The bucket was flattened, as in the case of the first one. The height was 16 centimetres, and its width was 26 centimetres; however, the bottom has not survived. This was the first find that was recognised as a bucket, because a loop made from lime bast was noticed by the upper edge. A cord twisted from lime bast had survived in the loop. The length of the cord was seven centimetres. The discovery of the bucket finally allowed for the interpretation of the wooden construction as a well, while before this there had been many doubts.

The third bucket. At a depth of 3.6 metres in the corner of the well lay the third bucket. Its bottom was pressed against the corner pillar, and its opening faced the inside of the well. Its side was pressed against one of the fallen planks of the northwest wall of the well. The diameter of the bucket and the height were 18 centimetres. Unlike the buckets described above, this one had not completely lost its form; it was only slightly flattened. The third bucket, like the other buckets, was

Fig. 13. The third bucket

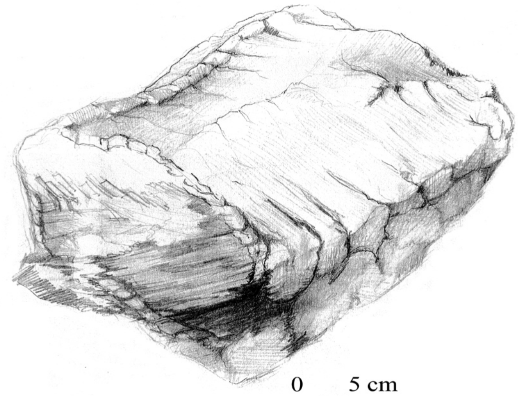

Fig. 14. The fourth bucket

sewn from a piece of turned tree bark, which was in good condition; therefore, the conclusion was made that it was lime bark. The hems of the bucket were also in a good state. The side of it was sewn with double hems, making oblique, 1.5-centimetre-long stitches. The bottom was sewn to the sides, making stitches of the same length, with 0.7-centimetre gaps between the stitches (Fig. 13).

The fourth bucket. At a depth of 3.9 metres, 35 centimetres from the southwest end of the well, alongside the well, lay the fourth bucket. Its bottom faced the southwest wall. It was flattened and disintegrating. The height, as well as its width, was 22 centimetres. Although it had deteriorated quite a bit, its shape and the technique of its production could be determined quite clearly. The only parts missing were the cord and some pieces.

The fifth bucket. At a depth of 3.1 to 3.2 metres, in the very middle of the well, in thick mud, lay the fifth bucket. It was flattened, very crumpled and disintegrated. The height of the bucket was 24 centimetres, and its width was 21 centimetres. The bucket lay 55 centimetres from the western end of the well, and its opening faced the northwest side. The two loops of the bucket had survived, but the cord was broken (Fig. 14).

The sixth bucket. At a depth of 3.3 to 3.4 metres, in the middle of the well, lay the sixth bucket. It pointed in the opposite direction to the fifth bucket. This bucket is in the best condition. Presumably, it had sunk while still new and preserved its original form. The bucket was almost round, 25 centimetres long, and had a diameter of 25 centimetres. The bark of the bucket was very smooth, not crumpled. On the surface of the bark, cracked lime tree bast could be seen. The edges of the bark were overlapping by four centimetres, and sewn with a bast cord, the same way as all the others. Both loops had survived, but not the cord. It was full of well mud and sand from the bottom.

The seventh bucket. Over the southeast corner of the sixth bucket, only facing in the opposite direction, lay the seventh bucket. Its opening faced southwest. The southern, unsupported wall had fallen on to this bucket. It was flattened, and its bark was crumpled. The height of the bucket was 25 centimetres and its width was 27 centimetres. It had been made in the same way as all the other buckets.

The eighth bucket. The eighth bucket was found at the same depth as the sixth and the seventh. It lay two centimetres west of the sixth bucket, across the well, with its opening facing southwest. The bottom lay on the bottom of the well, on sand. From above, it was covered with mud, but it was in rather good condition; it was less flattened than the fifth bucket, even though its bark was crumpled. The remaining few pieces of a very disintegrated bast cord were noticed in the loops.

From these descriptions, it is clear that all the lime bark buckets were made in the same manner, only the dimensions differed slightly. Those found in the third well were three to four centimetres taller and wider than the buckets in the first well. Among the buckets found, there was one that seemed much newer than the rest (the sixth), but there were also a few in poor condition (the first, the second and the fifth), as well as a few that were more or less threadbare. From these facts, we can draw the conclusion that, as time passed, lime bark buckets became softer, their bark became sodden and puckered, but they were still used, until the cords of the buckets broke and the buckets sank.

Reconstruction

Data from archaeological excavations has provided some information about the material used in the production of the buckets and the sewing technique; however, it was necessary to determine the process of the preparation of the material and the method of production of the buckets.

The tradition of producing domestic objects from lime bark, or sewing them to make an oblique hem, as in the case of the buckets described, has not survived in Lithuania. However, lime bark boxes with plank bottoms, nailed with tacks, can be seen in museums. The sides of these boxes are quilted, making a single hem along the side. Moreover, the use of lime bast for twisting string and weaving bast shoes is also known. K. Ščesnulevičius (Ščesnulevičius 1936) wrote about bast shoe weaving in 1936. In his article, he describes the kinds of trees and the type of bark which had been used for weaving bast shoes, when the bark was taken, and how the bark was prepared and kept. This information was useful in the process of choosing the trees and preparing the bark. Lime bark used to be gathered in the spring and summer. The bark at the bottom of a tree was cut with a knife along the bottom of the trunk, and peeled until it came off. Later, it would be soaked for about two weeks. Then it was dried, and the bast was pulled out and wrapped up. This "pickled" bast is especially flexible and solid. Bast bark weaving with hooks is also known in Lithuanian villages. This method was taken from one of the craftsmen.

The raw material and tools. The buckets were made from green lime bark. For this purpose, a young, straight lime tree, with as few branches as possible, growing in a forest and about 15 centimetres in diameter, is needed.

The buckets are sewn using twisted lime bast cord. Loops for the handle and the handle itself are made from cord of the same type.

An axe, a knife, an awl, a hook for weaving the string, and some wax, are needed for the production of a bucket (Fig. 15). In order to ensure the accuracy of the experiment, copies of axes, knives and awls found in the cemetery at Lieporiai, as well as a wooden hook and some wax that were taken from ethnographical material, were used for this reconstruction.

The preparation of the raw material. Having cut a lime tree, a 0.6 to one-metre-area of the trunk, free of bigger branches, scars or other bark injuries, is cut out with a knife, across the trunk, from both ends, and then cut lengthwise. For this purpose, a very sharp knife is needed, so that the bark is cut to the very timber; otherwise, the uncut bast will tear the bark and spoil its edge. A straight and undamaged edge of the bark guarantees the watertightness of a bucket. The bark from the trunk is then peeled off with the blade of a knife or an axe, carefully pulling the bast from the timber along the lengthwise cut and increasing the gap. If the tree is barked in spring, it can be barked using only the hands, placing the fingers into the gap between the rind and the trunk. Usually, while barking a tree, the bast cracks lengthwise in some places, but the outer side of the bark has to remain undamaged.

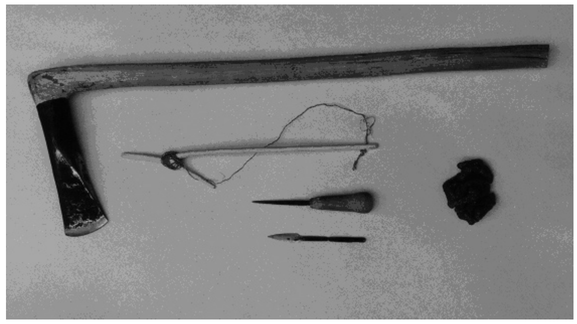
Fig. 15. The tools for making buckets


Fig. 16. Peeling the bark from the lime trunk

The best time to bark a tree is in spring, when the bark separates easily from the trunk. After bark gathered in the spring has been soaked, the bast separates from it very easily, and it is flexible and solid. The peeled bark may be kept dried. However, before the buckets are made, the bark must be soaked in cold water for up to three days. If necessary, the bark may be peeled off during other seasons, but it becomes more difficult, as it is more likely to be damaged and the bast is almost impossible to separate from the bark; therefore, they have to be cut with a knife (Fig. 16).

Once the bark is peeled, it must immediately be turned so that the bast is on the top (if it cannot be done immediately, then at least before it gets dry). It has to be rolled into a cylinder and tied up with a string. Only in this way can the bark be completely straightened, so that its edges do not turn towards the inside.

Bark from the very top of the tree and from bigger branches is peeled for bast. Using a knife or an axe, the lower edge of the bark, the width of which is not important, is peeled until the bark tears off. The pieces of bark are soaked in water for two or three weeks, in order for the bast to separate from the bark more easily.

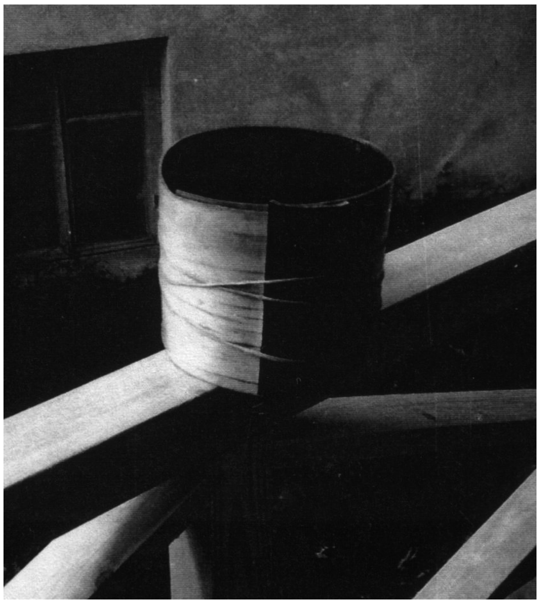

Fig. 17. The lime bark prepared for sewing

Fig. 18. Sewing the bucket

Then the pieces of bark are taken out of the water and dried. After that, the bast is pulled by hand. It is thin, flexible and soft, and can easily be woven into string (Fig. 17).

String is woven from bast using a wooden hook, which is made from a tree branch, 30 centimetres long and one centimetre in diameter, with a smaller branch sprouting from it. The branch is cut five centimetres from the join, which is of the same length. The length of the handle of the hook is about 25 centimetres. The ends are smoothed with a knife.

The string is woven from one 30 to 40-centimetre-long and one-centimetre-wide piece of bast. One end of the bast is put around the hook, leaving a five to seven-centimetre tip on one side. This tip, together with the longer end of the bast, is taken with the left hand, and the hook is turned around its longitudinal axis using the right hand. This way, the long and the short ends are twisted, and the rest of the string is woven following the same method. In order for the bast to stay woven, its twisted end is wrapped around the hook. Finally, when the bast is woven, the string is wound off the hook and its pointed, single end is waxed with good beeswax. The waxed end of the string should look like a needle.

Looking for a way to sew bark with a cord, the first method tried was to pull the end of the cord through a hole made with an awl, using a darning needle, which was made especially for the purpose, but this method failed. The end of the cord cracked, split into threads, and could not be pulled through the hole. What was helpful here was a technique used by shoemakers. A hole was made with an awl, the waxed end of the cord was put through, and from the opposite side the end was pulled out. The waxed end of a bast cord, twisted between the fingers, becomes hard and pointed and can be pulled through the hole quite easily.

Sewing a bucket. The edges of the lime bark are cut using a knife till they are even. A 75 to 80-centimetre-long and 22 to 25-centimetre-wide rectangle is cut and rolled lengthwise down the bast, with the outward side of the bark facing inside. During the archaeological excavations, it was noticed that the bark of buckets was rolled with the bast facing outwards, but it was not clear why all these buckets were rolled only this way. Having tried to roll the bark so that the bast was facing inwards several times, the outward side soon cracked. Thus, it became clear that the bark has to be rolled with the bast facing outwards only. The edges of the bark overlap five to seven centimetres, and the cylinder is tied tightly with bast or cord made from it. The remaining piece of bark is pressed with a plank in order to uncurl it. It will be used for the bottom of the bucket. If the bark is soaked for several days, it uncurls easily, and it is not necessary to press it (Fig. 18).

Bark scalded with boiling water or soaked in cold water for a day becomes more flexible. A bucket of a more regular form is made from such bark. It appears that bark may be softened and steamed by putting the lime log into a heated bread-baking stove, but we did not try this method (Ščesnulevičius 1936).

The bucket is sewn leaving the bark cylinder tied tightly with bast; otherwise, it would be impossible to keep it rolled and to sew it evenly. In order to keep the outward edge of the bark pressed to the side of the bucket more tightly, an oblong piece of bark can be put crosswise behind the bast. It is sewn using cord woven from dried bast. The archaeologist R. Rimantienė once wrote that before the process, the bast was soaked (Rimantienė 1995), but our experiment showed that this was not true. Wet bast cannot be twisted, knotted or tightened, and loosens up immediately. It is also impossible to point it and to pull it through a hole. The most convenient way to sew it is to use a 30 to 40-centimetre-long cord; a longer cord usually cracks by the time the sewing is over, and it breaks more often. The side of the bucket is sewn making a double hem in the following way: a hole is made with an obtuse (so that the bark does not split as easily) iron awl through both of the overlapping ends of the bark. The hole is made 1.5 centimetres from the top of the cylinder, two to three centimetres from the outward edge of the bark. A well-twisted, waxed, pointed bast cord is stringed into the hole and tied firmly. The shorter end of the cord is stringed into the gap between the overlapping edges of the bucket, and the longer one is used for sewing. Alongside the overlapping edge, two lines of holes are made, one to 1.5 centimetres from each another. The gaps between the holes are 0.5 to one centimetre wide, and the holes are arranged in a chessboard order. By stringing the cord through the holes of both lines, skew stitches are formed. Such a double hem presses the joining pieces more tightly and does not damage the outward edges of the bark. Every hole is made separately, so that it does not get covered. The holes are made in the same direction as that in which the cord will be stringed, because the outward hole is wider and its edges are more even.

After sewing the side of the bucket, the excess string is cut off. The bucket is put on a straightened piece of bark, laid with its outward side facing up. Pressing it very tightly, the bottom of the bucket is cut out with a sharp knife. The bottom is several millimetres wider than the cylinder of the bucket. It is sewn to the bucket making a double hem as well, using holes with 0.5-centimetre gaps between them. The cord is stringed in succession into the holes of the cylinder and into the holes of the bottom. The holes are not made ahead of time or all at once, but while sewing, each one is made separately. It is easier to string the cord into a newly made hole, as, after some time, the hole contracts and it has to be widened with an awl. The bottom holes are made from the inside of the bucket, while the holes of the cylinder edges are made from the outer side. The cord is stringed into the holes in this order, because otherwise, trying to make a hole at the bottom of the cylinder from the inner side is very difficult, as it is hard to see. The holes in the cylinder are made not in a line, but in chessboard order, every other hole a bit lower so that the bast does not rip lengthwise and does not fall together with the bottom.

Fig. 19. A replica of a lime bark bucket

After the bucket is sewn, holes for a vertical loop are made 2.5 to three centimetres from each other, approximately in the middle of the overlapping edges, two centimetres below the upper edge. If the loops are not made where the edges of the cylinder overlap, is impossible to keep the bucket balanced, as the heavier side of the bucket will weigh it down. The loop is made from a double bast cord. In order for it to be firmer, the same cord is wound around the outer side of the loop. A loop of the same kind is made on the opposite side of the bucket. A 0.5-centimetre-thick cord, woven from two-bast ply, is stringed into the loops. Then, a 40 to 50-centimetre-long cord, thicker than that used earlier for sewing, is taken. One of its edges is stringed through the loop and bent so that one quarter of its length remains on one side, with the other three quarters on the other side. Then both ends of the cord are twisted into one. The end of the shorter part is stringed between the cord's filaments, and fastened so that it does not break or come loose. The bast is not slippery, and the cord stays twisted. The other end of the cord is twisted the same way. The handle can be made in the following way. A single cord is stringed into one of the loops; the cord is bent in the middle and twisted to the end by hand. Then its end is pulled through the second loop. Its ten-centimetre end is bent under the loop and woven into the twisted cord. This way, a firm cord handle for the bucket is made from double bast. The capacity of the bucket is usually eight or nine litres (Fig. 19).

A finished lime bark bucket was tested. It was soaked in water for three days. During this time the bark became swollen, and all of the holes were filled; the overlapping edges were tightly pressed. The bast cord also became swollen, and filled the holes tightly. The bucket became almost completely hermetic. It could be used

Fig. 20. The Days of Living Archaeology in Kernavė, 2001. Making lime bark buckets

to draw water, which dripped only slightly from it. After being carried for 100 metres, 0.5 litres of water had dripped from the bucket. This shows that the bucket is not suitable for carrying and keeping water. However, it is suitable for drawing water from a well, because it is light, capacious, and can easily be drawn up from a deep well. Fastening the bucket to a perch can draw the water; otherwise the bucket will not sink and be filled with water. A stone found in the first bucket could have been used as a form of ballast, so that the bucket sank and was filled with water.

It is possible that buckets in wells were kept in the water all the time, and that is why they did not dry out and were watertight. It was noticed that the bark of a bucket used for a longer period of time would get softer; the bucket would lose its resilience, and would become soft and flat like a basket. No bucket has been found with the entire cord remaining, which indicates that the buckets sank when their cords broke.

To this day, 150 buckets have been made using the method described above. A reconstruction of the method of production was elaborated further in 1998–2002, when the author of this article and Audronė Šapaitė, the head of the archaeological department at the Aušra museum in Šiauliai, participated in various experimental archaeology events. The method of production was demonstrated at the Biskupin festival of open archaeology in Poland, from 9 to 19 September 1998, and 18 to 22 September 1999, as well as at the Kernavė archaeological museum during the Days of Living Archaeology, and at the international symposium "Ancient Trades and Traditions of the Countries of the Baltic Sea Region" in Nida in 1999. The method was also demonstrated in Nida in 2000–2002 during the Viking Festival; in Volin, Poland, in 1999 and 2001; it was also shown in 2002 at the "Living History" camp which took place in the Šiauliai region and was hosted by Šiauliai Aukuras, the nature and cultural heritage protection club; also, in 2000, during the ancient trades day at the Aušra museum in Šiauliai; at the festival of medieval trades in 2001 in Cēcis, Latvia, as well as in several other places (Fig. 20).

Conclusions

1. In 1987–2002 the Lieporiai complex of archaeological monuments (a cemetery and two settlements) near Šiauliai was excavated. A site for iron smelting was excavated, and dated to the fourth to eighth centuries AD.
2. Unique findings, four wells (three with wooden constructions) and eight lime bark buckets, were discovered.

3. A reconstruction of a wooden well was made at the Aušra museum in Šiauliai in 2004, but archaeological experiments in lime bark bucket production were accomplished in 1998.
4. Lime bark, an axe, a knife, an awl, a hook for weaving the string, as well as some wax, is needed for the production of a bucket. The method of production has been reconstructed and 150 buckets have been made using this method. All the reconstructions were demonstrated at festivals of experimental archaeology in Poland, Latvia and Lithuania.

References

Kairaitis J., Karpavičius J. 1997. Dėl šulinio iš Lieporių gyvenvietės amžiaus. Kauno botanikos sodas. In: *Šiaulių "Aušros" muziejaus Archeologijos skyriaus archyvas*.

Kernavė - litewska Troja. 2002. *Katalog wystawy ze zbiorow Panstvovego Muzeum-Rezerwatu Archeologii w Kernavė.* Warszawa.

Mažeika J., Petrošius R. 1999. Šiauliai No 1, Šiauliai Nr. 2. Geologijos institutas, Radioizotopinių tyrimų laboratorija. In: *Šiaulių "Aušros" muziejaus archeologijos skyriaus archyvas*.

Navasaitis J., Chodočinskas S., Blaževičius H. 1996. Šlako reikšmė kalviškosios geležies metalurgijoje. In: *Mechanika-96. Tarptautinės konferencijos pranešimų medžiaga*. Kaunas, 177–180.

Navasaitis J. 1997. Lieporių rudnelės rekonstrukcija. In: *Kultūros paveldas-97: Respublikinio seminaro medžiaga (Metalų gavyba, jų sudėtis ir metalinių dirbinių gamyba).* Vilnius, 39–44.

Navasaitis J., Sveikauskaitė A., Selskis A. and Matulionis E. 1999. Ironmaking technique during the Roman period in Lithuania. In: *Prehistoric and Medieval Direct Iron Smelting in Scandinavia and Europe. Aspect of Technology and Society*. Aarhus, 87–97.

Navasaitis J., Sveikauskaitė A., Selskis A. 1999a. Lietuvos rudnių šlako sudėtis ir savybės. In: *Lietuvos archeologija*. 18. Vilnius, 121–133.

Rimantienė R. 1995. *Lietuva iki Kristaus*. Vilnius, 55.

Rimantienė R. 1996. *Akmens amžius Lietuvoje*. Vilnius, 21.

Salatkienė B. 1992. Lieporių (Šiauliai) kapinyno 1990–1991 m. Tyrinėjimai. In: *Archeologiniai tyrinėjimai Lietuvoje 1990–1991 m*. Vilnius, 117–122.

Salatkienė B. 1993. Žemaičių karių kapai Lieporių V-VIII a. po Kr. kapinyne. In: *Mūsų kraštas*. No 2(3), 21–29.

Salatkienė B. 1993a. *The complex of archaeological monuments in Lieporiai 5th-8th c. AD*. Vejle, 103–105.

Salatkienė B. 1994. Lieporių gyvenvietės tyrinėjimai. In: *Archeologiniai tyrinėjimai Lietuvoje 1992–1993 m*. Vilnius, 64–73.

Salatkienė B. 1994a. Ar išsaugos Šiauliai savo archeologinius paminklus? In: *Mokslas ir gyvenimas*. No 4, 32–33.

Salatkienė B. 1996. Lieporių I gyvenvietės tyrinėjimai. In: *Archeologiniai tyrinėjimai Lietuvoje 1994–1995 m.* Vilnius, 47–52.

Salatkienė B. 1996a. Lieporių archeologinių paminklų kompleksas. In: *Šiaulių metraštis 1994–1995*. Šiauliai, 161–169.

Salatkienė B. 1997. Geležies lydymo verslas Lieporių I-oje gyvenvietėje. In: *Kultūros paveldas-97: Respublikinio seminaro medžiaga (Metalų gavyba, jų sudėtis ir metalinių dirbinių gamyba).*Vilnius, 30–39.

Salatkienė B. 1998. Lieporių 1-sios gyvenvietės tyrinėjimai. In: *Archeologiniai tyrinėjimai Lietuvoje 1996 ir 1997 metais*. Vilnius, 90–99.

Salatkienė B. 1999. Archeologinė rekonstrukcija kaip tyrimo metodas. In: *Lietuvos muziejų rinkiniai*. Tyrinėjimų metodika. Konferencijos tezės ir pranešimai. Vilnius, 10–12.

Salatkienė B. 2000. Lieporių 1-sios gyvenvietės tyrinėjimai. In: *Archeologiniai tyrinėjimai Lietuvoje 1998 ir 1999 metais*. Vilnius, 103–106.

Salatkienė B. 2001. Lieporių 1-ji gyvenvietė. In: *Archeologiniai tyrinėjimai Lietuvoje 2000 metais.* Vilnius, 37–40.

Salatkienė B. 2002. Lieporių 1-ji gyvenvietė. In: *Archeologiniai tyrinėjimai Lietuvoje 2001 metais.* Vilnius, 47–53.

Salatkienė B. 2003. Geležies lydymo ir apdirbimo radiniai Lieporių 1-oje gyvenvietėje. In: *Istorija. Lietuvos aukštųjų mokyklų mokslo darbai*. LVI. Vilnius, 3–16.

Stankus J. 2001. Geležies gamybos Lietuvoje apžvalga. In: *Lietuvos archeologija*. 21. Vilnius, 171–182.

Ščesnulevičius K. 1936. Vyžos. In: *Gimtasai kraštas*. Šiauliai. No 1(9), 15–18.

Vaškevičiūtė I. 1988. Lieporių (Šiaulių raj.) kapinynas. In: *Archeologiniai tyrinėjimai Lietuvoje 1986–1987 m*. Vilnius, 114–116.

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ŠULINIŲ IR LIEPOS KARNOS KIBIRĖLIŲ IŠ 1-OSIOS LIEPORIŲ GYVENVIETĖS REKONSTRUKCIJA

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Santrauka

Lietuvoje mažai domimasi eksperimentine archeologija. Tiek archeologinis eksperimentas, atliekamas kaip mokslinio tyrimo dalis, tiek rekonstrukcijos muziejų ekspozicijose tebėra retas dalykas. Neaprašomi ir nepublikuojami net tie eksperimentai, kurie atliekami eksperimentinės archeologijos festivaliuose ar panašaus pobūdžio renginiuose.

Svarbiausias šio straipsnio tikslas yra aprašyti ir paskelbti archeologinio eksperimento – liepos žievės kibirėlių vandeniui iš šulinio semti siuvimo ir bandymo rezultatus – medžiagas, eigą. Buvo padarytos ir šulinių, kuriuose rasti kibirėliai, medinių sienų rekonstrukcijos, tačiau ne natūraliomis sąlygomis, žemėje, laukuose, o muziejuje ir brėžiniuose.

Pirmojoje straipsnio dalyje detaliai aprašomos medinių šulinių su nuskendusiais liepos žievės kibirėliais atradimo aplinkybės, o antrojoje – jų rekonstrukcijos eiga.

Minėti radiniai buvo rasti 1983 metais pietiniame Šiaulių miesto pakraštyje aptiktame Lieporių archeologiniame komplekse, kurį sudaro 3 vienalaikiai paminklai – IV–VIII a. pr. Kr. gyvenvietės ir kapinynas. Kompleksas tyrinėjamas nuo 1987 metų. Kapinyne ištirti 95 kapai, surinkta daugiau kaip 450 archeologinių dirbinių, nustatyta, kad tai žemaičių paribyje su žiemgaliais gyvenusios bendruomenės palikimas. Lieporių 1-osios gyvenvietės vakarinėje dalyje ištirtas 2858 m^2 plotas ir užfiksuoti trys kultūrinio sluoksnio horizontai. Seniausias iš jų priskirtas Pabaltijo Madleno kultūrai ir datuotas X–VIII tūkst. per. Kr. Vidurinis, IV–VI a. po Kr., horizontas priklauso tam laikotarpiui, kai šioje gyvenvietės dalyje buvo lydoma geležis, o vėlyviausias, VI–VIII a., horizontas – tai laikotarpis, kai apleistoje geležies lydykloje buvo pastatytos sodybos ir apsigyveno žmonės.

Patys rečiausi ir vertingiausi vidurinio, geležies lydymo, laikotarpio horizonto radiniai. Tai geležies lydykla, kur vietoje buvo kasama hidratinė geležies rūda (rūdos kasimo duobės ir rūdos žaliava), plaunama (šuliniai ir juose paskendę kibirėliai, klojinys), degama (rūdos deginimo duobės), lydoma (20 rudnelių liekanos, medžio anglių degimo duobės ir židiniai), gauta kritė kaitinama žaizdre (kalvio žaizdras) ir galutinai apdirbama, kalant ant akmeninių priekalų. Unikalūs geležies lydyklos radiniai – tai mediniai šuliniai su nuskendusiais kibirėliais, neturintys vienalaikių analogijų Lietuvos archeologinėje medžiagoje.

Visi Lieporių šuliniai įrengti šiek tiek skirtingai. Trys iš jų (1, 3, 4) turėjo medines konstrukcijas, o vienas – neturėjo. Visos medinės konstrukcijos stulpinių statinių tipo, tačiau pirmajam šuliniui naudoti skelti pusrąsčiai, antrajam – skeltinės lentos, o trečiajam – nestori apvalūs rąsteliai. Visi mediniai šuliniai keturkampiai, pailgi, nuo 1,3 iki 1,8 m ilgio ir nuo 0,6 iki 0,8 m pločio, o šulinys be medinių sienų buvo apvalus, apie 1 m skersmens. Visais atvejais pirmiausia buvo iškasama duobė (nuo 2,4 m, 2,0 m, 2,7 m, 4,65 m gylio) ir jos sienos sutvirtinamos medinėmis konstrukcijomis, viduje prilaikomomis skersiniais rąsteliais ar kartimis.

Pirmajame ir trečiajame šuliniuose buvo rasti aštuoni nuskendę ir dumble užsikonservavę kibirėliai. Jie šiek tiek skyrėsi dydžiu (aukštis nuo 16 iki 27 cm, skersmuo nuo 18 iki 27 cm), tačiau visi buvo cilindro formos, karnos virvele susiūti iš luobu į viršų išverstos liepos žievės, prisiūtu dugnu. Kibirėlių lankeliai suvyti iš karnos virvelės, šonuose įvertos į kilpeles. Vienas kibirėlis buvo nuskendęs dar naujas, nepraradęs formos, kiti sunykę labiau, o keletas visai suminkštėję ir susiploję kaip krepšiai.

1998 metų vasarą, ruošiantis dalyvauti Biskupino (Lenkija) gyvosios archeologijos festivalyje, buvo padaryta liepos žievės kibirėlių gamybos rekonstrukcija (B. Salatkienė, A. Šapaitė), po to dar keletą metų eksperimentuota ir tobulinta technologija bei įrankiai. Liepos žievė tinka nuo 15–18 cm storio, tiesių, mažai šakotų, nukirstų pavasarį medelių. Žievę geriausia lupti pavasarį, kada ji lengvai atsiskiria nuo kamieno. Išmirkius pavasarį nuluptą žievę, nuo jos labai gerai atsiskiria karna, ji būna lanksti ir tvirta. Nuluptą žievę galima laikyti išdžiovintą, prieš tai išvertus ją luobu į išorę, susukus į cilindrą ir surišus. Luobu į vidų žievė nesisuka, jos viršutinis sluoksnis trūksta. Prieš kibirėlių siuvimą džiovintą žievę reikia 1–3 dienas mirkyti šaltame vandenyje. Kibirėliai siūti liepos karnos virvelėmis. Karnoms paruošti žievė mirkoma apie 2 savaites, po to išlupamas vidinis jos sluoksnis, kuris išdžiūvęs tampa tvirta karna. Virvelė vejama mediniu kabliu, jos galas vaškuojamas, kad lengviau praįstų pro skylutę žievėje. Į cilindrą sulenktos ir surištos žievės kraštai, užleisti vienas ant kito, siuvami dviguba siūle įstrižais dygsniais, skylutes dygsniams praduriant geležine yla. Kibirėlio dugnas išpjaunamas peiliu, taip pat luobu į išorę, ir prisiuvamas virvele įstrižais dygsniais. Kilpelės daromos iš karnos virvelės, praduriant po dvi skylutes kibirėlio šonuose. Į kilpeles įtvirtinama storesnė vyta virvutė, kuri atstoja kibirėlio lankelį.

Apie 25 cm skersmens ir tokio pat aukščio kibirėlis būna maždaug 8–9 l talpos. Tris dienas šaltame vandenyje mirkytas kibirėlis tampa pakankamai sandarus semti vandeniui iš šulinio ir nešti nedidelį atstumą. Vandeniui ilgesnį laiką laikyti kibirėlis netinka. Gali būti, kad kibirėliai buvo naudojami tik sėmimui, nuolat būdavo vandenyje, neišdžiūdavo ir išlikdavo sandarūs. Tačiau jie greitai minkštėdavo, deformuodavosi, jų virvelės trūkdavo ir jie skęsdavo.

Kibirėlio gamybos rekonstrukcija buvo demonstruojama 1998–2003 metais įvairiuose eksperimentinės ir gyvosios archeologijos renginiuose Lietuvoje, Lenkijoje ir Latvijoje.