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New insights into the medieval history of a non-urban territory: multidisciplinary investigations in SE Lithuania

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Abstract. This paper presents results of the interdisciplinary investigations into the ancient wooden construction, presumably, a well, discovered near the Pamerkiai village, south-eastern Lithuania. The study aims at ascertaining the context (specific geological-geomorphological situation and the habitation history of this territory) of this comparably well-preserved and very uncommon find. The discovered wooden construction and its environment were investigated applying a multi-disciplinary approach combining the archaeological survey, which includes analysis of the collected artefacts, the dendrological examination of the timber used for construction, investigations of the plant macroremains and pollen found in the infilling material, and the ^{14}C dating (conventional and AMS) of the organic material; and the geological-geomorphological characterization of the site. A new perspective to gain data about the infrastructure that might have existed in the area in the 15th century is provided: the integrated and interdisciplinary research is believed to reveal the natural and anthropogenic context. A discussion on the feasibility of tracing the origins of the modern Pamerkiai village is generated. It is alternatively hypothesized that the discovered wooden construction is part of the stopover place on the highroad that has been archaeologically unexplored.

Keywords: *geology; archaeobotany; ^{14}C dating; slow wheel-shaped pottery; wooden construction; 15th century; Medieval*

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INTRODUCTION

All changes occurring in population density, subsistence patterns, land use and other anthropogenic elements in the course of human history affect landscape causing its changes. As an object of research, anthropogenic land cover change models (Kurila 2014; Klein Goldjewijk *et al.* 2010; Kaplan *et al.* 2009, 2010; Ledger *et al.* 2015) are explored in many branches of science including the history of past societies, palaeoenvironmental as well as palaeoclimatic studies. However, the prehistoric population data are not equally representative of all the regions. More detailed knowledge on the loads of past societies may be obtained from the region- or local-scale studies using the palaeodemographic data on the material relics found at living spaces (Kurilienė 2013) or the human remains at burial sites (Kurila 2014). For a better understanding of human – environmental interactions, it is also necessary to pay a certain attention to the living space organization and separate elements of settlements specific to a certain region.

In Lithuania, the medieval period was archaeologically studied in numerous towns as well as at burial sites and hillforts as the most evident objects. Historical, archaeological, and environmental sources bear witness that social and economic innovations were exchanged and transmitted from past communities in cultural centres (towns) to those in peripheral settlements (Volkaitė-Kulikauskienė 1978, 1981; Zabiela 1995; Kuncevičius 2005; Bumblauskas 2005; Stančikaitė *et al.* 2009, 2013, 2019). The system of the infrastructure around Medieval towns indicates a certain level of the country's evolution from an area of separate settlements to the united State (Gudavičius 1991; Bumblauskas 2005; Alexandrowicz 2011). In the 13th century, the first established entity – the Kingdom of Lithuania – embraced the lands surrounding the capital Vilnius, and also two towns of high importance – Kernavė and Trakai (Vėlius 2003; Gudavičius 1991). According to the historical data available, the roads crossing the territory were of several types. Some of them were called *highroads*, which implies their high significance (Čelkis 2021). The others were named after the state nobility or military leaders, i.e., 'the road of Algirdas'' or 'the ford of Kęstutis' (Čelkis 2013, 2020, 2021). The main roads connected the biggest towns and the capital Vilnius. According to the written sources, one of the highroads stretched from Vilnius to Warsaw (Celichowski, 1892, p. 164). Later, this track to Poland evolved into the gateway to the Western culture, political bonds, innovations and religion.

However, investigations into different aspects of the medieval history in the areas between towns and/or hillforts, devoid of actual or visual evidence of archaeological monuments, are still a challenge for scientists. These, presumably, uninhabited or sparsely inhabited territories were large, covering hundreds of square kilometres. Therefore, detection of any infrastructure-related objects such as stopovers, fords, ancient road fragments, etc. in this part of Europe as well as on the territory of Lithuania is in general hardly possible. Although archaeological evidence is scarce, historians assume that small medieval settlements or habitation sites did exist between the main centres, and territories along the main roads might have been particularly significant (Čelkis 2013, 2021). To fill this gap, new archaeological or multidisciplinary information is highly required.

For the above-mentioned reasons, the rescue archaeological expedition organized to the Pamerkiai village environs, south-eastern Lithuania, in 2018 was especially relevant. Here, at a location 65 km away from Vilnius, and at least a dozen kilometres away from the smaller towns, known from the Medieval period, an ancient wooden construction unrelated to any of the already recorded archaeological sites was discovered. During the rescue excavation, this archaeological site was fully uncovered, and archaeological as well as environmental material was collected for the analysis to be conducted by the interdisciplinary team.

The atypical location of the discovered find has raised several issues to be clarified. Firstly, could it be regarded as the first opportunity in Lithuania to investigate archaeological remains of the Medieval infrastructure in between densely inhabited areas? Secondly, it was necessary to make sure that employment of interdisciplinary research methods can yield relevant data. And finally, it had to be elucidated whether the data obtained can be analysed in the regional context thereby encouraging to take a novel approach to the history of the Medieval habitation development in this part of Europe.

SITE DESCRIPTION

Geological-geomorphological background

The new archaeological object was discovered in the locality of Baltulis hill (The White Hill), an outcrop close to the Pamerkiai village, Varėna district, south-eastern Lithuania (54°18'45"N, 24°43'52"E) (Figs 1–2).

Here, the meandering Merkys River makes an oxbow, and, as a result of the intensive bank erosion (~0,5–1,0 m/y), a 150 m long sand cliff has formed. The outcrop reaches the level of the second river terrace and is 8–9 m above the river water table (109 m a.s.l.). At the discovered object location, the outcrop is ~8.8 m high. The top of the discovered timber

Fig. 1 Location of the study site (by M. Stančikaitė, on the www.maps.lt 3D visual basis)

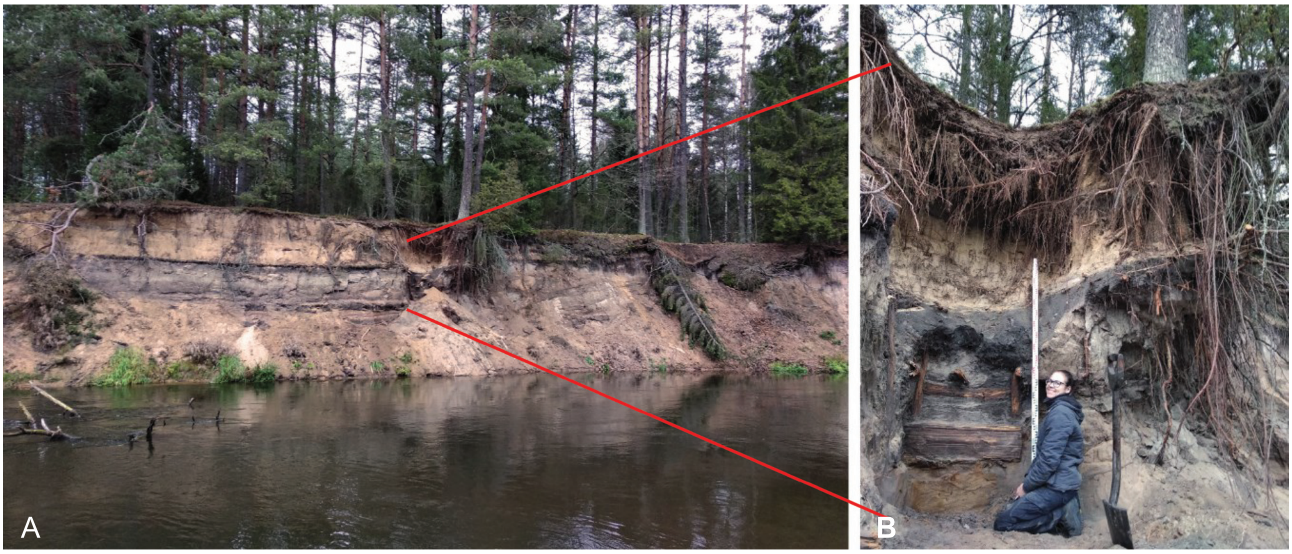

Fig. 2 A – the southern part of the Pamerkiai outcrop with the investigation area; B – position of the timber construction (photos by G. Motuza)

construction was about 3.2 m below the present-day surface, and about 5.6 m above the water table of the Merkys River.

The study site is situated in the marginal area of the Late Weichselian Glaciation, within the territory of the Vilnius–Warsaw–Berlin lateral palaeo-valley of the glaciofluvial origin, which crosses an outwash plain and a range of end moraines extending northwestwards to a distance of several kilometres. During the initial stages of ice retreat, glaciofluvial beds were deposited in this ancient valley. Later, glaciolimnic, limnic and biogenic sediments were deposited in water-filled depressions including clay, gyttja and peat.

Numerous palaeobotanical, lithological and chronological investigations have been performed in the area (Kondratienė 1964; Baltrūnas *et al.* 1984; Baltrūnas 2001; Blažauskas *et al.* 2007; Stančikaitė *et al.* 1998, 2008).

The geological characterization of the Pamerkiai outcrop is based on the above-mentioned studies with necessary specifications by the authors (Figs 1–3; Table 1). The description reflects the present-day situation in the southern part of the outcrop, whereas all the cited level calculations were done in relation to the top of the outcrop, which is 8.8 m above the average river water table here (Fig. 2).

The lower part of the investigated sequence, reaching 3 m above the river level, or about 6 m below the top of the outcrop (Fig. 3; Table 1), consists of glaciofluvial sediments deposited by the flow of ice-melt water forming an outwash plain during the initial stages of the Lateglacial (Blažauskas *et al.* 2007). Glaciofluvial sediments are overlain by a ~1 m thick bed of gyttja with a sand interlayer, containing remnants of water plants and tree trunks, predominantly of *Pinus sylvestris* L. The gyttja was presumably sedimented in an oxbow lake, which might have existed here at the end of the Pleistocene (Stančikaitė *et al.* 2008). The wedge of sand with fine gravel noted in the central part of this layer as well as their crossbedding implies the influence of the Merkys River stream on the sedimentation in the oxbow lake.

However, the thermokarst origin of this sedimentary basin cannot be rejected, as it was rather common in the area (Blažauskas *et al.* 1998). Such origin is implied by the sharp deepening and thickening of the gyttja layer in the southern part of the outcrop.

Six samples from the lower part of the gyttja layer were dated by ^{14}C method (Stančikaitė *et al.* 2008). The obtained dating results varied from 14 950–13 750 to 10 500–10 160 cal yr BP. However, there was an inversion of the obtained dates noted, i.e., some

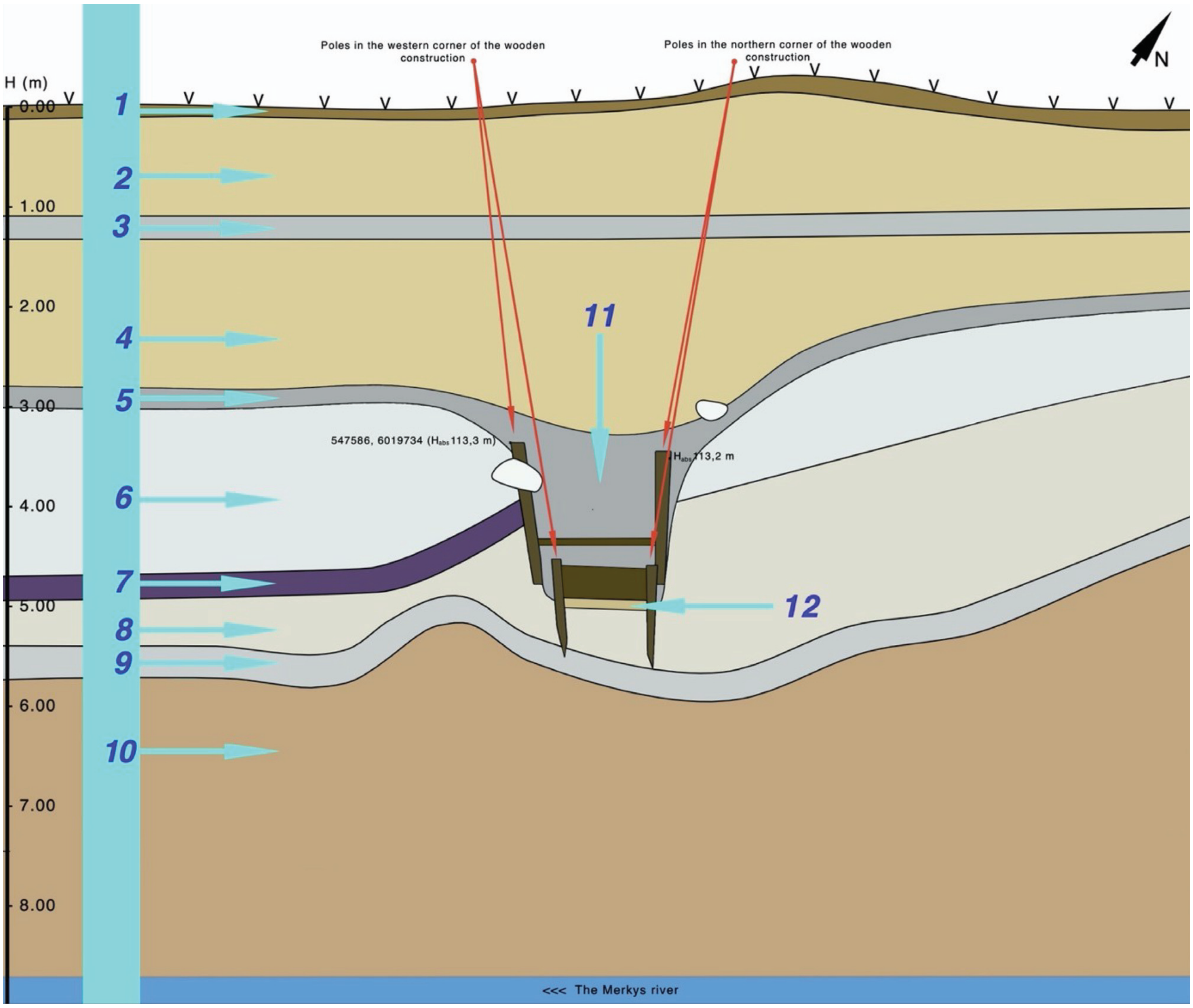

Fig. 3 Cross-section of the Pamerkiai outcrop with the discovered timber construction: 1 – modern soil; 2 – sand, aeolian, 18–20th c.; 3 – buried soil; 4 – sand, aeolian, 18–20th c.; 5 – grey soil with peat lenses, Late Holocene, cultural horizon; 6 – silty sand; 7 – gyttja; 8 – lacustrine silty sand, transition from Lateglacial to Early Holocene; 9 – clay with organic material; 10 – glaciofluvial cross-bedded sand; 11 – infill of the timber construction; 12 – flushed sand

Table 1 The geological cross-section of the Pamerkiai outcrop (by G. Motuza)

No.	Depth, cm	Age	Lithology
1	0–15	Modern times	Soil
2	15–120	18–20th c. AD	Aeolian fine-grained sand
3	120–145	18–20th c. AD	Buried soil layer
4	145–285	18–20th c. AD	Aeolian sand
5	285–320	Meghalayan Age; ~ 2500 cal yr BP	Grey soil with peat lenses, Late Holocene, cultural horizon
6	320–415?	Greenlandian Age; ~11 100–10 100 cal yr BP	Dark silty sand with organic material
6	415?–465	Lateglacial Stadial; 11 100–12 800 cal yr BP	Silty sand with organic material of lacustrine origin
7	465–487	Lateglacial Interstadial; ~14 000–12 800 cal yr BP	Gyttja
8	487–535		Lacustrine silty sand, clayey layers with organic material
9	535–572		Clay with organic material; gyttja
10	572–880	>14 650 cal yr BP	Various-grained cross-bedded sand of glaciofluvial origin

samples taken from deeper intervals appeared to be younger. Therefore, taking into account the biostratigraphical data, this layer was approximately attributed to the Lateglacial Interstadial, i.e., about 14 000–12 800 cal yr BP (Table 1).

The gyttja layer is overlain by a 1.45 m thick layer of silty sand with organic material of lacustrine origin. ^{14}C data from this interval are absent. Based on the palaeobotanical data (Kondratienė 1996; Baltrūnas 2001; Stančikaitė *et al.* 2008), the lower part of this sequence was attributed to the Lateglacial Stadial, while the upper interval indicated transition from the Lateglacial Stadial to the Greenlandian Age (Early Holocene). The exact position of the boundary between these lithostratigraphic units was not estimated.

On the top of silty sand, a ~20–40 cm thick layer of soil with lenses of peat appears. On the basis of the palynological record, this layer was attributed to the final stages of the Meghalayan Age (Late Holocene) and dated back to about 2500 cal yr BP (Stančikaitė *et al*. 2008). This layer is covered by aeolian sand, with an interfering 25 cm thick layer of soil, dated back to 18–20th c. AD (Fig. 4).

The actual thickness of the aeolian sand layer is nearly 3 metres. However, the Meghalayan soil layer below it lifts up, and 20–30 m further, it appears only at a depth of 0.5 m. The thickness of the aeolian sand covering the soil layer and forming a dune varies accordingly. The Late Glacial layer of gyttja lifts even more sharply, and is cut off by the layer of the Meghalayan soil (Fig. 3). Below gyttja, the layer of clay with organic material and trunks of trees extends further outwards approaching the surface in the northern part of the outcrop.

Archaeological-historical background

The Pamerkiai village was first mentioned in 1516, in the document issued by the Great Duke of Lithuania Sigismundus I the Old (Isokas, Tervydis 2008). At that time, the village belonged to the Lieponys manor. Life in this area may have been indirectly or directly influenced by the highroad that connected Vilnius and Kraków. Near this road, in Valkininkai, which is about 10 km north-east of the Pamerkiai village, there was a royal castle. In the 16–17th centuries, 5 km north-east of Pamerkiai, there was a functioning armoury, where

Fig. 4 Sand cover in between the Pamerkiai village and the Merkys River, 1952

cannons and other weaponry were produced. Metal and other raw materials needed for the production of weapons were transported by the Merkys River. In addition, some pitch production places dating back to the 15–16th centuries and possibly related to the factory of weapons were identified a few kilometres to the north. According to written sources, in the 13th century, this area was part of the domain of the Lithuanian Duke Mindaugas, which was further extended by defeating other Dukes and annexing their lands. Duke Mindaugas succeeded in uniting local fiefdoms under his rule, becoming the Grand Duke of Lithuania and thus laying foundations for the Lithuanian state (Bumblauskas 2005). So far, there have been few archaeological objects of the chronological period of interest in the closest proximity. Only a few Iron Age or Medieval sites could be mentioned: an ancient cemetery and a hillfort in the Krūminiai village, and the Jurgiškiai burial site, all situated at a distance of approximately 7 km from Pamerkiai (Tarasenka 1928; Kulikauskienė 1970; Baubonis, Dakanis 1998). As indicated by the archaeological finds, the Krūminiai cemetery dates back to the 15–16th centuries, whereas the fortifications of the hillfort are characteristic of the 15th century. It is possible that the hillfort was inhabited at that time. However, it was built and mostly used much earlier, possibly, in the first millennium BC already (Volkaitė-Kulikauskienė 1979; Striškienė 2000). Yet, even though these objects are attributable to the same chronological period, they are too far from the area under discussion to be directly linked to the Pamerkiai site. Therefore, they should not be regarded as parts of one complex. However, taking into account the continuous inhabitation of the region, future investigations might reveal much more indicators of the human presence therein in the first half of the last millennium.

MATERIALS AND METHODS

For the investigation of the discovered archaeological construction and the palaeoenvironmental situation, the following set of methods was applied: archaeological, litho-sedimentological, chronological (artefact typology, ^{14}C, and dendrochronology), as well as palaeobotanical (dendrological, pollen and, plant macrofossil).

Lithological-sedimentological and petrographic survey

The lithostratigraphic characterization of the outcrop was made based on the data obtained from the previous survey. It was improved with the newly obtained data and was specified considering the peculiarities of the site.

Archaeological investigations and sampling

Condition of the naturally unearthed wooden object was evaluated as dangerous due to the erosion activity of the Merkys River, and therefore a rescue project was organised. Small-scale archaeological excavations and a surface survey were performed in 2018. A metal detector survey was conducted all along the visible grey soil layer and at the trench excavation site in particular.

Due to the 2.4 m thick aeolian sand bed overlaying the object and several pines growing on top of the slope, employment of the conventional archaeological methodology, i.e., the gradual uncovering of the object starting from the top, was not possible. Therefore, the excavation was conducted in an atypical way – the timber construction was unearthed from the profile, by first removing a small amount of sediments from the middle and lower parts of the construction. The excavation of the whole timber construction in its full size using the above-described method was not possible because of the risk of a landslide. For this reason, it was dismantled in parts. The detailed photo- and drawing recording of the construction and its infill as well as sampling for the micro and macrofossil survey and dendrological analysis was performed simultaneously. Immediately after the extraction, the wooden fragments in a well- or very well-preserved condition were immersed into the antiseptic solution.

Some fragments of a ceramic pot discovered in the infilling material of the timber construction were recorded *in situ*. Also, there were some other pottery pieces found in both, the infill and in the grey soil layer above the construction. They were recorded as separate finds. The collected rock fragments belonging to the same context and discovered in the proximity were characterised petrographically, emphasizing utilisation-induced changes (heat-affected, sooty, weathered, etc.).

Chronological investigations

The time of the timber construction installation was dated and the period of its utilisation was determined by dating wooden elements (planks, a corner post, and a crossbar) (Figs 5–6); organic material, charcoal, and particular grains discovered in the infill (Table 1).

Wood samples were dated in the Laboratory of Nuclear Geophysics and Radioecology at the Nature Research Centre in Vilnius applying the conventional ^{14}C dating method reported in Gupta, Polach (1985), Arslanov (1985), or Skripkin, Kovaliukh (1994). The palaeosoil with low C_{org} content and small samples of charcoal were dated at the Centre for Physical Sciences and Technology in Vilnius applying the ^{14}C AMS method (Ežerinskis *et al.* 2018). A single buckwheat nutlet discovered in the infilling material of the timber construction was investigated at the Scottish Universities Environmental Research Centre, Glasgow, UK applying the ^{14}C AMS method (Shanks *et al.* 2015).

All 15 datings were calibrated using the IntCal20 dataset (Reimer *et al.* 2020) within OxCal v4.4.4 (Bronk Ramsey 1995; Bronk Ramsey, Lee 2013). The ^{14}C dated wood samples with known relative ages (one pair of wood samples with the known number of annual growth rings in between), were subjected to D_Sequence analysis (Bronk Ramsey *et al.* 2001) to improve the accuracy and to tie the radiocarbon dates to narrower intervals on the IntCal20 radiocarbon calibration dataset.

The tree-ring analysis was conducted to characterise the timber from which the construction under discussion was made and to specify its chronology. The visual inspection of the construction elements showed a low number of annual rings, which suggests that most of the elements were made from young trees. In addition, wood tissues were damaged by wood degrading fungi, and wood layers with outermost rings had lost their structural integrity. Therefore, only three more integral elements, i.e., two vertical planks and a corner post from the upper level, were selected and sampled for dendrochronological analysis. Other elements, when possible, were analysed just for ring-count.

The tree ring width series of the selected samples were measured on cross-sections along two radii in the direction from pith to bark. For the determination of tree ring boundaries, the surface of the cross-sections was pre-cut with a razor blade. Results of the semi-automatic tree-ring measurement stage performed at the University of Sheffield (accuracy $\leq$ 0.01 mm) were used for the measurements. The measured ring width series were processed using the Dendro software package (I. Tyers, unpublished). The cross-dating between the series and dating against reference chronologies were based on statistical tests and visual cross-matching (Eckstein 1987). The *t*-test according to Baillie, Pilcher (1973) was used as a statistical test for cross-matching the tree ring series.

Palaeobotanical survey

Both, micro and macro palaeobotanical methods (pollen, plant macrofossil survey and wood species identification) were applied for the analysis of the origin and age of the archaeological object, as well as for the reconstruction of the palaeovegetation pattern, including landscape utilisation practices conducted in the closest proximity.

Plant macrofossil analysis. Four samples (P0–P3) of the material infilling the inner part of the construction were taken for the analysis (Fig. 5). Sample P0 was taken from the compressed thin layer of the washed organic material from the very bottom (0.5 litre); sample P1 was collected from the lower part of the timber construction infill (30 litres); P2 – from the central part of the timber construction infill (30 litres); and P3 – from the grey soil layer above the timber construction (30 litres). The collected material was floated through a 300 μ sieve. The remaining detritus was analysed under the magnification of ×20–80. The atlases by Cappers *et al.* (2006), Grigas (1986) and Berggren (1969, 1981) as well as carpological collections were used for the identification of the discovered plant macrofossils. The discovered finds were divided into socioecological groups: cultivated plants; weeds of cereals; weeds of millet and gardens, ruderals; dray grasslands and pastures; wetlands, fresh meadows; aquatic plants; forests, glades and cleanings; and etc. (finds identified to the family and genus level) (Behre, Jacomet 1991; Ellenberg *et al.* 1991; Latalowa 1999).

Pollen analysis. Three samples (P1, P2, P3) were examined for pollen content. The samples prepared in accordance with classical chemical procedures (Grichiuk 1940; Erdtman 1936; Berglund, Ralska-Jasiewiczowa 1986) were analysed. The discovered pollen grains were identified to the lowest possible taxonomic level, and no fewer than 1000 terrestrial pollen grains were counted per each pollen spectrum

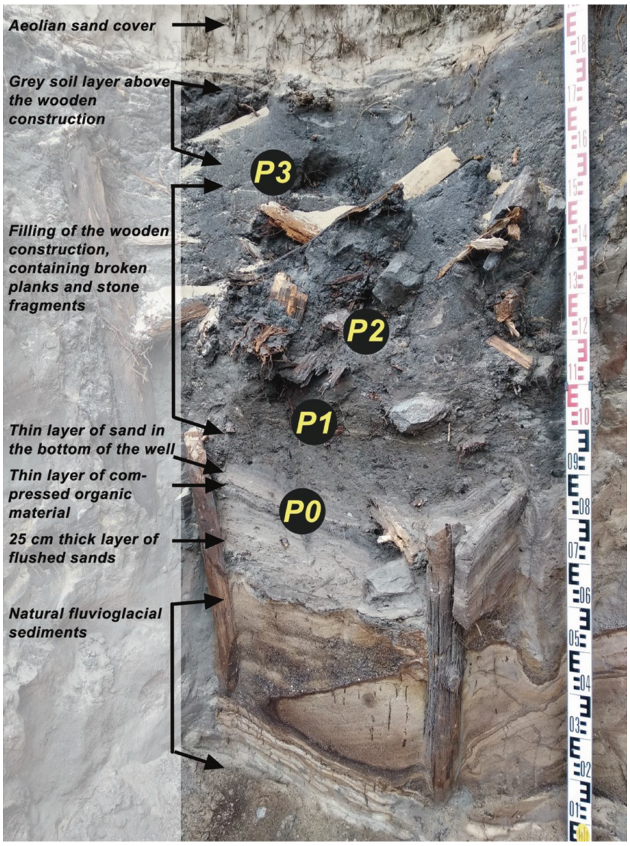

Fig. 5 Samples taken for the archaeobotanical survey (P0–P3 – macrofossil analysis; P1–P3 – pollen analysis) (photo by G. Motuza)

following Moore *et al.* (1991). For the analysis of the human activity, clustering of the pollen taxa was performed as per Behre (1981), Berglund, Ralska-Jasiewiczowa (1986), Gaillard, Berglund (1988), Hammar (1999), Veski (1998), Poska *et al.* (2004) and Stančikaitė *et al.* (2008, 2013).

Wood species identification. Nine elements of the timber construction were sampled for the microscopic wood species identification (ID). In addition, a branched woody segment (Ø 25 mm) with a tool mark (cutting) found in the infill between the shaft wall and the wooden lining, and a charcoal piece from the same layer were sampled (Table 2). The histological analysis of the wood was carried out by inspecting the diagnostic features of wood cells in the transverse, tangential and radial planes, at 40×–400× magnification and following the methodological approach provided by Gale, Cutler (2000); Panshin, De Zeeuw (1980), Schweingruber (1982) and diagnostic atlases. Samples for transmitted light microscopy, i.e., wood slices, were manually prepared by sectioning tissues along the planes with a razor blade. The charcoal samples, which were prepared by fracturing along the planes, were analysed using incident light microscopy.

RESULTS OF THE INTEGRATED RESEARCH

Location and characterization of the timber construction

Originally, the bottom of the timber construction reached the level of Lateglacial gyttja, but later it was deepened into the layer of glaciofluvial sand. The top of the unearthed timber construction lay at the level of Meghalayan deposits, dated back to about 2500 cal yr BP, in a wet, swampy terrain, as indicated by peat lentils. In this layer, fragments of boulders and some artefacts were found. Based on the stratigraphical record, techonomic data and the typology of the discovered artefacts, we describe this layer as cultural.

The wooden object appeared to be a timber box frame installed in a 1.15 m deep hole. It was of two levels (Figs 6–7). The lower-level part of the box frame was formed of four corner stakes joined horizontally with wooden planks on all sides and driven into the ground. The upper-level part of the box frame was constructed in a different manner: four vertical posts were held in place with horizontal beams and clad in timber uprights to form a wall. Although there was no cladding on 3 sides of this construction, it was assumed to have originally been a four-walled frame, designed to shore the sides of a well or pit. Assumedly, the missing wooden planks were re-appropriated for use elsewhere on the site. Also present on the upper level were four-pointed timber uprights on two opposing sides, presumably to support the corner posts and stake the construction into the ground.

From the technological point of view, the two levels of the construction were built in a slightly different manner. The lower part was built or reconstructed after using it for some time, suggesting a long period of the well utilisation. The drawing of the reconstructed well, limited by elements found *in situ*, is presented in Fig. 7.

Results of wood analysis are presented in Table 2. Both, histological and wood species ID investigations show that the construction was made predominantly using the timber of Scots pine (*Pinus sylvestris* L.)

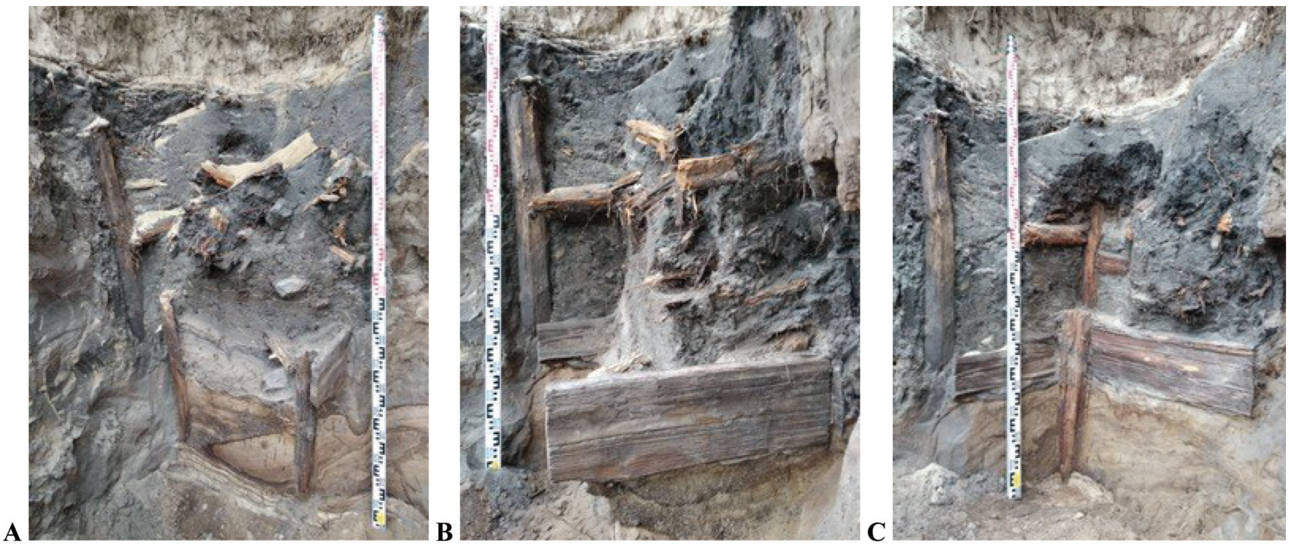

Fig. 6 Timber construction during the excavation: A – the view of poles of the lower and upper construction levels from the south; the fragments of planks and stones visible in the infill; B – view from the south-east – planks on the construction sides are uncovered, and an organic-rich soil mixed with stones and wooden plank fragments (waste?) inside the construction is preserved; C – the northern corner of the construction unearthed at the final excavation stage (photo by G. Gudaitienė)

Table 2 Summarised results of ^{14}C dating and wood analysis. Abbreviations: TC – timber construction, WSp – wood species identification, TR – tree ring analysis, ^{14}C – radiocarbon analysis

Sample No.	Sample context	Description	Material	Methods used	Plant species	Number of tree rings, date of the last ring	^{14}C Lab code	^{14}C age, yr BP ± 1σ	Main intervals of calibrated age range (95.4% probability)
C1	TC, upper level	Vertical plank	Wood (1–10 rings)	WSp, TR, ^{14}C LSC	*Pinus sylvestris*	56, AD1469	Vs-2951	441 ± 33	1410–1495 AD (92.5%)
			Wood (30–55 rings)				Vs-2953	372 ± 4 0	1440–1530 AD (51.3%) 1535–1635 AD (44.1%)
C2	TC, upper level	Corner post	Wood	WSp, TR, ^{14}C LSC	*P. sylvestris*	22	Vs-2949	388 ± 34	1440–1530 AD (61.9%) 1550–1640 AD (33.6%)
C3	Fill	Fragment of pointed stake	Wood	WSp, TR, ^{14}C LSC	*P. sylvestris*	~22	Vs-2947	437 ± 39	1410–1520 AD (87.6%)
C4	TC, upper level	Vertical plank	Wood	WSp, TR, ^{14}C LSC	*P. sylvestris*	28	Vs-2948	398 ± 33	1430–1530 AD (70.0%)
C5	Fill	Cut root	Wood	WSp, ^{14}C LSC	*P. sylvestris, root*	–	Vs-2950	418 ± 34	1420–1520 AD (82.4%)
C6	TC, upper level	Corner post	Wood	WSp	*P. sylvestris*	–	–	–	–
C7	TC, upper level	Crossbar	Wood	WSp	*P. sylvestris*	–	–	–	–
C8	Fill	Fragment of post	Wood	WSp, TR, ^{14}C LSC	*P. sylvestris*	21	Vs-2955	435 ± 34	1420–1510 AD (90.2%)
C9	TC, bottom level	Horizontal plank	Wood	WSp, ^{14}C LSC	*P. sylvestris*	–	Vs-2954	443 ± 33	1410–1500 AD (93.3%)
C10	Fill	Palaeo-surface	Soil	^{14}C AMS	–	–	FTMC-48-2	1740 ± 40	240–410 AD (95.4%)
C11	Fill	Charcoal	Charcoal	WSp, ^{14}C	*P. sylvestris*	–	FTMC-48-1	577 ± 40	1300–1430 AD (95.4%)
C12	TC, upper level	Crossbar	Wood	WSp, TR, ^{14}C LSC	*P. sylvestris*	21	Vs-2909	935 ± 50	1020–1220 AD (95.4%)
							Vs-2965	1055 ± 50	880 – 1050 AD (87.4%)
C13	TC, upper level	Corner post	Wood	WSp, TR, ^{14}C LSC	*P. sylvestris*	~23	Vs-2956	389 ± 33	1440–1530 AD (63.2%) 1550–1640 AD (32.2%)
C14	Lower part of the infill (sample P1)		Buckwheat nutlet	^{14}C AMS	*Fagopyrum esculentum*	–	UCIAMS-219323	200 ± 15	1730–1810 AD (61.3%)
C15	Lower part of the infill (sample P1)		Cannabis seed (Hemp)	^{14}C AMS	*Cannabis sativa*	–	FTMC-VR52-1	617 ± 50	1280–1410 AD (95.4%)

(Fig. 8). The charcoal pieces from the infill appeared to be of *P. sylvestris* also. The branched woody segment with the tool mark (cutting) sampled from the infill in

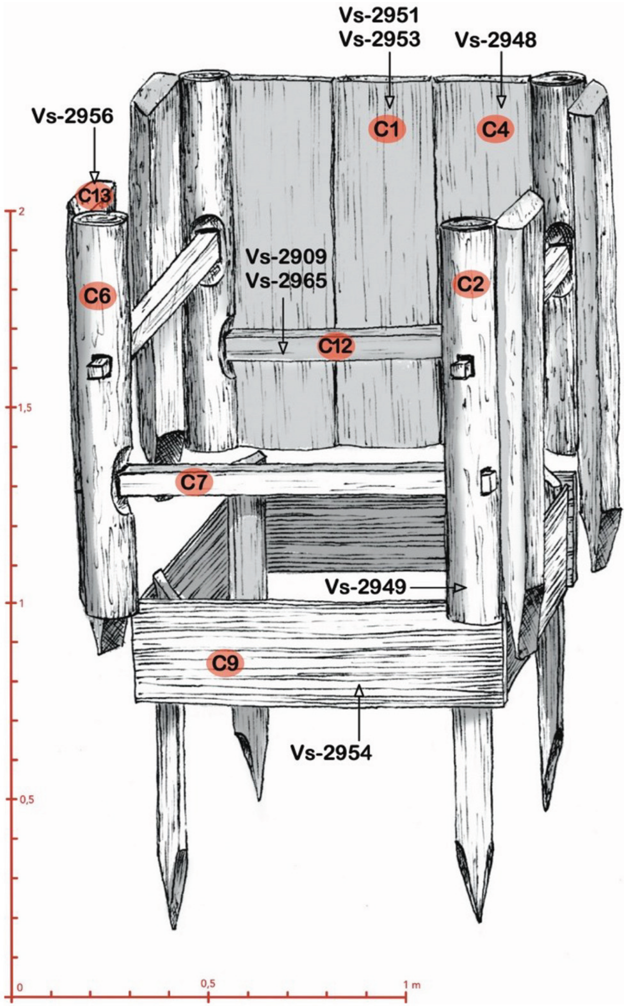

Fig. 7 Reconstruction of the well (by G. Gudaitienė) with the elements (indicated by circled numbers) sampled for the dendrological survey and respective ^{14}C lab codes (see Table 2)

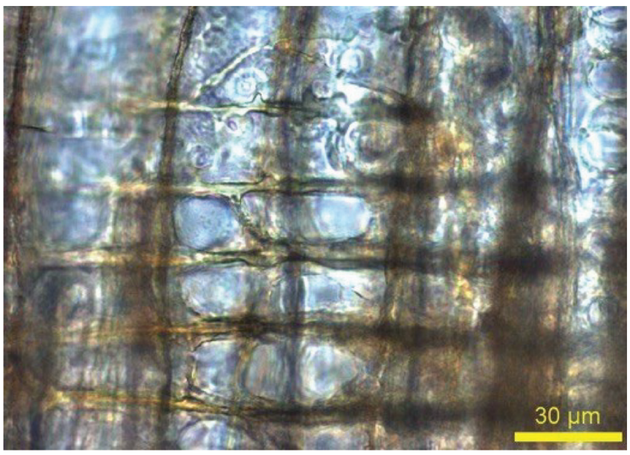

Fig. 8 Diagnostic features of Scots pine (microphoto of radial section of plank No. C1): large fenestriform pits from ray parenchima cells to tracheids, dentated ray tracheids, bordered pits in tracheids (photo by R. Pukienė)

the space between the shaft wall and the wooden lining (sample No C5) was identified as a pine root. Probably, it was cut during the installation of the well, suggesting the proximity of pine trees to the well.

Pine trees under the age of 30 years were mainly used for making the vertical posts of the construction. However, decay of (especially) the outermost layers of the wood impeded the establishment of the exact age of the samples analysed. Older trees were used for making split planks and crossbars. Plank No C1 contained the maximum number of tree rings – 56 (Fig. 9). Although some central rings were missing, the pine tree, from which the plank was made, seemed to have been about 60–70 years old. Crossbar No C12 was made from the inner heartwood part of a tree trunk and contained only 21 annual rings, though the tree could have been much older (Fig. 10).

Chronological framework

Radiocarbon dating. Results of the radiocarbon dating of wood samples are presented in Table 2 and Figure 7. Nine samples (Vs-2951, Vs-2953, Vs-2949, Vs-2947, Vs-2948, Vs-2950, Vs-2955, Vs-2954, and Vs-2956), representing the main elements of the timber construction or wood fragments from the infilling material, were dated back to the interval of 1400–1600 cal AD. Two radiocarbon dates were attributed to wood samples with the known number of annual growth rings. After modelling they were compared to unmodelled dates, which yielded slightly narrower age intervals – 1424–1608 cal AD, and 1444–1628 cal AD for samples Vs-2951 and Vs-2953, respectively (Fig. 11).

Two samples that were collected from the infilling material of the construction – the charcoal and cannabis seed – were found to be somewhat older: 1295–1425 cal AD (FTMC-48-1) and 1285–1410 cal AD (FTMC-VR52-1), respectively. Nevertheless, the obtained ages overlap with the above-mentioned chronological interval.

Two samples (Vs-2909 and Vs-2965) attributed to the fragments of the same crossbar No. C12, were dated back to 1015–1210 cal AD and 875–1050 AD, respectively. Meanwhile, the age of a buckwheat nutlet from the infill of the timber construction appeared to be within the range the mid 17th-early 19th c. AD.

In addition, organic material from the uppermost part of the construction infill was dated. The determined age was 210–400 cal AD (FTMC-48-2), which plausibly indicates the mixing of different age deposits in the course of filling up the abandoned construction.

Dendrochronological dating. Separate elements of the timber construction were characterized by short tree ring series, which made independent dendro-

Fig. 9 Cros-section of plank No. C1 (photo by R. Pukienė)

Fig. 10 Cross-section of crossbar No. C12 (photo by R. Pukienė)

chronological dating impossible. An attempt to cross-match the measured tree ring series against the dated reference pine chronologies from Eastern Lithuania was made within the interval of the obtained radiocarbon dates. The best and replicated agreement between the longest series of plank No. C1 and reference chronology was found in the position of the last ring dated to 1469 AD (max t value 4.48). The last rings of the plank were very thin. It is very likely that the plank had a bark edge, or that only a few outermost rings were missing. Thus, the tree was felled in 1469 or a few years later.

Archaeological artefacts as the context of the well

Pottery finds. There were some pottery sherds unearthed in the grey soil layer and in the timber construction infill. Ten fragments found in the infill belonged to the same thin-walled vessel (Fig. 12A–B). On its outer side of the bottom, a non-decipherable rectangular symbol, presumably the craftsman's stamp, was apparent. Also, one separate fragment of pottery was found in the sediments of the timber construction infill.

Other pottery fragments (Fig. 12C) were discovered in the grey soil layer (the so-called "cultural layer") stretching above the timber construction. All of them were slow wheel-shaped, made by leaning clay with small grained crushed stone admixture. The thickness of the pottery sherds varied between thin (up to 6 mm) and average (7–8 mm). Some vessels were decorated with horizontal lines using either a single wooden stick or a specific comb-like tool. On one sherd, there were also wide, oblique short line imprints (notches) present.

Wheel-thrown vessels with marked bottoms showing the craftsman's mark appeared during the 11–12th c. AD in Lithuania (Mulevičienė 1970; Simniškytė 2013). They can also be found in the archaeological monuments dated back to the 15th or even 16th c. AD, but not in large quantities (Rumšiškės burial-ground) (Mulevičienė 1970). Rectangular symbols, both, with and without crosses inside, were found in various monuments of the 13–15th c. AD (Poškienė 2002; Mulevičienė 1970).

These thin-walled vessels decorated with horizontal line ornaments using comb-like tools were also recorded in other archaeological objects in Eastern Lithuania, dated to the 11th and 15th centuries on the basis of artefact typology, e. g., in Paverkniai, Alytus hillforts, Dubičiai, Margiai settlements, or Bazorai, Jurgionys cemeteries.

Metal detector survey. The metal detector survey revealed no metal finds either in the timber construction, or the presumed cultural layer stretching over the entire outcrop.

Boulder fragments. Infill of the timber construction has yielded ~150 fragments of rocks whose total weight reached up to 100 kg. The size of stones varied: the largest one was plate-shaped, 32 × 23 × 10 cm size, and weighed 17 kg (Fig. 13A–C). Twenty-seven stones were larger than 10 cm.

The rock types were characteristic of local erratic boulders. Granitic, and tonalitic fragments accounted for about 50%; granitic gneiss – 17%; Jotnian sandstone – 17%; migmatised gneisses – 6%; basic rocks (gabbro, amphibolite) – 8%; quartzite, mylonite, porphyry – 1–3%. Only 6 stones were rounded in shape, characteristic of boulders, while the rest of them were

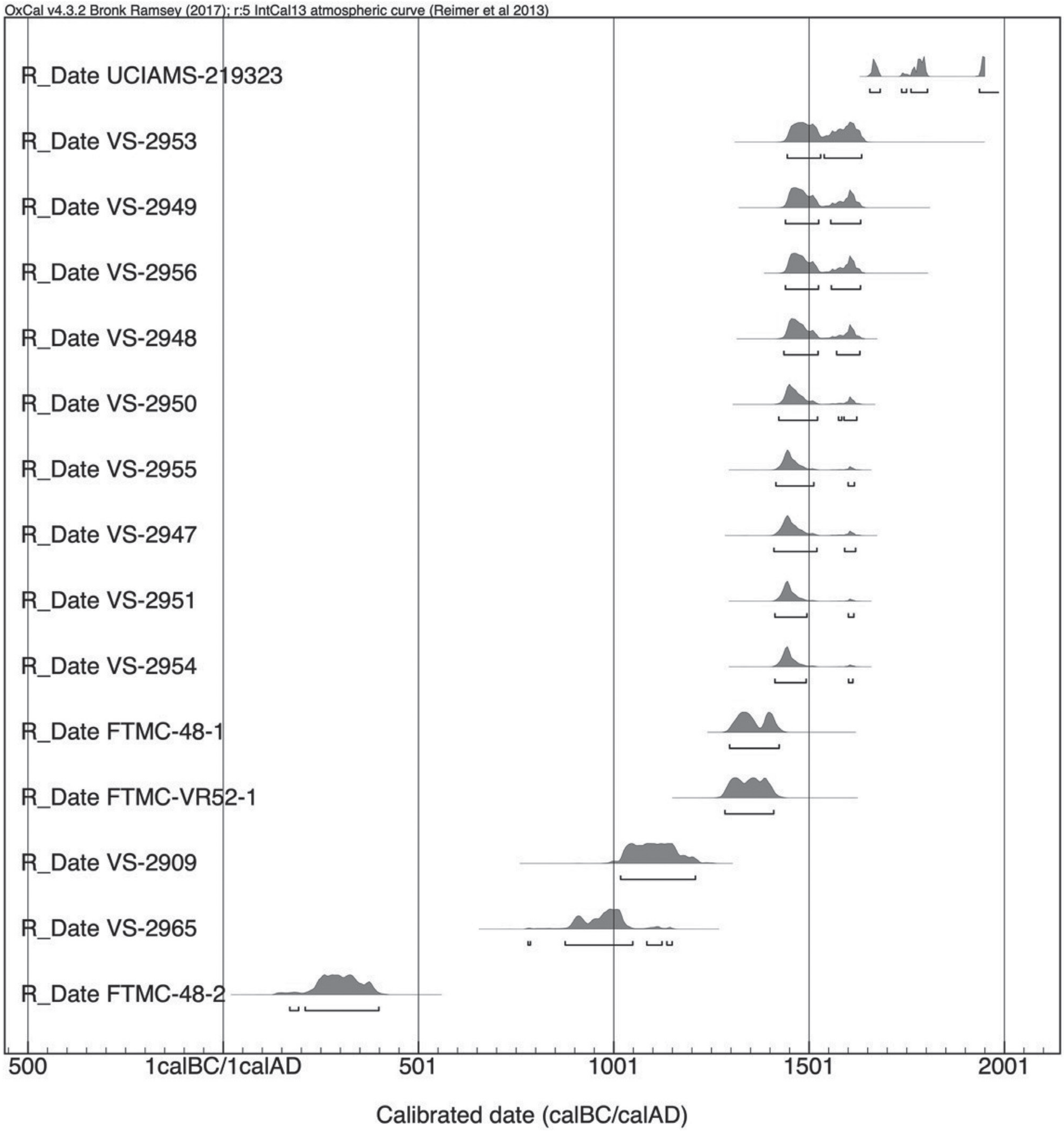

Fig. 11 Probability plots of ^{14}C data. Detailed characterization of samples is presented in Table 2

angular-shaped, fractured and weathered, most probably heat-affected, 10% of them were sooty.

Some stones had traces of utilisation, e. g. polishing. Plausibly, they were used as millstones. The two largest stones were lying at the mouth of the timber construction. If the wooden construction under discussion was a well, these stones could have been used for conveniently placing some household items, e. g., a bucket.

The surrounding area is mainly covered by wind-blown aeolian or fine-grained fluvial sand that does not contain the clastic material of the psefitic fraction. Therefore, stones must have been brought to the settlement, thrown into the timber construction, or placed around it intentionally. Fragments of heat-affected weathered angular boulders were abundant throughout the cultural layer.

Macro botanical remains. Our study covered macrofossil remains ascribed to 91 taxa. Most of the discovered specimens were described to species level. However, due to the bad preservation of diagnostic features, some plant remains were described to genus or family, and placed to the category of "others" in the diagram (Fig. 14). A small part of the discovered plant fossils was found to be charred.

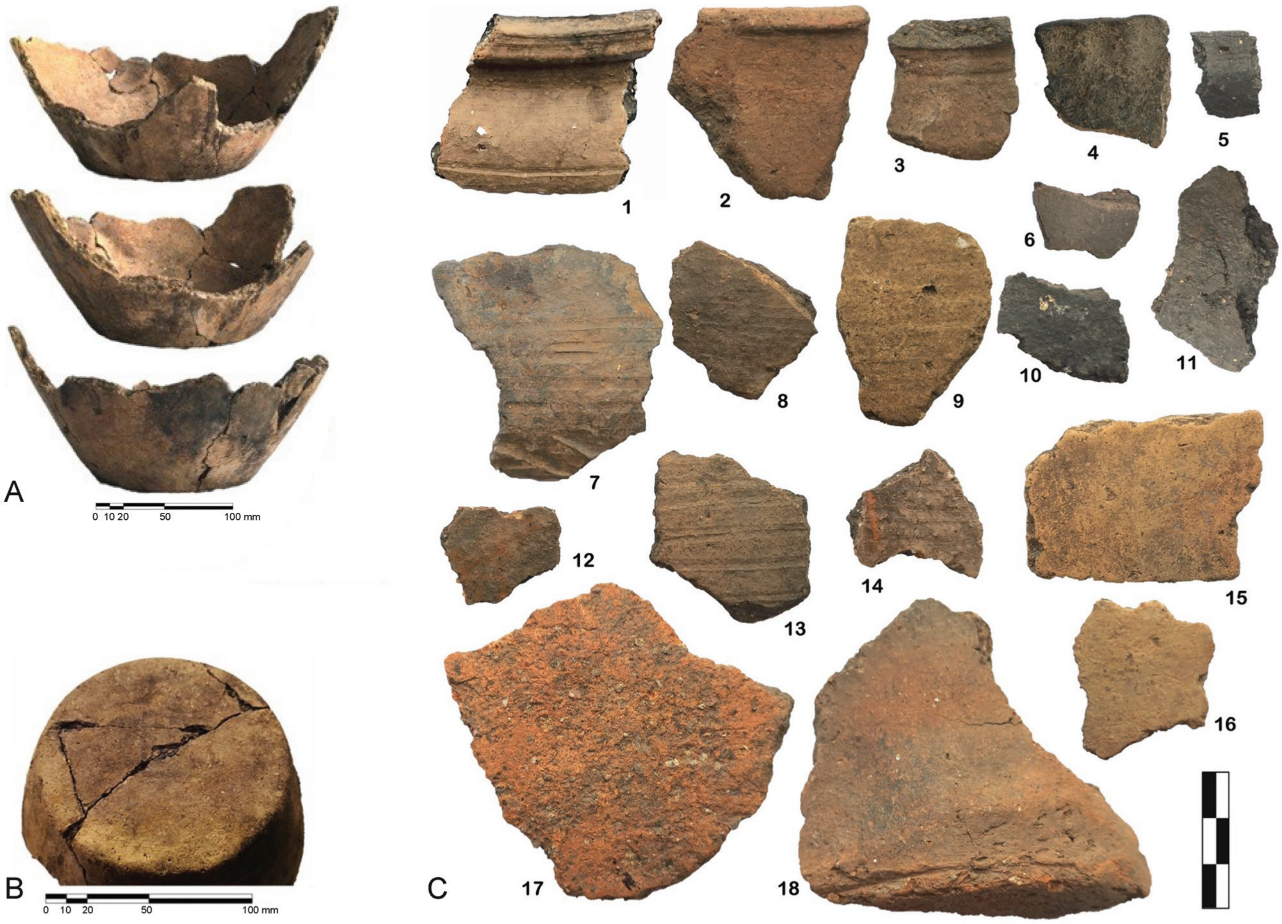

Fig. 12 The reconstructed part of the vessel discovered in the infill of the timber construction (A), and its bottom with a rectangular stamp mark (B); pot sherds found in the grey soil layer (cultural layer) stretching above the timber construction (C) (photos by G. Gudaitienė)

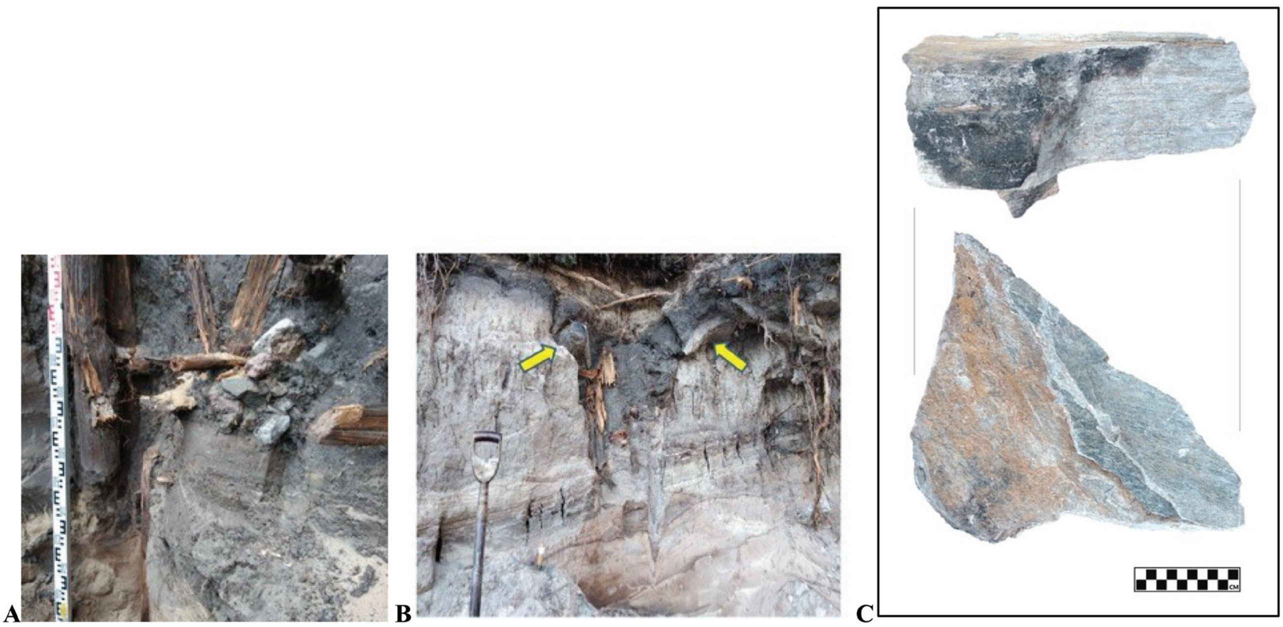

Fig. 13 A – boulders and plank fragments in the infill of the timber construction; B – flat stones located on both sides, at the mouth of the timber construction (marked by arrows); C – the largest sooty stone found on the western side, at the mouth of the timber construction (photos by G. Motuza)

The examination of the P0 sample revealed a very small diversity of plant species. 226 specimens were ascribed to 26 taxa. Most plant remains belonged to wetland species (50%) (Fig. 14), absolutely dominated by *Stellaria nemorum.* 31% were ruderal plants, mostly represented by *Chenopodium album*. No cultivated plants were recorded, and only *Galeopsis tetrahit* and *Spergulla arvensis* could be associated with the fields of the cultivated crops. A lot of carpological remains were poorly preserved, maybe due to secondary deposition. No remains of charred plants were found.

The most abundant flora of macrofossils (1541 specimen in total, and 13 of them charred), was found in the P1 sample (Fig. 14). They were ascribed to 70 taxa. Three species of cultivated plants were identified here: *Secale cereale* (charred grain), *Cannabis sativa* (fruit), and *Fagopyrum esculentum* (fruit fragments). Weeds typical of the cereal fields were scarce – only 6 species (4%) were identified. *Fallopia convolvulus*, *Galeopsis tetrahit* type, and *Spergulla arvensis* were the most abundant. The latter, presumably, implicates some context of *Fagopyrum esculentum* crops. About 23% of the identified taxa (45% of all macroremains) were attributed to plants typical of the habitats, stretching in the closest proximity to household and farming areas, among which *Chenopodium album*, *Urtica dioica*, *Polygonum aviculare*, *Rumex crispus* were predominant. Plants characteristic of dry fields were scarce, and representatives of only 4 species were identified. Meanwhile, the group of wetland plants (34% of taxa) comprising 46% of all the macrofossil remains, was much more numerous. This group was dominated by *Eleocharis palustris*, *Alisma plantago-aquatica*, *Stellaria nemorum*, *Stellaria holostea*, *Persicaria hydropiper*, *Solanum dulcamara* and *Ranunculus* species. In addition, 4 species of water plants (6%) were detected, of which *Lemna trisulca* was the most abundant. Forest plants constituted a small part of the sample – up to 7% of all the macrofossil species.

The P2 sample contained 360 macrofossils in total (39 were charred), which was significantly less than the number of macrofossils found in sample P1. They were ascribed to 37 taxa. Despite the reduced number of specimens, proportions between the main socioecological groups of plants remained very similar (Fig. 14). About 8% of species (1% of all the finds) were attributed to the group of cultivated plants. It was represented by several macrofossils of *Cannabis sativa* and *Fagopyrum esculentum*, whilst one charred seed of *Brassica rapa/campestris* might be ascribed either to cultivated plants or weeds due to its very poor preservation. The weeds of cereals mainly consisted of *Fallopia convolvulus* and *Galium spurium* charred remains. The group of ruderal and farming-related plants contained 30% of taxa (Fig. 14), mostly represented by *Chenopodium album*, *Urtica dioica*, *Persicaria* spp., and by charred macrofossils of *Rumex crispus* and *Persicaria maculosa*. Dry grassland plants were not detected, whereas wetland species were abundant, comprising 24%. Among them, *Eleocharis palustris* and different *Ranunculus* species were predominant. The water plant group was represented only by several endocarps of *Potamogeton natans*. A large percentage (27%) of taxons was ascribed to the group of "others" due to the bad preservation of plant remains.

A low variety of plant species was detected in sample P3. In total, 29 taxons were determined, yet the number of plant macrofossils reached 1001 speci-

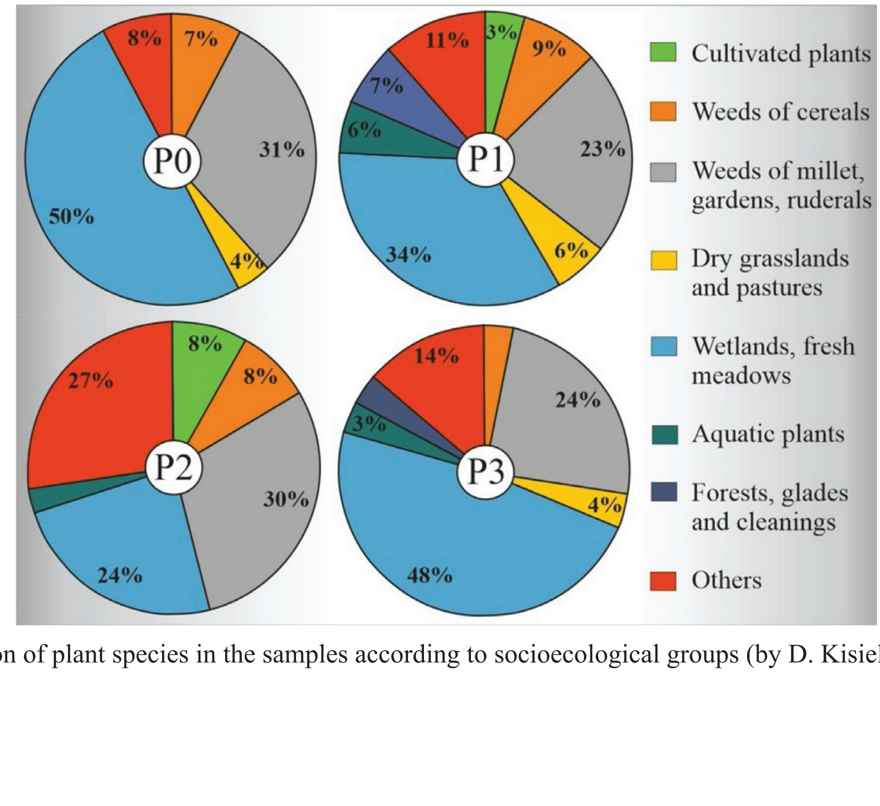

Fig. 14 Distribution of plant species in the samples according to socioecological groups (by D. Kisielienė)

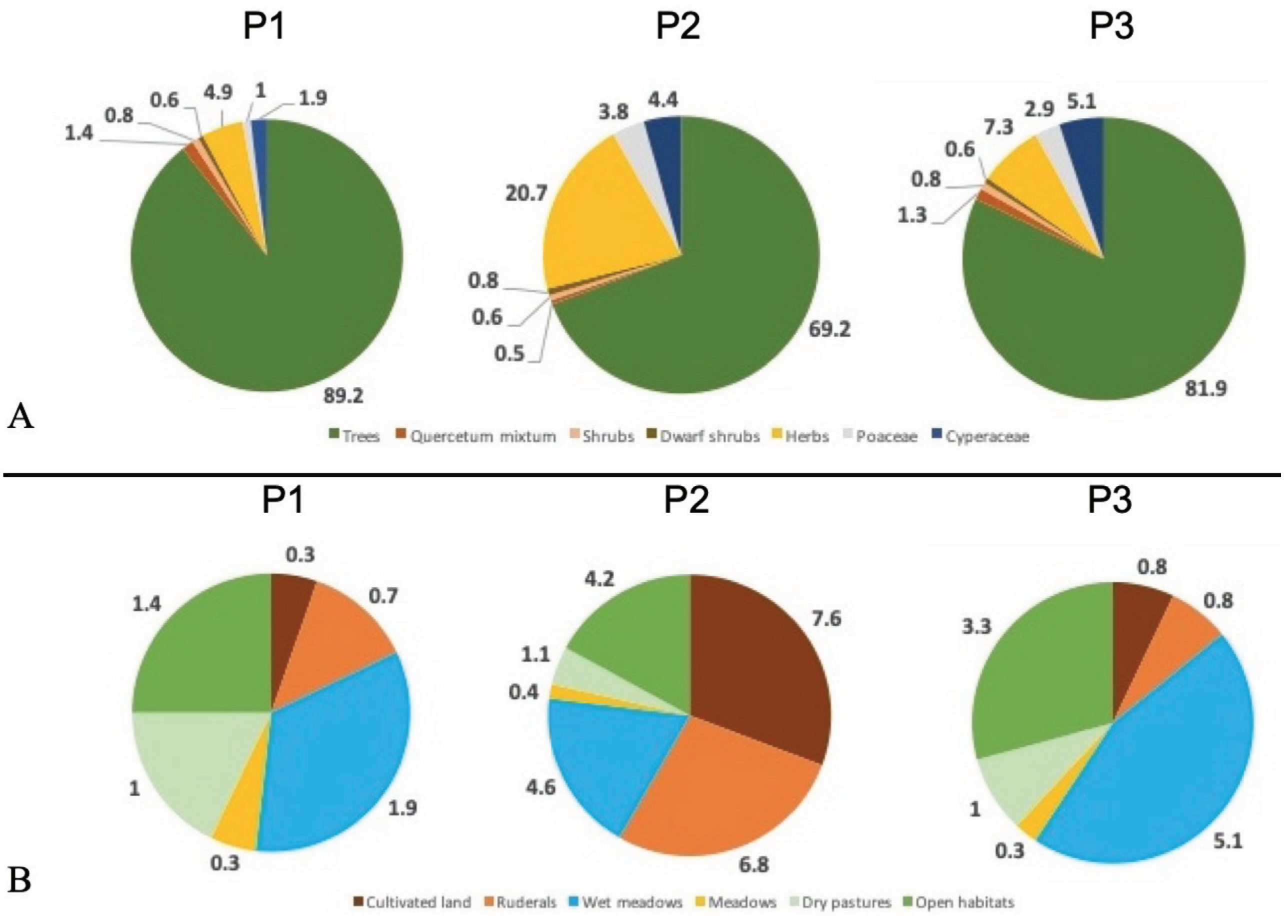

Fig. 15 Distribution of plant groups (A) and human related taxa (B) according to pollen data

mens. Two groups of plants were dominant here: wetland species (48%), as well as farming-related and ruderal plant species (24%) (Fig. 14). The farming-related and ruderal plants were mostly represented by *Mentha, Chenopodium album* and *Urtica dioica* species that are common in the nitrogen enriched soil. The remains of *Eleocharis palustris*, *Ranunculus* and *Carex* genus constituted the absolute majority of wetland plant finds, the number of species in the other socioecological groups being low (up to 3–4%).

The analysed macrofossil remains represented two types of the environment: one related to human activity, and another – to the natural plant cover surrounding the timber construction. Although some species were significantly more abundant, the general composition of plant groups in samples P1, P2 and P3 was similar. Two groups of plants were dominant: farm-related weeds and ruderals, and wetland species. These data suggest that the timber construction was situated close to a water body, presumably, in a lowland, where the ground water level was high. Therefore, the well was installed not very deep in the ground.

Pollen data. The sample location is shown in Fig. 5. Pollen spectra prove the flourishing of the *Pinus*-predominated forest on the sandy soil (Fig. 15). In the meantime, the wet terraces of the Merkys River and the flood plain were overgrown with *Corylus*, *Alnus* and *Betula.* The low representation of *Picea* in pollen spectra indicates that the origin both of the discovered grains and of *Quercetum mixtum* (*Tilia*, *Ulmus* and *Quercus*) is regional. The number of NAP (non-arboreal taxa) was small, with only Poaceae and Cyperaceae recorded in higher proportions. Nevertheless, the number and variety of NAP, suggest the existence of open habitats in the vegetation cover. Such pioneer light demanding taxa as *Artemisia*, *Urtica*, Brassicaceae and etc. were recorded in the area. Generally, pollen spectra signal the presence of a rather homogenous forest cover with the restricted existence of open grasslands and pastures nearby. The low representation of cereals and ruderals points to the limited human activity in the vicinity.

DISCUSSION

The multi-proxy studies of archaeological and environmental data carried out at Pamerkiai have provided new information on the 15th c habitation history in the sparsely inhabited territories of the Grand Duchy of Lithuania and in the close proximity to one of the main highroads of those times.

Condition, chronological attribution and function of the unearthed construction

Based on the data obtained from the analysis of the timber construction and its infill, it was concluded that the discovered two-level construction had been used for the preservation of some space, and/or for reaching a certain layer underground. The case reported in this paper appeared to have no exact analogues on the regional scale. First of all, the object was discovered not in a densely inhabited old settlement or town (a developed locality in the context of the Middle Ages), but in an unknown place where, according to written or cartography sources, the presence of a settlement was reported only some hundred years later. The timber construction was preserved comparatively well in a sandy environment, which is usually highly unfavourable for wood preservation. It is usually only from a wet anoxic environment that similar objects of different chronology are unearthed in a good condition (Salatkienė 1996; Urbanavičius 2010; Masiulienė 2012; Luchtanas 2015).

It is important to note that the lowermost part of the construction reached the groundwater table. Furthermore, in the lowermost part of the construction, a 25 cm thick layer of flushed sand was deposited, which is, presumably, due to intentional or natural water movement (Fig. 5). On top of it, there was a thin layer of washed organic material without archaeological finds deposited. The lithological composition of the lowermost part of the infill suggested an interval of calm sedimentation regime, i.e., this layer was settled in stagnant water. The rest of the construction was filled with a mixture of organic enriched material with a high content of sand. The infilling material contained a lot of fragmented planks that might have been either parts of the above-ground part of the construction (a cover?), or pieces of some other wooden structures that existed nearby and were later thrown into the abandoned construction as waste.

Based on archaeological and environmental factors, the construction under discussion was interpreted as a well. It was noted that the unearthed construction was in many features similar to the Medieval wells that existed in the 14^{th} c. AD in Kernavė (Luchtanas 2015). Similar wooden shafts were observed in the 13^{th} c. wells discovered in Greifswald, North-Eastern Germany (Heußner, Heiko 1999). However, there were some differences noted as well. The Pamerkiai well was a two-level construction, with no stones found on its bottom, as was the case with the Kernavė well. The latter had two layers of walls, while the Pamerkiai well had only one layer. Wells of earlier epochs are known to have been constructed from horizontal planks and not from the vertical ones, e.g., the well in Bocheń (Poland), 400 km away from the study location, which was dendrochronologically dated back to the 9^{th} c. AD (Dulinicz, Biermann 2001). This type of well is the most common, although many different types are recorded archaeologically as well, e.g., wells with round casing made of a hollowed tree trunk, wells with double – round and quadrangular – casing, etc. (Piotrowska, Michałowski 2018). One part of the well infill is usually clean soil, and another part is contaminated-cultural soil with archaeological artefacts. The latter may yield all sorts of items: the most common artefacts are fragments of pottery and organic remains, yet, sometimes, some extraordinary finds (e.g., dog remains) may be unearthed (in Kwiatków site: Piotrowska, Michałowski 2018). No archaeological finds typical of latrine-type objects, i.e., coins, metal artefacts and lost items, were discovered in Pamerkiai, and only one fragment of pottery and a broken vessel were found inside the construction. In any case, the discovered construction was unique, because despite the fact that it was located in a particular geological-geomorphological context, it was very similar to that recorded in an urban context (Vaičiūnienė 2002; Luchtanas 2015). The environmental context, i.e., the high ground water level and the lithological composition of the infilling material, affected the preservation of the object positively, *inter alia*.

The chronological attribution of the well was based on information from various sources, including: a) ^{14}C dating, b) dendrochronological data, c) the typology of the discovered pottery finds. According to the isotopic data (Vs-2909 and Vs-2965, Table 2) supported by the typological ascription of ceramic pots to the 11^{th} c., some human activity episode in this area might be traced back to the $10–11^{th}$ c. AD or shortly later. However, these two arguments do not seem convincing enough for making a further assumption that the wooden construction under discussion was constructed or used throughout the $11–15^{th}$ c. AD. Optionally, this outlying early date might be explained by the fact that the dated crossbar was made from the inner heartwood part of a tree trunk (Fig. 8), which could have been up to a few hundred years older than the outermost rings indicating the time of the tree felling. In addition, this crossbar might have been made from the wood of an already dead tree, thus producing the "old wood" effect and resulting in the earlier ^{14}C dating (Cook, Comstock 2014; Schiffer 1986). According to the chronological attribution of the infilling material (FTMC-48-1 and FTMC-VR52-1, Table 2), the wooden construction could have been used until the 15^{th} c. AD, at the latest. Nine radiocarbon dates of the wooden elements also cluster around late 15^{th} c. AD (Table 2, Fig. 9). Thus, even though the gained material provides evidence for the human activity episode at the site as early as the pre-15^{th} century and a later episode in the 15th century, the latter one is more substantiated, and therefore should be considered as the focus of this study.

Most of ^{14}C dates are methodologically reliable and should be interpreted together in the same model. Nevertheless, several results require a particular interpretation, e.g., the organic matter dated to 240–410 cal? AD representing the upper part of the infilling material should be regarded to be of artificial origin. Moreover, the buckwheat nutlet (*Fagopyrum esculentum*), which was dated to 1730–1810 cal AD, might have been naturally flushed into the construction a few hundred years later. In general, the chronological framework of the construction correlates well with the typological record of the discovered pottery fragments. In south-eastern Lithuania, similar pottery was used in the 11–15th c. AD. In limited amounts, (Poškienė 2002; Mulevičienė 1970) pottery of this type might be found in the 16th c. AD cultural layers. The vessel found in the upper part of the infill should be associated with the time when this construction was abandoned. The infill contained some waste of that time, i.e., plank fragments, stones and a broken vessel. It might have been filled soon after it was abandoned in the 15th c. AD.

As for the material that was used for the construction of the well, the predominance of Scots pine (*P. sylvestris* L.) should be emphasised. Posts and stakes were made from rather young trees, while planks and crossbars from older trees. It is possible that during the period of its exploitation, the well was twice subjected to reconstruction during which some old elements were installed into a new construction. This hypothesis is supported by the architectural data – the distribution of building elements represented a construction with a broken symmetry and variegated architecture. The lower part of the construction differed from the upper one technologically (Fig. 7). The latter might have been built first, as two samples (Vs-2909 and Vs-2965) of one and the same crossbar were dated to 1015–1210 cal AD and 875–1050 cal AD, respectively. This fact suggests that some wooden planks from the construction, which was built at the site much earlier, might have been re-used when building the well a few hundred years later. Meanwhile, the two-level construction of the well suggests continuous and rather long-term human activity in that barely inhabited territory.

Another reconstruction of the well must have involved its deepening. The possible reason for reconstructing the well was the need to repair the rotten wooden parts, or to reach the water level that had lowered as a result of the climate change. At that time, the "Medieval Warm Period" was replaced by the climate cooling phase called the "Little Ice Age", which initiated pronounced deterioration of the climatic regime all over the northern Europe (Grove 1988). According to different proxies, the noted phenomenon, i.e., first of all, the lowering of the mean temperature, started in about 1550 AD (Jones, Bradley 1992), 1350 AD (Hass 1996; Matthews, Briffa 2005) or even in 1250 AD (Luckman 1994; Wanner *et al.* 2011), and lasted until around 1850 AD (Jones, Bradley 1992). It was accompanied by the concurrent abatement of the human-environmental interaction in the peripheral parts of the inhabited areas within the territory of the present-day Lithuania (Stančikaitė *et al.* 2013, 2019). The fact that the well was abandoned can be explained by both social reasons and environmental changes. Moreover, it seems that the well was partly dismantled shortly before the abandonment, because the wood planks of three walls had been removed. They must have been well-preserved and of good quality if they had been selected for reuse. However, it is not clear why one wall was not dismantled. The possible answer could be that the planks of this wall were older and worse preserved. On the other hand, the only wall that was not dismantled could also imply another stage of the well rebuilding, i.e., the last, yet, maybe unsuccessful, effort to renovate the construction before dismantling and abandoning it.

Wells might be considered as attributes of permanent settlements, be they built near dwelling houses, or on the settlement peripheries. Also, they could be seen as a shared property – the „third" or „communal" form of property. In Medieval times, in Lithuania, wells had a very big value, and were usually built, used and maintained by several different families; they belonged to the same category of shared property as roads, bridges, forest animals and firewood (Łowmiański 1931). In the case of Pamerkiai, the traces of permanent settlement or intense human activity recorded in its closest proximity to date, e.g., a) some burnt cracked stone fragments and potsherds in grey soil, and b) a, presumedly, log-joining part of some wooden construction that was noticed protruding out of the outcrop sand 6–7 decades ago, are highly questionable. Therefore, wells might be alternatively associated with some elements of other infrastructure, i.e., road systems.

As already mentioned, according to the information provided by residents of the present-day Pamerkiai village, some exposed wooden construction (a log-joining part?) was spotted in the Pamerkiai outcrop a few decades ago. Once the outcrop erosion speed had been estimated, the presumption was made that the distance between the discovered well and the previously noticed object should have been a few dozens of metres. Unfortunately, no more information regarding the condition and chronological attribution of that object is available.

Although located close to the riverside, the well might have been exploited in winter time when the river was frozen. The craftsman's sign on the vessel discovered at the study site suggests that it was an item of mass production, possibly transported from some economic centre. It might have been used by people travelling from town. Otherwise, our palaeobotanical findings, i.e., the recorded cultivars, weeds and indicators of wet meadows, point to agriculture or animal husbandry, and suggest pastoral farming or horse-feeding as some activities possibly undertaken in the area. However, pastoral farming and agriculture could have been developed only at a rather long distance from the well, as no archaeological finds confirming these activities were discovered in the closest vicinity.

The human-nature interaction in the area

According to the palaeobotanical data, there existed a forested landscape in the area at the time under consideration. The flourishing of pine-predominated forests on sandy soils with the admixture of hazel, alder and birch on the wet ones was typical of the period under discussion. Spruce and broad-leaved taxa were noted only on the regional scale. Generally, a rather homogenous forest cover with a limited presence of open grasslands developed and flourished in both wet and dry open habitats in the area. The remains of wetland plants (*Alisma plantago-aquatica*, *Eleocharis palustri, Persicaria hydropiper,* etc.) abundantly found in the sediments indicate that wet areas were common. The discovered remains of water plants (*Lemna trisulca, Ceratophyllum demersum, Potamogeton natans*) suggest some water flooding events, during which some plants could have been flushed into the well from the closest vicinity (possibly, some fresh-water body, river or spring). It must be noted that the majority of water plant remains were discovered in the lower part of the construction. These sediments formed after the renovation of the well, when the lower frame was built to deepen it.

The remains of *Polygonum aviculare* and *Potentilla anserina species,* common to well-trodden paths, suggest the intense use of the well or some regular movement nearby (possibly, a path). Numerous specimens of *Chenopodium, Persicaria lapathifolia, Rumex crispus, Urtica dioica* and other weed types indicate some living and farming activity. It is more likely that they were related to gardening rather than to cereal cultivation as remains of cereals or associated weeds were very scarce in the lowermost part of the construction (P0). Meantime, the rest part of the infilling material yielded a much lower diversity of plants and was, therefore, interpreted by the authors as impure soil from the outside. Most probably, at some point, after being abandoned, the well was filled up and was naturally overgrown. Furthermore, the sediments above the construction were found to contain a relatively low spectrum of macroflora, dominated by *Ranunculus*, *Eleocharis palustris, Carex.* Similar water wells of simple construction located on river banks or lakes shores are still common in small villages of Lithuania. They are agricultural wells, installed for easier supply of water to be used for farming purposes, but not for the supply of potable water.

Based on the data available, two different human activity-related contexts were determined. The scattered macroremains of weeds were noted in the lowermost part of the profile, meanwhile the microremains of cereals, cannabis, buckwheat, weeds and other plants were found in the infilling material proving human presence and certain activity nearby. Both, cereals, including Cerealia (*Secale cerealia*, *Triticum*, *Cannabis sativa*, *Fagopyrum),* and ruderals (*Centaurea cyanus*, *Artemisia*, *Polygonum persicaria*, *Chenopodium*, *Rumex*) were noted. Also, there were remains of charred plants, including *Secale cereale*, uncharred *Cannabis sativa* macrofossil accompanied by various ruderal plants and some other related species discovered. The pollen data recorded therein point to the presence of buckwheat. The oldest buckwheat pollen records in Lithuania were obtained from the Vilnius Lower Castle (mid-13th c. AD, Stančikaitė *et al.* 2008) and western Lithuania (Skomantai archaeological site, Stančikaitė *et al.* 2013). The origin of this part of the infilling material can be traced to the waste from a fireplace containing burnt waste and remains of cultivated plants, which were later thrown into the well to fill it up.

Some human activity might have reappeared in the area a few hundred years later and can be dated back to between the late 17th and the mid-19th centuries. The buckwheat nutlet dated to 1730–1810 c. AD (UCIAMS-219323, Table 2) confirms this presumption. Obviously, the discovered macrofossil of the *Fagopyrum esculentum* appeared in the well fill by accident, possibly from the nearby fields as the cartographic documents indicate the location of the modern Pamerkiai village nearby. Abandonment of this settlement might be related to the increased wind activity and resultant erosion of soil and sand transportation, destruction of fields, pastures and dwelling places. The aeolian processes taking place therein might have been initiated by deforestation, which, as is known from historical sources and confirmed by dendrochronological data, was caused by the increased felling of forests (forest felling for timber export was liberalized after the Battle of Grunwald in 1410) in the Nemunas River basin from the mid-15th century, and especially intensified in the 16th c. (Ivinskis 1933, 1934; Pukienė 2010). Moreover, an increase in the fuel load was indicated in NW and NE Europe (Brown, Giesecke 2014). Among the reasons behind these changes, the climate shift in the above-mentioned "Little Ice Age" could be emphasized. The aeolian processes continued in the area until the mid-20th c. AD when the gradual re-colonisation of the open habitats by pine-predominated successions began.

On a large road or at the end of a small path?

Historical sources of the Middle Ages prompt an alternative hypothesis concerning this site and its interpretation. The area is presumed to have been barely populated in the Late Iron Age and in the Medieval times, which represent a highly significant period in the Lithuanian history, i.e., the period when the Lithuanian State was established. The Pamerkiai village is located in the region where the most powerful dukes united the Lithuanian tribal lands into the first administrative unit out of which the Lithuanian Kingdom was created in the 13th c. AD. The village is a few dozens of kilometres away from the known and investigated Medieval towns. However, the Pamerkiai settlement was first mentioned in historical sources only in the 16th c. AD. Yet, it is located somewhere in between the most important towns, i.e. the capital Vilnius and Hrodna (and Kraków), on the supposed track connecting them. It was the main direction of Grand Dukes' travels from the capital (and from 14th c. AD – the religious center) Vilnius to important political meetings organized in Poland at the hunting grounds in Podlaskie Province.

The well-known highroad connecting Eastern and Western Europe and heavily used in the Medieval times is known to have been bypassing the Valkininkai town at a distance of 10 km, which allows presuming that it may have been also bypassing the Pamerkiai village towards Varėna. This road was used by all people travelling from Vilnius to Bialystok, Grodno, Kraków, or further. Back in the 15th c. AD, the Podlaskie Province was well known as a forested land where the royals used to ride hunting. Along this highroad, like along other roads in the Middle Ages, there were many stopovers, i.e., various resting places where travelling people could rest their horses, spend a night, or meet someone travelling from the opposite side, established at a certain distance between them. The stopover place in Valkininkai was around 10 km away from the Pamerkiai village. The distance between stopover places was not long, shorter than the average horse riding distance per day, because the stopover places were designed to meet the needs of people travelling in different ways (travelling on horseback, in a horse-drawn carriage, on foot, etc.). Hence, the net of stopover places was dense enough. Such a stopover place at the Merkys River could have served as a rest place before or after crossing the river, or for meeting someone, because fords usually connected a few roads and were accessible from at least several different sides. As mentioned in historic sources, the royals demanded that a good water supply and good meadows for horses to rest be ensured during their trips. According to the documented survey of uninhabited lands of the Grand Duchy of Lithuania dated back to 1559, "on the road from Vilnius to Pinsk, in an uninhabited land, there was a well that belonged to Vytautas [the Grand Duke of Lithuania]": "отъ того врочища Вулхи до Витовтова колодезя врочищи Надлевъ [...] дорогою великою Пинскою" (see reference in: Čelkis 2021, p. 64). In the early 17th c. AD, wells were recorded as having certain titles. Many of them were mentioned in the "Book of the Big Map", recording the borders of the State of Moscow in 1627. The information was collected on the basis of the knowledge from the 16th c. AD, which presumably came from even earlier times. Most likely, wells were installed close to the roads purposefully to serve the needs of travelling people (Книга Большому Чертежу 1950). Apparently, stopovers were established not only in villages or towns, but also in uninhabited areas in between them.

If such a stopover was archaeologically traced, scientists would expect to find nearly the same features as those recorded in the Pamerkiai village: a) a long-used, several times renovated, yet abandoned well; b) a non-agricultural environment with signs of some forests and meadows somewhere nearby; c) possibly, some remains of pottery, yet a not intense cultural layer around the well; d) possibly, some small building (the one, that had been washed away from the outcrop many decades ago?) for spending a night or taking a short rest; e) archaeobotanical remains indicating the past existence of a path nearby. Another factor to support the viability of a settlement or some road infrastructure element is a ford. There was a ford nearby, down the Merkys River, and another one was a few hundred meters away from the discovered well location. Thus, a tentative hypothesis can be proposed that the wooden well unearthed in the Pamerkiai outcrop may be the sign that a stopover place on a Medieval highroad has been first traced and recorded.

All things considered, a variety of the above-mentioned factors suggest that this place may be related to some economic infrastructure or a road system that could have induced the emergence or development of the Pamerkiai settlement, which exists to this day.

CONCLUSIONS

Based on the location, structural characteristics, chronological and palaeobotanical (pollen, plant macro remains and dendrological) records as well as on the inner sediment stratigraphy and its comparison with the analogues discovered elsewhere, the timber construction unearthed in the Pamerkiai outcrop was interpreted as a Medieval well. Dated to the 15th c. AD, the object seems to have been in use for a long period and to have undergone renovation several times. According to archaeological evidence, some human activity in the area can be traced back even to the 11–12th c. AD.

In the case of Pamerkiai, the examination of the presumed cultural layer did not yield a large amount of settlement-related artefacts characteristic of a permanent site. Moreover, results of the performed archaeobotanical analysis imply natural environment with rather low anthropogenic interference in the surrounding area during the period of the well existence. Various land-use practices (including cultivation of winter cereals) were carried out in the area at that time. Based on the collected data, the well has been associated with certain elements of the Medieval infrastructure, possibly, a road system. So far, it is the only Medieval timber construction discovered outside densely inhabited areas within the territory of Lithuania, and, to our knowledge, the whole Eastern Baltic region. Obviously, it is already in the Early-Middle Medieval period that the area around the present-day Pamerkiai village was exploited.

The Pamerkiai outcrop is regarded to be a promising site where some more archaeological objects are expected to be naturally uncovered in the future, therefore it is being monitored.

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