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TURINYS / CONTENT

Agnė Čivilytė — PRATARMĖ 7
FOREWORD 11

Christopher Barber Troskosky, Tianyu Chen, Katie Nicole Troskosky — ALICE'S ADVENTURES IN COMPUTATIONAL MODELLING OF THE SUB-NEOLITHIC BOUNDARY: CURIOUSER AND CURIOUSER DYNAMICS GOVERNING THE ADAPTIVE MORPHOGENESIS OF CULTURE 15
ALICE NUOTYKIAI KOMPIUTERINIAME MODELIAVIME: SUBNEOLITO PARIBYS IR SMALSUMO DINAMIKOS VALDYMAS KULTŪROS EVOLIUCIJOJE 35

Aleksander Kośko, Marzena Szmyt — MARIJA GIMBUTAS AND HER VISION OF THE STEPPE INDO-EUROPEANIZATION OF EUROPE: RECEPTION, REJECTION AND REVITALIZATION 39
MARIJA GIMBUTIENĖ IR JOS EUROPOS STEPINĖS INDOEUROPEIZACIJOS VIZIJA: RECEPCIJA, ATMETIMAS IR ATGAIVINIMAS 53

Agnė Čivilytė, Vytenis Podėnas, Karolis Minkevičius, Heidi Luik — VĖLYVOJO BRONZOS AMŽIAUS EKONOMIKA RYTŲ BALTIJOS REGIONE: NAUJO MODELIO LINK 57
LATE BRONZE AGE ECONOMY IN THE EASTERN BALTIC REGION: TOWARDS A NEW MODEL 96

Rokas Vengalis, Gytis Piličiauskas, Karolis Minkevičius, Mantas Valančius, Miglė Stančikaitė, Giedrė Vaikutienė, Giedrė Piličiauskienė — NEW DATA ON THE STRUCTURE AND ECONOMY OF UNENCLOSED SETTLEMENTS IN THE LATE STRIATED WARE CULTURE: THE SKUDENIAI SETTLEMENT SITE IN SOUTHEASTERN LITHUANIA 101
NAUJI DUOMENYS APIE VĖLYVOSIOS BRŪKŠNIUOTOSIOS KERAMIKOS KULTŪROS NEĮTVIRTINTŲ GYVENVIEČIŲ STRUKTŪRĄ IR EKONOMIKĄ: SKUDENIŲ GYVENVIETĖ PIETRYČIŲ LIETUVOJE 150

Laurynas Kurila — MIRUSIŲJŲ DEGINIMO PAPROČIO PLITIMAS RYTŲ LIETUVOJE: NAUJAS CHRONOLOGINIS MODELIS, PAREMTAS RADIOKARBONINIO DATAVIMO DUOMENIMIS 155
THE SPREAD OF CREMATION CUSTOM THROUGHOUT EASTERN LITHUANIA: A NEW CHRONOLOGICAL MODEL BASED ON THE DATA OF RADIOCARBON DATING 181

Rytis Jonaitis, Irma Kaplūnaitė — TRACES OF CHRISTIAN CULTURAL INFLUENCES IN PAGAN VILNIUS: THE CEMETERY ON BOKŠTO STREET 185
KRIKŠČIONIŲ KULTŪRINIŲ ĮTAKŲ PĖDSAKAI PAGONIŠKAME VILNIUJE: BOKŠTO GATVĖS KAPINYNAS 203

Larissa Kulakovska — TYPOLOGICAL CHARACTERISTICS OF THE INDUSTRY IN LAYER VI OF THE KOROLEVO SITE IN THE TRANSCARPATHIA REGION 207
KOROLEVO ARCHEOLOGINĖS VIETOVĖS (UŽKARPATĖS REGIONAS) VI SLUOKSNIOINDUSTRIJOS TIPOLOGINĖ CHARAKTERISTIKA 218

Baranov Vyacheslav, Ivakin Vsevolod, Shiroukhov Roman — BURIALS WITH BUCKETS AT THE OSTRIV THE 11th CENTURY CEMETERY IN THE MIDDLE DNIPRO REGION 221
PALAIDOJIMAI SU KIBIRAIS OSTRIVO XI A. KAPINYNE VIDURIO DNIEPRO SRITYJE 262

Oleg Petrauskas, Mykhaylo Syvolap — THE MONSTROUS (MONSTRUOSO) FIBULA FROM THE DNIPRO RIVER REGION 265
MONSTRIOZINĖ SEGĖ, APTIKTA DNIEPRO REGIONE 282

Svitlana Biliaieva, Natalia Danute Bimbirayte — THE HISTORICAL AND CULTURAL HERITAGE OF THE GRAND DUCHY OF LITHUANIA IN THE SOUTH OF UKRAINE: TYAHIN FORTRESS 285
LIETUVOS DIDŽIOSIOS KUNIGAIKŠTYSTĖS ISTORINIS IR KULTŪRINIS PAVELDAS UKRAINOS PIETUOSE: TYAGINO TVIRTOVĖ 308

Alla Valeriivna Buiskikh, Dmytro Mykolayovych Khmelevskiy — THE EARLIEST FINDS OF PANATHENAIC PRIZE AMPHORAE IN OLBIA PONTICA 311
ANKSTYVIAUSI PANATĖNAJOS PRIZINIŲ AMFORŲ RADINIAI OLBIJOJE 325

KITAIP APIE ARCHEOLOGIJĄ / ALTERNATIVE PERCEPTIONS OF ARCHAEOLOGY

Eligijus Raila — APIE KAULŲ KVAPĄ IR SKONĮ 327

AUTORIŲ DĖMESIUI 330

GUIDELINES FOR AUTHORS 333

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NEW DATA ON THE STRUCTURE AND ECONOMY OF UNENCLOSED SETTLEMENTS IN THE LATE STRIATED WARE CULTURE: THE SKUDENIAI SETTLEMENT SITE IN SOUTHEASTERN LITHUANIA

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In 2020, the construction of a pipeline led to a rescue archaeological excavation at the 130–240 cal AD Roman Iron Age settlement site near Skudeniai. The discovered material from its brief occupation has provided substantial new data on unenclosed settlements in the Late Striated Ware Culture. The distinct posthole accumulations in the surveyed area make it possible to identify building locations and to analyse the settlement's structure by differentiating between the domestic and economic activity zones. The collection of pottery from Skudeniai's brief existence provided a better understanding of the differences between the contemporary pottery groups. The first ever application of the petrographic method in the analysis of this culture's ceramics also yielded important results that led to a new classification system that established distinctions between the three contemporary pottery groups. The archaeobotanical material from Skudeniai is of great importance for understanding the development of agriculture as it is only the second Late Striated Ware Culture archaeobotanical assemblege from a chronologically pure context. The article also analyses issues related to non-ferrous and ferrous metallurgy and trade connections.

Keywords: Late Striated Ware Culture, unenclosed settlements, pottery, petrography, agriculture.

2020 m. tiesiant magistralinį dujotiekį buvo vykdomi gelbėjamieji archeologiniai tyrimai romėniškojo geležies amžiaus Skudenių gyvenvietėje (Kaišiadorių r.), kuri datuota 130–240 cal AD. Čia aptikta trumpo laikotarpio medžiaga pateikė daug naujų duomenų apie neįtvirtintas Vėlyvosios brūkšniuotosios keramikos kultūros gyvenvietes. Tirtame plote aiškiai išsiskiriančios stulpaviečių sankaupos leidžia identifikuoti pastatų vietas, analizuoti gyvenvietės struktūrą, išskiriant gyvenamąsias ir ūkinės veiklos zonas. Trumpo laikotarpio Skudenių keramikos kolekcija padėjo geriau suprasti vienu metu naudotos keramikos grupių skirtumus. Svarbių rezultatų gauta ir pirmą kartą šios kultūros keramikos analizei pritaikius petrografinį metodą. Visa tai leido pateikti ir naują šios kultūros keramikos klasifikaciją, išskiriant vienu metu naudotų trijų grupių keramiką. Žemės ūkio raidos pažinimui labai svarbi archeobotaninė medžiaga – tai tik antra archeobotaninė Vėlyvosios brūkšniuotosios keramikos kultūros kolekcija, aptikta chronologiškai nesumišusioje gyvenvietėje. Straipsnyje taip pat nagrinėjami su spalvotąja ir juodąja metalurgija, prekybiniais ryšiais susiję reiškiniai.

Reikšminiai žodžiai: Vėlyvoji brūkšniuotosios keramikos kultūra, neįtvirtintos gyvenvietės, keramika, petrografija, žemdirbystė.

INTRODUCTION

The Roman Iron Age (RIA, 1–400 AD) in E Lithuania is marked by significant cultural changes: the spread of the custom of burial in barrows, the beginning of iron extraction from local ore on a massive scale, the replacement of striated pottery with rusticated (coarse slipped) pottery, and the abandonment of fortified hilltop settlements. These simultaneous changes in the burial customs, material culture, and the settlement system allow researchers to speak of a transformation of the entire archaeological culture, which is interpreted as the disappearance of the Late Striated Ware Culture (LSWC) and the emergence of the East Lithuanian Barrow Culture (ELBC) (Лухтанас 2001; Bliujienė 2013, 162). These changes are almost certainly linked to significant shifts in the local economy and social order, but these aspects have not yet been addressed to any greater extent. This is not surprising, since so far the early RIA used to be analysed only on the basis of fortified settlements, and the late RIA on the basis of burial sites. When different types of sites are analysed, the changes between the two periods are very difficult to observe, let alone explain.

Unenclosed settlements with RIA occupation horizons, both adjacent to and remote from hillforts, have been identified and excavated in large numbers since the mid-20th century (Migonys, Bačkininkėliai, etc.). However, the resulting material has yet to be analysed in detail. The settlements were dated only typologically, and even then not on the basis of pottery, but rather on jewelry which is rarely found in them. This has led to situations where different researchers have attributed identical material to completely different periods, e.g., identical pottery assemblages (striated pottery typical of the LSWC together with rusticated pottery, typical of the ELBC) were dated to the 5th–1st centuries BC at Lapainia (Rimantienė 1961) and to the 4th–5th centuries AD at Migonys (Volkaite-Kulikauskienė 1958). Detailed publications on the material from selected RIA settlements, which would provide a comprehensive analysis of the archaeological layers, features and finds, and would clearly identify the phases of occupation and their chronology, are not available to date. Synthesis-type works, when analysing settlement material, present the RIA as a whole, without distinguishing individual phases, so that no changes in the development of settlements are noticeable in this way (Banytė-Rowell 2007, 145–162; Bliujienė 2013, 147–197).

Admittedly, this situation is caused not only by a lack of settlement data analyses, but also by the material's limited informational value. Although a number of RIA settlements in E Lithuania have been excavated, the material from most of them is not very suitable for detailed analysis due in part to the small size of the excavated areas, the poor survival of the archaeological layer, and/or the use of poor field research methodology by contemporary standards, but mainly because the archaeological layers at these sites almost always contain vertically mixed finds that fall within a broad chronology.

The 2020–2021 archaeological surveys conducted in connection with the construction of the Gas Interconnection Poland-Lithuania (GIPL) pipeline and the subsequent large-scale excavations have provided qualitatively new data for understanding such settlements. The discovery of short-term settlement sites from various periods, including the RIA, has led to not only the excavation of large areas at them and the collection of archaeological finds, as is unfortunately still common in Lithuanian rescue archaeology, but also the taking of samples for laboratory analysis and the obtaining of a significant number of AMS ^{14}C dates. The Lithuanian Institute of History (LIH) excavated one such settlement in Skudeniai, which yielded copious material from a brief period, the final phase of the LSWC, which was not intermixed with finds from other periods. We believe that the study of this material would

contribute significantly to the knowledge of the RIA in E Lithuania. The aim of this article is not just to merely present the results of this research, but also to provide a more detailed analysis of the findings and to bring this new evidence into the scientific discussion.

THE FIELD RESEARCH

Skudeniai village is located in the interfluve of the Nemunas and Neris rivers (Kaišiadorys Municipality; N54.760°; E24.458°) in SE Lithuania. A 2015 surface artefact survey conducted along the planned route of the GIPL pipeline by the present authors (RV and GP) yielded a number of archaeological finds, such as potsherds with striated surfaces, flint flakes, and charred bone fragments, in the arable fields around this village (Vengalis *ir kt.* 2016).

In 2020, archaeological surveys were conducted along the entire route in conjunction with the pipeline's construction. The Skudeniai settlement site lay in the section surveyed by the Klaipėda University (KU) expedition led by Gintautas Zabiela. The excavation of eight 0.5x0.5 m test-pits at 10 m intervals at the 2015 find spot revealed a 10–15 cm thick, unploughed archaeological layer containing handmade pottery in a roughly 50 m long route section, establishing the need for further excavations, which were entrusted to an LIH expedition led by GP and RV. This investigated a 350 m long section, yielding the remains of an archaeological settlement: archaeological layer and sunken features. The investigation beyond this section to both directions (led by KU) yielded no further related artefacts.

At the settlement site, the plough layer was mechanically stripped to an archaeologically-determined depth in a roughly 2500 m^2 area in a 350x4–8 m trench. Prior to starting work, boreholes were used to preliminarily identify any surviving unploughed archaeological layer so that the stripping depth could be set shallow enough at those locations to avoid damaging it and deep enough elsewhere to clearly reveal any sunken features below the plough layer. After removing the topsoil, full-scale excavations were conducted at the sites of the unploughed archaeological layer. Where there was no such layer and a sterile horizon was exposed immediately beneath the ploughsoil, excavations were limited to the locations of sunken features.

The full-scale excavations were conducted in 8 trenches totalling 431 m^2. The unploughed archaeological layer was removed using shovels and trowels and sieved using a 5 mm mesh where it was sandy soil. Very clayey and peaty soils were stripped off in thin layers without sieving. The soil of sunken features was sieved in its entirety. The unploughed archaeological layer was explored in 10–20 cm thick mechanical levels with the exposed relief being recorded for each level.

TOPOGRAPHY AND LANDSCAPE

Geomorphologically, Skudeniai settlement was established at the margin between two different landform types in the N part of the Aukštadvaris Upland (Fig. 1). To its W lies a glaciodepression that has a slightly undulating surface sloping towards its centre, a stream (the Kertus) running NW through it, and several former small lake basins, now completely overgrown. To its E lies a morainic hilly upland composed of small hills and valleys currently without any bodies of water, either streams or lakes. The topsoil consists mainly of gravelly loams and clays. It can, however, be assumed that prior to the creation of the present-day drainage system, the landscape was somewhat different. In the hilly terrain with its clayey, poorly water-permeable soil, rainfall water did not have a stable outflow and accumulated in the hollows between the hills, running from the higher to the lower hollows only when they overflowed. During the postglacial period, small lakes would have formed in these hollows, but the shallow depths of many of them are likely to have caused their early

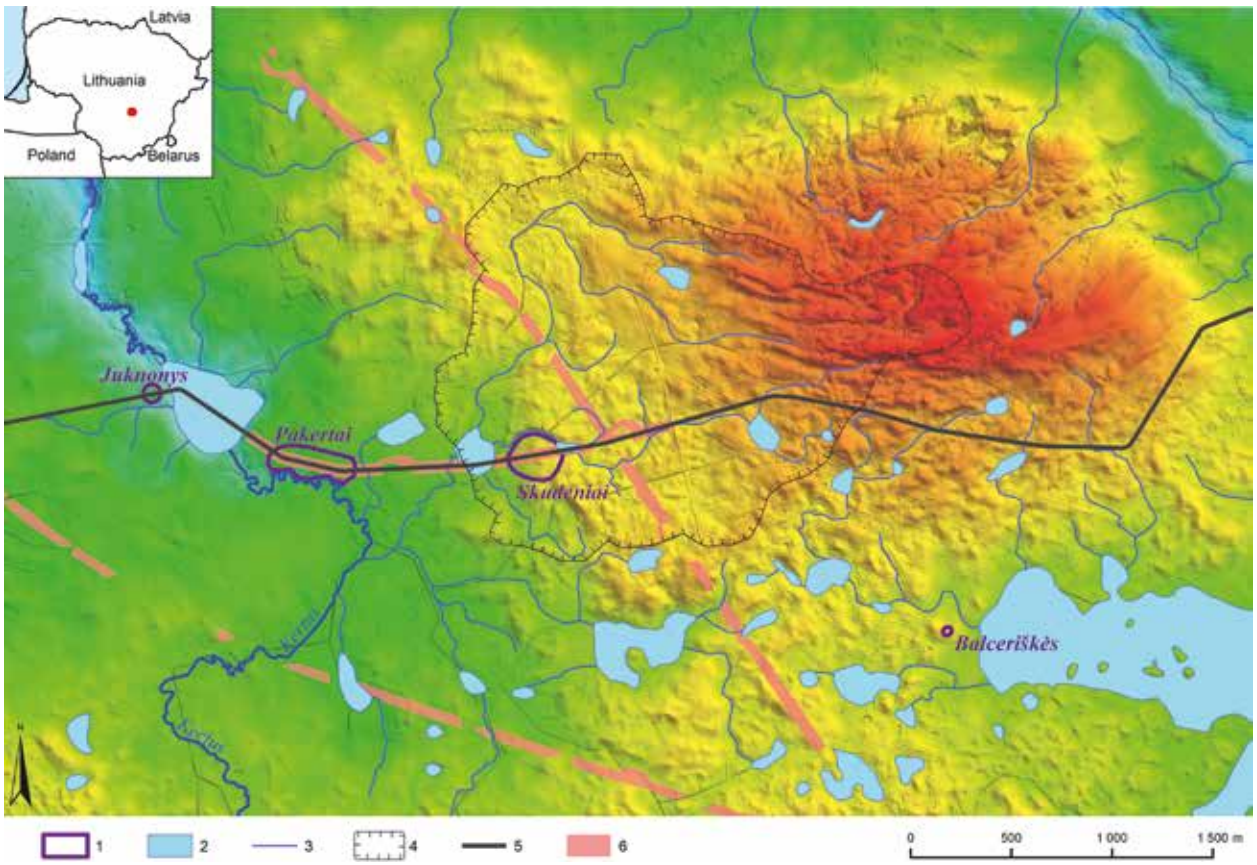

Fig. 1. Landscape of the Skudeniai region: 1 – prehistoric settlement sites; 2 – palaeolakes; 3 – former streams; 4 – basin of the lower palaeolake near Skudeniai settlement; 5 – the gas pipeline route surveyed in 2020; 6 – the areas of the 2015 and 2020 surface surveys. The terrain image is based on LiDAR data (SEŽP_0.5LT © National Land Service under the Ministry of Agriculture of the Republic of Lithuania, 2009–2010). *Annotated by R. Vengalis.*
1 pav. Skudenių apylinkių kraštovaizdis: 1 – žinomos archeologinės gyvenvietės; 2 – buvusių ežerų duburiai; 3 – buvusių upelių vagos; 4 – buvusio Skudenių žemutinio ežero baseinas; 5 – 2020 m. tyrinėta dujotiekio trasa; 6 – 2015 ir 2020 m. paviršinių žvalgymų plotai. Žemėlapio pagrindas sudarytas interpoliuojant LiDAR duomenis (SEŽP_0,5LT © Nacionalinė žemės tarnyba prie Žemės ūkio ministerijos, 2009–2010). *R. Vengalio brėž.*

overgrowth. As peat gradually accumulated in the hollows and the barriers between them eroded, the cascading hollows turned into continuous gullies, where permanent streams, rather than seasonal ones, may have formed. However, they must not have been very well-watered because of their small catchment area, which is only approximately 10 km^2 for the whole of the upland massif (Fig. 1).

Only 3 other archaeological sites are known in the same geomorphological region in the vicinity of Skudeniai: Balceriškės Hillfort and the unenclosed settlements of Pakertai and Juknonys (Fig. 1). In fact, until 2015, this region was entirely obscure: the existence of only Balceriškės Hillfort being known, but it had not been investigated, had yielded no recorded finds, and did not have a clear chronology (Kurilienė 2009, 86–87). Presumably, this low number of archaeological sites is primarily due to a lack of field surveys rather than the sparse occupation in prehistory. The region's very first archaeological

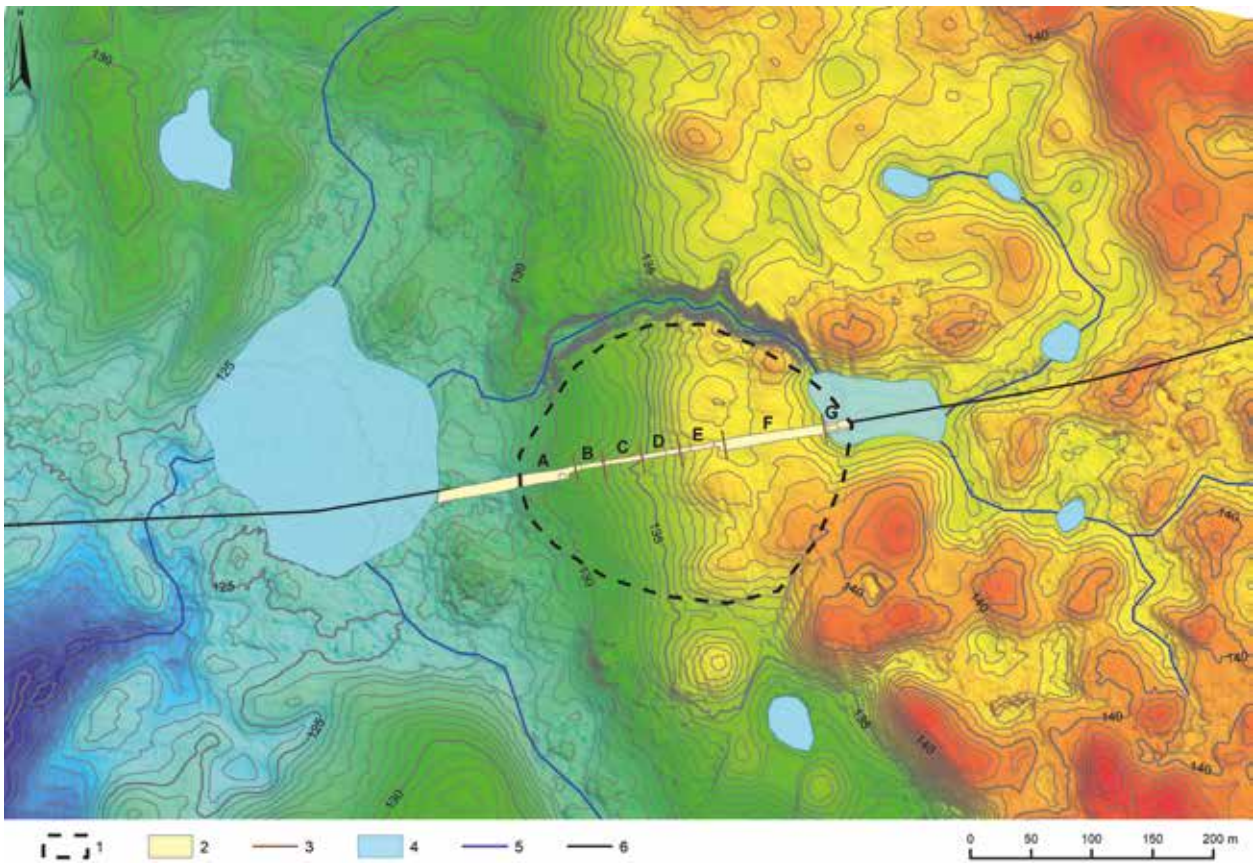

Fig. 2. Topography of the Skudeniai settlement: 1 – presumed settlement boundaries; 2 – the area investigated in 2020; 3 – the settlement zones delineated in the article; 4 – palaeolakes; 5 – former streams; 6 – the gas pipeline route surveyed in 2020. The terrain image is based on LiDAR data (SEŽP_0.5LT © National Land Service under the Ministry of Agriculture of the Republic of Lithuania, 2009–2010). *Annotated by R. Vengalis.*
2 pav. Skudenių gyvenvietės topografija: 1 – gyvenvietės ribos; 2 – 2020 m. tirtas plotas; 3 – straipsnyje išskirtų gyvenvietės zonų ribos; 4 – buvusių ežerų duburiai; 5 – buvę upeliai; 6 – 2020 m. tyrinėta dujotiekio trasa. Žemėlapio pagrindas sudarytas interpoliuojant LiDAR duomenis (SEŽP_0,5LT © Nacionalinė žemės tarnyba prie Žemės ūkio ministerijos, 2009–2010). *R. Vengalio brėž.*

surveys in 2015 identified the Skudeniai settlement site and yielded 2 flint flakes at the Pakertai settlement site (Vengalis *ir kt.* 2016). The 2020 construction of the gas pipeline E–W across the region resulted in the archaeological survey of the entire route, thus providing an archaeological cross-section of both the hilly uplands and the glaciodepression. Interestingly, while no archaeological sites were identified on the uplands, three were found on the glaciodepression, including Skudeniai on its margin. The Pakertai settlement site was discovered on the banks of the Kertus, roughly 800 m to the W of Skudeniai. Its traces were recorded in a 400 m long stretch, but the archaeological layer was not preserved continuously, only in the relief depressions. The main occupational phase of Pakertai settlement is attributed to the RIA, but it also yielded earlier and later finds (Šatavičė 2021a). The 1st-millennium BC Juknoniai settlement site was identified roughly 600 m to the NW of the Pakertai settlement (Zabiela, Tomašauskas 2021).

In 2020, the region was also surveyed in the framework of another project. Surface surveys

Zone	Zone length (m)	Excavated area (m^2)	Area of unploughed archaeological layer within the excavated plot (m^2)	Thickness of the archaeological layer	Average density of potsherds in the archaeological layer		Sunken features	AMS ^{14}C dates
					n/m^2	g/m^2		
A	46	400	4	up to 12 cm	2,9	8,6	7	1
B	24	96	26	up to 25 cm	5,7	30	14	
C	32	120	0	-	-	-	2	
D	32	71	68	up to 15 cm	21,2	103	13	2
			22	up to 5 cm	2,2	7,3		
E	37	162	64	up to 15 cm	6,3	24	32	1
F	83	720	0	-	-	-	18	1
G	22	182	159	up to 90 cm	12,1	68	0	2

Table 1. Settlement zones and their main characteristics.
1 lentelė. Gyvenvietės zonos ir jų pagrindiniai parametrai.

have been carried out in two alternative routes of the planned RailBaltica railway (Fig. 1), but yielded no archaeological finds in the vicinity of Skudeniai (Piličiauskas, Vengalis 2021). While the survey results cannot yet be considered representative for the region, they may already point to a settlement trend where the archaeological sites are concentrated in the water-rich lowlands and absent in the drier uplands.

Skudeniai settlement is located on a 10–15 m high terrace on the E bank of a former small, roughly 250x200 m lake with another smaller, 40–50 m diameter, higher lake to the settlement's E. The latter drained into the former via a deeply incised streambed (Fig. 2). A topographical analysis of the region using ESRI ArcGIS spatial analyst hydrology tools showed that the former was fed by a basin covering the whole of the W side of the upland, an area of over 300 ha (Fig. 1). The latter, although smaller, also collected a relatively large amount of water from a basin in excess of 100 ha. Thus, although the lakes were small, their extensive basins must have supported year-round high water levels. According to the local residents, until the 20th century, when a drainage system was created, the upper lake did not dry up, even in summer. In a landscape lacking large bodies of water, where the surface water mainly collected in peaty hollows, such small year-round reservoirs were undoubtedly very important sources of water for both people and their livestock. Such reservoirs may have also played an important role in selecting settlement locations, both in this and in other similar, morainic hilly landscapes.

Traces of the Skudeniai archaeological settlement were detected in a 270 m long section of the pipeline route. Since the surveys conducted beyond either end of this section yielded no archaeological finds or sunken features, it can be assumed that the settlement's E and W boundaries are clear. The settlement boundaries in the S–N direction remained undetermined during the surveys, but can be approximated from the topography. On the N, the settlement may have been bounded by the deep ravine that drained water from the upper lake to the lower one and on the SW, by peaty lowlands that must have been waterlogged before irrigation. The SE boundary is the least clear, but the settlement was probably confined to a single hill, being unlikely to have extended onto the adjacent hills (Fig. 2), meaning the settlement may have covered an area of approximately 4.5 ha.

A long, narrow section of the settlement was investigated using two methodologies: in places, by archaeologically excavated trenches, elsewhere by monitoring of the topsoil's mechanised removal. To facilitate comprehension, this article has divided the settlement area from W to E into Zones A–G (Fig. 2), which were delineated based on the extent of the unploughed archaeological layer and the density of the sunken features (Table 1).

The settlement's terrain is uneven, the elevation ranging from 127 to 140 m a.s.l. The terrain on the lower W side (Zones A–D) descends westwards towards the lower lake, alternating on the higher E side (Zones E–F) between low hillocks and shallow depressions, the elevation ranging within 1.5 m. Zone G lies within the basin of the former upper lake (Fig. 2).

PALAEOENVIRONMENT

Some evidence of environmental change was obtained from the strata of the former lake sediments in the E part of the settlement (Zone G). Twelve samples were taken from the various layers here, each of which was analysed for diatoms and pollen. The sampling locations are shown in Figure 3. After chemical treatment and analysis of the samples, diatoms were detected in only two and pollen in five.

The diatom samples (50 g of sediment) were prepared following the technique described by Battarbee (1986). Slides for microscopic analysis were made using *Naphrax* mounting medium (refractive index 1.73). The diatom species were identified using a *Nikon Eclipse 200* light microscope, at ×1000 magnification. Diatoms identification was mainly based on Krammer and Lange-Bertalot (1986; 1988; 1991a; 1991b). The species names were verified and updated according to the *AlgaeBase* database taxonomic nomenclature (Guiry, Guiry 2020). The diatom checklist by Van Dam et al. (1994) was mainly used for information on the ecological preferences of the species.

The Holocene sediment thickness at this place is up to 3.5 m (Fig. 3). Beneath the 20–50 cm thick ploughsoil (1), up to 70 cm thick grey-brown loam (2) with interbeds of alluvial sand (3) is recorded here. These layers were formed late in time and no archaeological finds have been found in them. Underlying these layers was an upper archaeological layer of dark grey sandy loam (4). It is up to 60 cm thick and only formed on the slope of the hollow. Potsherds and a large number of various-sized stones, the majority fire-cracked, were found in this layer. At the hollow's centre, the upper archaeological layer was separated from a lower one by a thin layer of light grey lacustrine clay, up to 15 cm thick, with no archaeological finds (5). The lower, 15–30 cm thick, dark grey loam archaeological layer (6) extended across the entire hollow and likewise contained potsherds and overheated stones. Non-charred waterlogged wood was also preserved, but it was sparse, with only a few tree branches without traces of woodworking. Beneath the lower archaeological layer lay fine sand (8) in the W part of the section and light grey clay (7) elsewhere, both of which were devoid of archaeological evidence. This lacustrine clay overlay boggy deposits of poorly decomposed brown peat up to 35 cm thick (9). The peat is overlying lacustrine sediments: a greenish grey-brown gyttja transitioning to aleurite in its base (10). This layer was only excavated and tested in an area of approximately 2.4x1 m area, which yielded no archaeological traces. At a depth of 3.4–3.5 m in the hollow's centre, the boreholes reached pebbly loamy sand, the glacigenic subsurface (11).

The strata thus suggest that the hollow contained a small lake with a water level that fluctuated over time. The ravine on the NW shore drained any excess water into the lower lake, meaning the water level could not have exceeded the altitude of the sources of this ravine's stream (Fig. 2). This altitude may have changed over time, either by erosion or by accretion such as through sedimentation or beaver activity or even deliberate human damming.

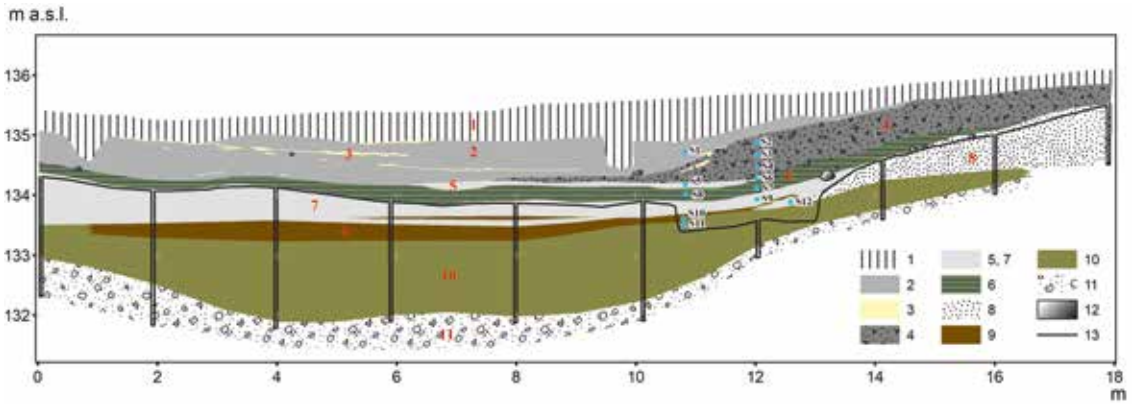

Fig. 3. Southern profile of the excavated trench in Zone G: 1 – grey-brown loam (ploughsoil); 2 – grey, grey-brown loam; 3 – brownish, whitish coarse and medium sand; 4 – dark grey sandy loam (upper archaeological layer); 5 – light grey clay; 6 – grey, dark grey loam (lower archaeological layer); 7 – light grey clay; 8 – light brown fine sand and sandy loam; 9 – brown, poorly decomposed peat; 10 – greenish grey-brown gyttja; 11 – yellowish, whitish sand and pebbly loam (glacigenic sediments); 12 – stones; 13 – bottom of the trench, drill holes. *Drawing by G. Piličiauskas.*
3 pav. Archeologinio sluoksnio ir ežerinių nuosėdų stratigrafija zonoje G, pietinėje sienoje: 1 – pilkai rudas priemolis (armuo); 2 – pilkas, pilkai rudas priemolis; 3 – rusvas, balsvas stambus ir vidutinis smėlis; 4 – tamsiai pilkas priesmėlis (viršutinis archeologinis sluoksnis); 5 – šviesiai pilkas molis; 6 – pilkas, tamsiai pilkas priemolis (apatinis archeologinis sluoksnis); 7 – šviesiai pilkas molis; 8 – rusvas, šviesiai pilkas smulkus smėlis ir priesmėlis; 9 – ruda silpnai susiskaidžiusi durpė; 10 – žalsvai/pilkai rudas sapropelis; 11 – gelsvas, balsvas smėlis ir žvirgždingas priesmėlis (glacigeninės nuosėdos); 12 – akmenys; 13 – perkasos dugnas, gręžiniai. *G. Piličiausko brėž.*

The lower layers (7–10) were formed before the lakeside settlement's establishment. Sample S11 from the top of the gyttja layer (10) is dominated by mostly a single diatom species: *Cymbopleura inaequalis*, indicating the presence of a shallow, alkaline, mesotrophic small lake or pond (Van Dam *et al*., 1994). The predominance of only one species suggests that relatively stable, shallow nearshore conditions may have been present. The peat layer (9) must have formed as the water level dropped while the clay (7) probably indicates its resurgence. Only diatom fragments were found in these layers indicating that the near-shore conditions were not favourable for their survival, probably due to changing conditions. Judging by its colour and texture, the clay layer (7) contains much less organic matter than the lower layer (10), suggesting that, after the deposition of the peat layer (9), resurgent water levels and fairly intense nearby soil erosion resulted in a relatively higher load of terrigenous matter.

The environment of the wider region is reflected in the diversity of pollen deposited in these layers (Fig. 4). The pollen spectrum of the oldest sample (S11) is characterised by a predominance of tree pollen, especially *Pinus* and *Betula*, suggesting that the area was characterised by open woods with a relatively rich undergrowth. The sediments are also rich in Cyperaceae and Poaceae pollen, which are characteristic of open habitats. *Juniperus* thrived in the open, dry areas. Farming activities may also have been present, as cereal (*Cerealia*, *Cannabinaceae*) and ruderal plant (*Artemisia*, Chenopodiaceae) pollen as well as high levels of charcoal particles were identified in the sample.

Sample S12, obtained from a clay layer interspersed between the gyttja and peat layers (Fig. 3), indicates that similar open *Pinus-Betula* woods continued to dominate the landscape. Quite significant increase in farming activities is reflected by the higher levels of Cerealia, ruderals (*Artemisia*, Chenopodiaceae,

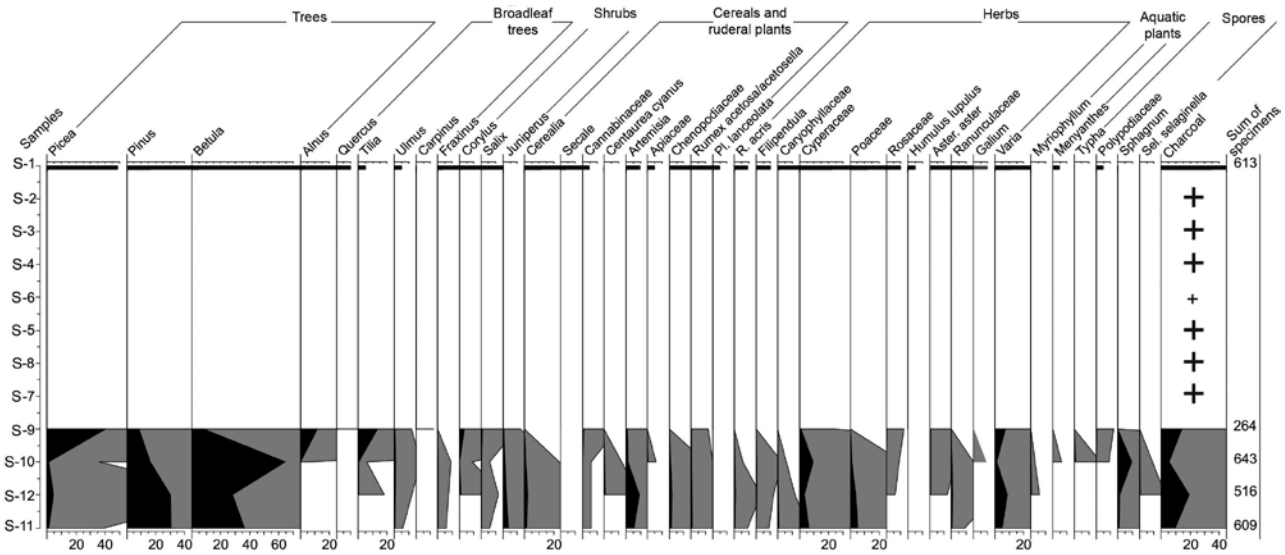

Fig. 4. A percentage pollen diagram for the samples taken from sediments in Zone G. *Created by M. Stančikaitė.*
4 pav. Žiedadulkių procentinė diagrama iš G zonos bandinių. *M. Stančikaitės brėž.*

R. acris, etc.) and indicators of open grasslands and pastures, together with the high levels of microscopic charcoals. The increased pollen content of *Picea* may have been caused by the formation of pioneer plant colonies in the area, i.e., the overgrowth of abandoned cultivated fields and pastures. Such habitats are characterised by a high species diversity of herbaceous plant pollen, which is also recorded in this sample. The simultaneous increase in indicators of both active and abandoned farming fields may be a reflection of a slash-and-burn farming. Based on the general knowledge of the development of agriculture in Lithuania (Minkevičius 2020), we can say that the abundant indicators of farming suggest that this layer must have been formed not earlier than the very end of the 2nd millennium BC. The stratigraphy of the lacustrine sediments shows that sedimentation was stable for a long time from the beginning of the Holocene until this period, and that from the 1st millennium BC onwards, these conditions became increasingly volatile.

Sample S10 from the peat layer (9) suggests that open and light *Betula* woods flourished in the vicinity. The exceptionally high pollen content of *Betula* was present while other trees, with the exception of *Picea*, accounted for only a few percent of the spectra or even less, i.e. these plants were virtually absent in the area. Herbaceous plants have a low pollen content, with the most significant share coming from Cyperaceae. The latter plants are typical of the wetland habitats which presence in the vicinity is also evidenced by the pollen of the aquatic plant *Menyanthes*. The diversity of pollen from herbaceous plants suggests the existence of some open, treeless habitats. Meanwhile, the small amounts of Cerealia and Cannabinaceae pollen as well as microscopic charcoal indicate that farming activities in the vicinity have significantly declined.

Sample S9 from the lacustrine clay layer (7), reflecting the period immediately prior to the establishment of the settlement at Skudeniai, demonstrates even more declined economic activities. The pollen spectrum of this sample is characterised by a high content of tree pollen, especially *Picea*. The landscape at this time would have been dominated by dense dark *Picea* forests, which were supplemented by *Alnus* and *Corylus* in the more humid habitats.

Pinus and *Betula* thrived in the poorer, drier areas, while *Tilia* flourished in the fertile lands. Herbaceous plants had very low pollen counts, indicating that the open areas were very limited. The eroded surfaces were covered by *Artemisia*, *R. acetosa-acetosella*, etc.

Such data suggest that the Skudeniai settlement was established as a result of the colonisation of a new, previously uninhabited region. Although more substantial traces of economic activity are evident in sample S12, the later samples S10 and S9 indicate that the region was most likely abandoned afterwards. Samples taken in different layers also show changes in forest structure. The region may have been suitable for economic development while open pine and birch forests dominated, but once dense spruce forests became prevalent, the population moved out. The most relevant for this paper was to determine the natural environment at the time of the existence of the Skudeniai settlement, but unfortunately all samples (S2–S4, S7–S8) taken from the archaeological layers did not reveal any diatoms or pollen at all. This could be due to the sedimentation being sufficiently intense to hinder significant amounts of pollen or spores from entering the sediment, as well as the unfavourable conditions for microfossils to survive.

Both diatoms and pollen have been found in the loam sediments deposited after the settlement was abandoned. The diatoms in sample S1 were not abundant but they indicate that the sediments were deposited in a very shallow small freshwater lake. The water was neutral to slightly alkaline. The presence of several species living in flowing water (Gomphonema sp.) and temporary dry places (*Pinnularia viridis*, *Hantzschia amphioxys*, Van Dam *et al.*, 1994) indicate that the lake could be fed by a small stream with a low, perhaps inconsistent, water flow. Meanwhile, the pollen spectra observed in the same sample show that despite the abandonment of the Skudeniai settlement, the region continued to be intensively populated. The sample contained a high proportion of herbaceous plants (Poaceae, Cyperaceae), with a significant share of cultivated plants (Cerealia and Secale) and their accompanying weeds (*Artemisia*, Chenopodiaceae), as well as pasture-specific plants (*R. acetosa-acetosella*, *Ranunculus acris*, *Caryophyllaceae*, *Aster. Sect. Aster.*) pollen. The amount of tree pollen detected is very low, indicating that the landscape was open and that forests were a very minor element of it.

ARCHAEOLOGICAL LAYER

As mentioned above, two archaeological layers were recorded in Zone G, separated by a thin layer of sterile lacustrine clay (Fig. 3). The different textures of the lower (6) and upper (4) archaeological layers, and the interbed (5) between them, indicate marked changes in the sedimentary settings, which were present during the existence of the settlement. The thickness of the lower archaeological layer is uniform throughout the hollow and its texture is similar to that of the underlying and overlying lacustrine clays. These characteristics suggest that the formation of this layer may be linked to erosion some distance away from the lake shores (in residential areas or arable fields). Activities close to the shore have led to the saturation of the layer with organic matter and the addition of archaeological finds. However, these activities did not lead to surface erosion and did not add additional terrigenous matter. Subsequently, the occupation of the settlement ceased for some time, resulting in a formation of a clay layer devoid of organic matter and archaeological finds. The formation of the upper archaeological layer, which marks a distinct phase of occupation, was influenced by different processes. Its coarser, unsorted fraction (sandy loam), its considerable thickness and its occurrence only on the lake foreshore indicate that its formation was the result of colluvial processes caused by the intensive erosion of the immediate lakeshore as a result of human activity.

Zone G was the only place where two separate archaeological layers representing two phases of

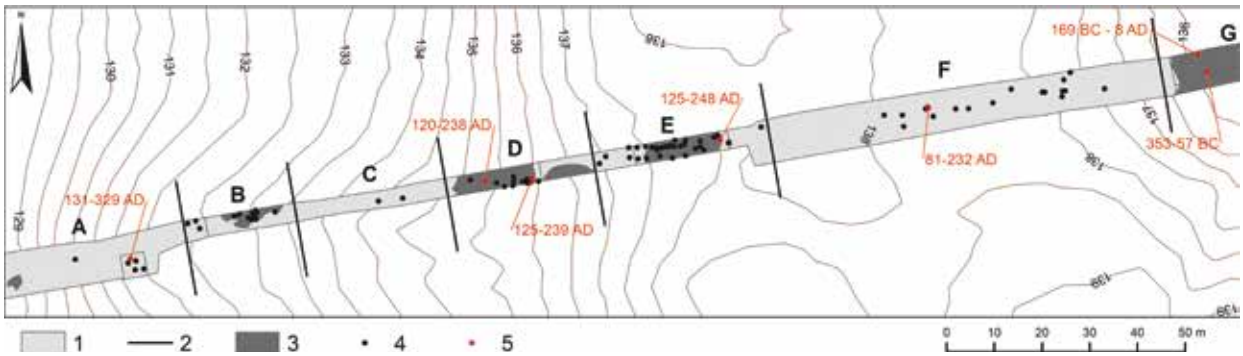

Fig. 5. Distribution of the archaeological layer and sunken features in the excavated area in the Skudeniai settlement: 1 – excavated area; 2 – boundaries of the zones; 3 – areas with an unploughed archaeological layer; 4 – sunken features; 5 – locations of the AMS ^{14}C dated samples. *Annotated by R. Vengalis*.
5 pav. Archeologinio sluoksnio ir įgilintų objektų paplitimas tirtame Skudenių gyvenvietės plote: 1 – tirtas plotas; 2 – zonų ribos; 3 – nesuartas archeologinis sluoksnis; 4 – įgilinti objektai; 5 – AMS ^{14}C metodu datuoti bandiniai. *R. Vengalio brėž.*

Fig. 6. The area with an unploughed archaeological layer in Zone D as seen from the W. *Photograph by G. Piličiauskas.*
6 pav. Nesuarto archeologinio sluoksnio arealas D zonoje. Vaizdas iš V pusės. *G. Piličiausko nuotrauka.*

Fig. 7. The typical stratigraphy of the unploughed archaeological layer in Zones A–E. A sample of the south profile in Zone D: 1 – dark grey-brown humic sandy loam (ploughsoil); 2 – dark grey sandy loam (the archaeological layer); 3 – brownish morainic sandy loam (the sterile horizon). *Photograph by G. Piličiauskas.*
7 pav. Tipiška stratigrafija A–E zonose. D zonos pietinės sienos fragmentas: 1 – tamsiai pilkai rudas humusingas priemolis/priesmėlis (armuo); 2 – tamsiai pilkas priemolis/priesmėlis (nesuartas archeologinis sluoksnis); 3 – rusvas moreninis priemolis/priesmėlis (įžemis). *G. Piličiausko nuotrauka.*

occupation were found. In contrast, the stratigraphy in Zones A–F is very simple, with a layer of grey-brown clayey ploughsoil 20–30 cm thick, in many places immediately underlying a layer of brown, brownish or whitish morainic loam or sandy loam. In five areas, an unploughed archaeological layer was preserved between the ploughsoil and the moraine (Fig. 5). This layer is unstratified, homogeneous and consists of dark grey loam (Figs. 6; 7). The areas of the preserved unplouged archaeological layer range

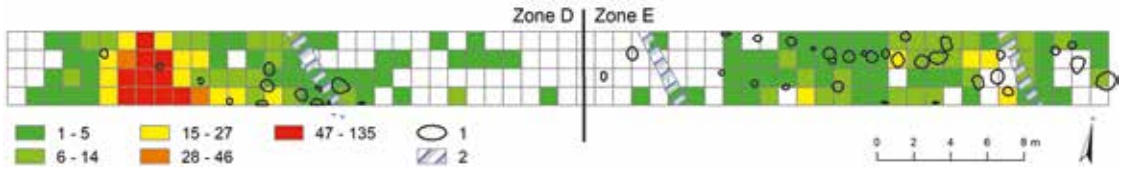

Fig. 8. The quantity of potsherds in the archaeological layer in Zones D and E. 1 – sunken features; 2 – 20th-century drainage ditches. *Drawing by R. Vengalis.*
8 pav. Keramikos radinių kiekis archeologiniame D ir E zonų sluoksnyje. 1 – įgilinti objektai; 2 – melioracijos grioviai. *R. Vengalio brėž.*

from 4 to 18 m in diameter. It was up to 25 cm thick, and in many places even thinner (Table 1). There is no doubt that this layer must have covered larger areas in the past – at the time of excavations only the lower part of it was preserved, while the upper part has been destroyed by years of ploughing. It should be noted that the archaeological layer does not coincide with the terrain depressions, so it can be assumed that it survived where it was thickest.

Comparing the areas of the unploughed archaeological layer in Zones A–F, it is worth emphasising the densities of archaeological finds in them. In most of the areas, the density of finds was low and even – 2–6 pottery sherds/m^2 (Table 1). Only the 4 m diameter area in Zone D stands out, with a density of 70–130 sherds/m^2. From the epicentre of this accumulation in all directions, the density of sherds decreases rapidly until it reaches the normal range of 2–6 sherds/m^2 (Fig. 8). This accumulation of pottery and other finds (i.e. clay plaster, overheated stones) is also distinguished by a darker soil colour, indicating a higher content of decayed organic matter and charcoal. A distinct assemblage of finds in a small area is an important indication of the short-term nature of the archaeological layer – in long-term settlements, the location of the different activity areas changes over time, and therefore the accumulations of finds become overlapping and difficult to identify (Vengalis 2012).

The two archaeological layers recorded in Zone G, representing separate phases of occupation, raise the question of whether the unstratified contiguous archaeological layer in Zones A–F also might represent several phases of occupation, only in this case they are intermixed. Unenclosed settlements on flat terrain tend to record a similar contiguous archaeological layer, even in cases where the occupation was very long (cf. Vengalis 2012). However, all the material from Zones A–F indicatess that the archaeological layer formed there represents only one phase of settlement. It is not the result of the intermixing of the two phases of occupation recorded in Zone G, but is associated only with the upper layer. In contrast, the main part of the settlement that left the lower archaeological layer in Zone G probably occurred outside the excavated area.

SUNKEN FEATURES

86 sunken features have been identified in the investigated area of the Skudeniai settlement site. All the features are pits exposed under the cultural layer. The distribution of the features is uneven throughout the investigated area, and they are clustered in 4 main areals, located in Zones B, D, E and F (Fig. 5). One compact cluster of features was found in Zone A, two postholes in Zone C and none in Zone G.

The majority of the sunken features – 65 out of 85 – can be interpreted as postholes. The postholes were circular or slightly oval in shape, usually 20–60 cm in diameter. They were 7–60 cm deep, mostly flat-bottomed in cross-section (n=39),

Fig. 9. Examples of the posthole cross-sections. The numbers correspond to the feature number (see Fig. 10). *Photos by G. Piličiauskas*.
9 pav. Stulpaviečių pjūvių pavyzdžiai. Numeriai atitinka objektų numerius (žr. 10 pav.). *G. Piličiausko nuotr.*

less often round-bottomed (n=22) or sharp-bottomed (n=3), and were filled with grey or dark grey loam (Fig. 9). The postholes also included 8 larger diameter features – circular flat-bottomed pits, 65–80 cm in diameter and 5–15 cm deep. Although this interpretation might be questioned by the relatively large diameter and shallow depth of these features, it is based on their arrangement: 5 of these features were lined up in a straight row at similar distances (50–60 cm) from each other. The presence of stones in the postholes was rare, with a few solitary stones found, and only in one case the post in the pit was anchored by supporting stones on all sides (Fig. 9: 15). Archaeological finds were not abundant in the postholes: in 23 cases none were found, in 29 cases 1–7 and in 14 cases 10–45 finds were recovered.

Postholes are usually associated with buildings, fences and other structures of the settlement. Postholes are abundant in Lithuanian Iron Age settlements, but it is usually not possible to group them into distinct structures due to the small

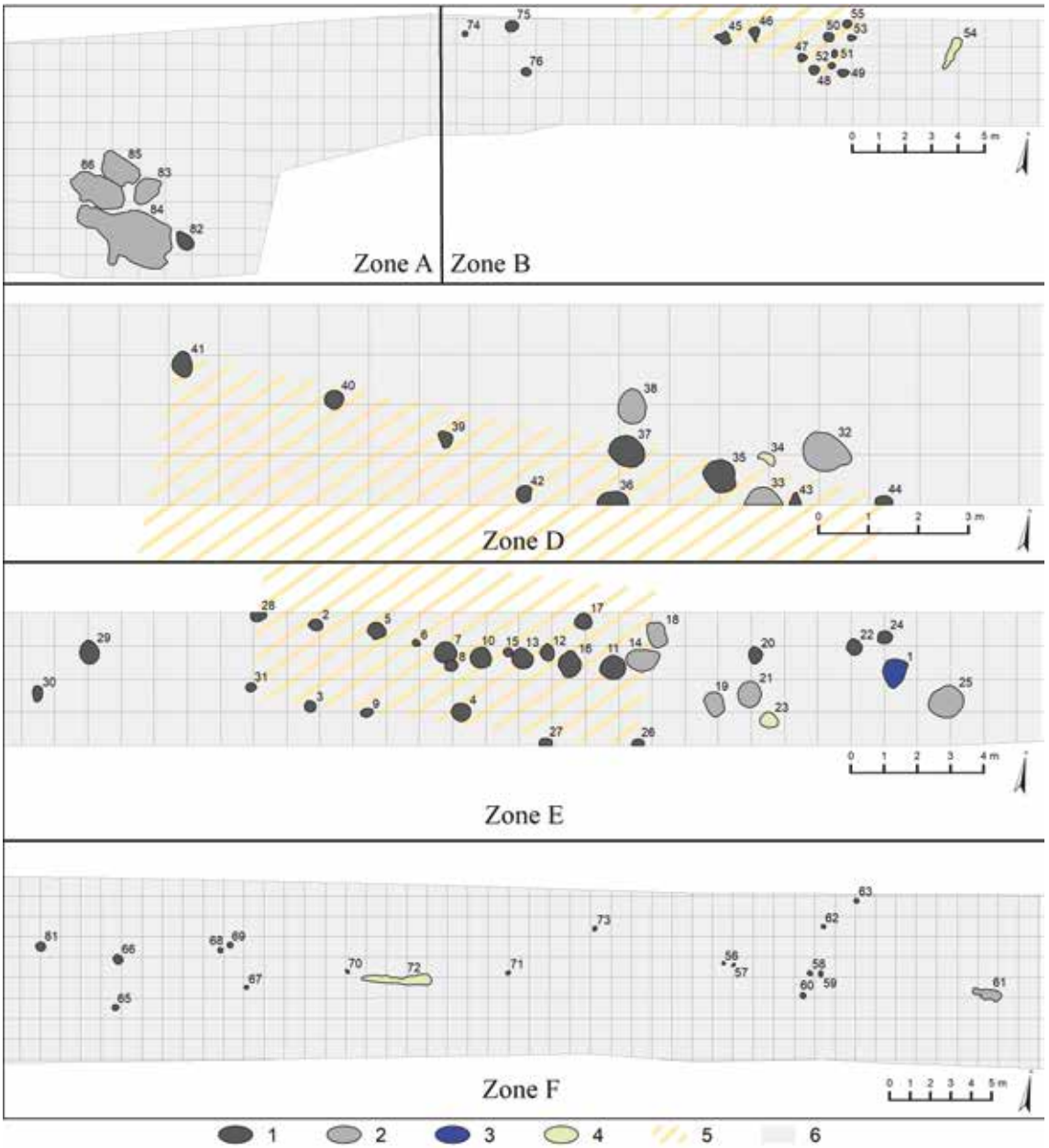

Fig. 10. Distribution and interpretation of the sunken features in the settlement's zones: 1 – postholes; 2 – pits of uncertain function; 3 – the pit associated with non-ferrous metallurgy; 4 – other features; 5 – locations of possible dwellings; 6 – excavated area. *Drawing by R. Vengalis*.

10 pav. Įgilintų objektų išsidėstymas skirtingose gyvenvietės zonose ir jų interpretacija: 1 – stulpavietės; 2 – neaiškios paskirties duobės; 3 – duobė, susijusi su spalvotąja metalurgija; 4 – kitos paskirties, neaiškūs ir gamtiniai objektai; 5 – spėjamų gyvenamųjų pastatų vietos; 6 – tirtas plotas. *R. Vengalio brėž.*

areas excavated, the palimpsest effect in long-term settlements and other factors (Vengalis 2016). In Skudeniai, where a relatively large area was uncovered and the occupation was short, certain trends in the arrangement of the postholes can already be recognized. In Zones D and E, the postholes are clearly aligned in rows along the E–W direction (Fig. 10). These rows are 10–15 m long, but possibly extend beyond the uncovered area. They are not perfectly straight and the postholes forming them are not identical, but vary in size, shape and depth. Nevertheless, we would suggest that these posthole structures can be interpreted as the remains of buildings. The irregular arrangement of postholes is also characteristic of the more extensively studied settlements of the West Balt Circle of this period, while very clear and geometrically regular posthole structures are not common (Szymański 2007, 173–174; Jaskanis, Szymański 2020, 65–66). It can be assumed that the walls of the buildings were made of horizontal logs anchored between vertical posts. A good example of this would be the Bakšiai settlement site, dated to the 2nd–5th cc. AD, where the impressions left by horizontal logs and the postholes along them are clearly distinguishable on the sterile horizon (Steponaitis 1996; Vengalis 2009, fig. 16). The irregularity of the arrangement of the postholes in this case can perhaps be explained by the assumption that the building was possibly being repaired during its life-time with additional posts being added to support collapsing walls and roof. Moreover, not all of the postholes survive and are visible during excavations.

There were no rows of postholes in other zones of the settlement. In Zone B, two groups of postholes can be distinguished. In the first group, 10 postholes were identified in an area of about 5 m in diameter, but their arrangement is rather random (Fig. 10). However, it can be speculated that a similar building may also have been present here, but only a small part of it, the SE corner, was within the excavated area. In the next group, there were only 3 postholes (Nos 74–76), forming a roughly right-angled corner between them, suggesting that a small (1.8 x 1.8 m) square posthouse or shed may have stood in this location. Interestingly, in Zone D, to the W of the main building, two postholes (Nos 29–30) separated by the same distance of 1.8 m were also found, which could indicate the presence of the same structure in this area. Such small four-post structures near dwellings are common in N European settlements of the 1st millennium AD and are associated with the storage of grain and other supplies (Hamerow 2002).

In Zone F, 16 postholes were identified in a 40 m long stretch. In this zone, they are sparser than elsewhere and are characterised by a small diameter, with a predominance of 15–30 cm. Some of them seem to form some kind of structures, in some cases they are arranged in pairs (Fig. 10). This arrangement suggests that this area of the settlement may have contained a number of small, lightweight (not requiring massive posts) ancillary buildings or shelters. Such structures have been found elsewhere in Lithuanian Iron Age settlements (Masiulienė 2009).

In addition to the postholes, there were also other types of features, but they were few in number. 14 features have been classified as pits of uncertain function. These are circular or oval, round-bottomed or flat-bottomed pits, with a larger diameter than the postholes (more than 50 cm). Such pits could have been used for the storage of foodstuffs or other supplies, for the disposal of waste as well as for other purposes. In Skudeniai, the pits are quite small, mostly up to 1.2 m in diameter and 13–32 cm deep. Only in Zone A were there a few larger pits of 1.6–3 m diameter. The number of finds at these features varies from a few to more than a hundred. The most abundant finds were from features 86 in Zone A, 32 in Zone D and 18 in Zone E. Feature 32 contained 106 sherds of pottery, including

Fig. 11. Cross-sections of Features 32 (1) and 1 (2). *Photos by G. Piličiauskas.*
11 pav. Objektų Nr. 32 (1) ir Nr. 1 (2) pjūviai. *G. Piličiausko nuotr.*

some rather large sherds, all of which are likely to be pieces of a single pot (Fig. 11: 1).

Almost all of the pits were clustered in three compact areas. In Zone A, 4 pits were located within a 5 m area, partially overlapping each other. In Zone D, 3 pits were situated within a 5 m diameter area to the N of the building. In zone E, 6 pits were spread over a 17 m wide area to the E of the building (Fig. 10). Such a distribution of pits indicates that most of the activities requiring these pits took place close to the buildings – there are almost no pits further away.

Significant feature was found in Zone E, in the same area where the pits were concentrated (Fig. 10). It is related to non-ferrous metallurgy, possibly a hearth for melting and casting. The pit is oval, filled with dark grey soil with abundant chunky oak charcoal[1] (Fig. 11: 2). The pit contained 1 intact crucible and 7 crucible fragments, a droplet of copper alloy, 13 small fragile pieces of clay plaster (possibly clay moulds that are no longer identifiable), 1 small potsherd and 5 fire-cracked stones.

POTTERY

It is remarkable that in the first half of the 1st millenium AD, in a very large region of Central-Eastern Europe, to the N of the Roman provinces, the pottery assemblages found in the settlements of the different cultures share certain common features. The pottery produced was hand-made, which is divided into two main categories – kitchenware and tableware (Русанова, Сымонович 1993; Szymański 2001; Пачкова 2006, 247–249). Kitchenware is universally coarse-grained, often with a coarse slipped surface, but the shape and decoration of the vessels varies between cultures. Tableware, on the other hand, is fine-grained, with a more delicate surface treatment. The common features between the different cultures are that it is usually with a burnished surface and fired in a reducing atmosphere, which gives it a grey or black colouring. Although tableware makes up a small percentage of the pottery in the settlements, it is abundant in graves where intact vessels are

[1] Wood species identification was made by Kęstutis Peseckas.

Fig. 12. Coarse-grained oxidised pottery (COP). Field numbers: 1 – 203; 2 – 66; 3 – 244; 4 – 247; 5 – 138; 6 – 260; 7 – 250; 8 – 269; 9 – 116; 10 – 63; 11 – 292; 12 – 240; 13 – 239; 14 – 131. The numbers of the thin-section samples are marked in red. *Photos by R. Vengalis*.

12 pav. Stambiagrūdė oksidacinė keramika (*COP*). Lauko numeriai: 1 – 203; 2 – 66; 3 – 244; 4 – 247; 5 – 138; 6 – 260; 7 – 250; 8 – 269; 9 – 116; 10 – 63; 11 – 292; 12 – 240; 13 – 239; 14 – 131. Mikrošlifų mėginių numeriai pažymėti raudonai. *R. Vengalio nuotr.*

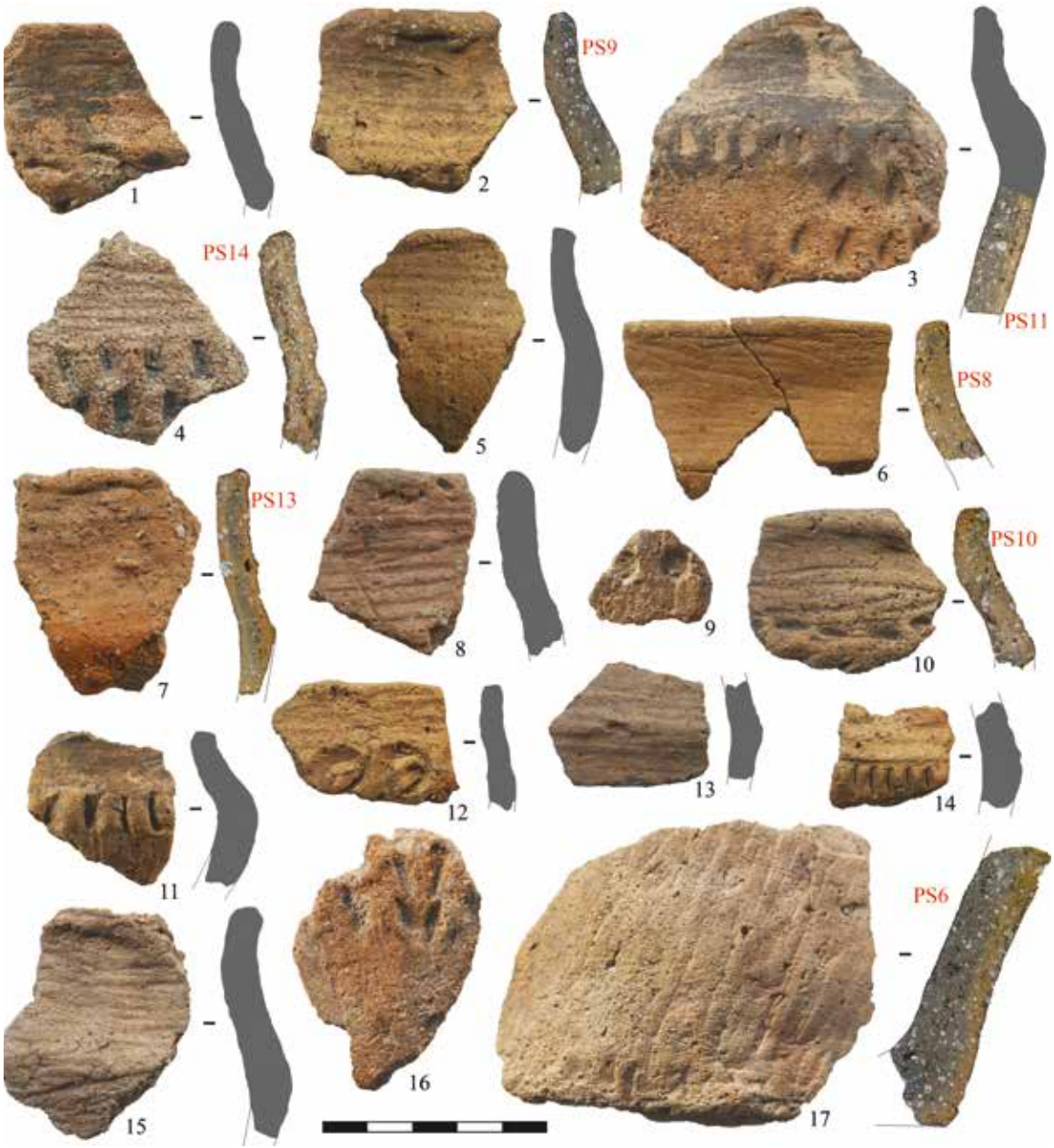

Fig. 13. Fine-grained oxidised pottery (FOP). Field numbers: 1 – 22; 2 – 137; 3 – 226; 4 – 289; 5 – 153; 6 – 102; 7 – 266; 8 – 284; 9 – 42; 10 – 156; 11 – 213; 12 – 130; 13 – 182; 14 – 82; 15 – 189; 16 – 58; 17 – 65. The numbers of the thin-section samples are marked in red. *Photos by R. Vengalis*.

13 pav. Smulkiagrūdė oksidacinė keramika (*FOP*). Lauko numeriai: 1 – 22; 2 – 137; 3 – 226; 4 – 289; 5 – 153; 6 – 102; 7 – 266; 8 – 284; 9 – 42; 10 – 156; 11 – 213; 12 – 130; 13 – 182; 14 – 82; 15 – 189; 16 – 58; 17 – 65. Mikrošlifų mėginių numeriai pažymėti raudonai. *R. Vengalio nuotr.*

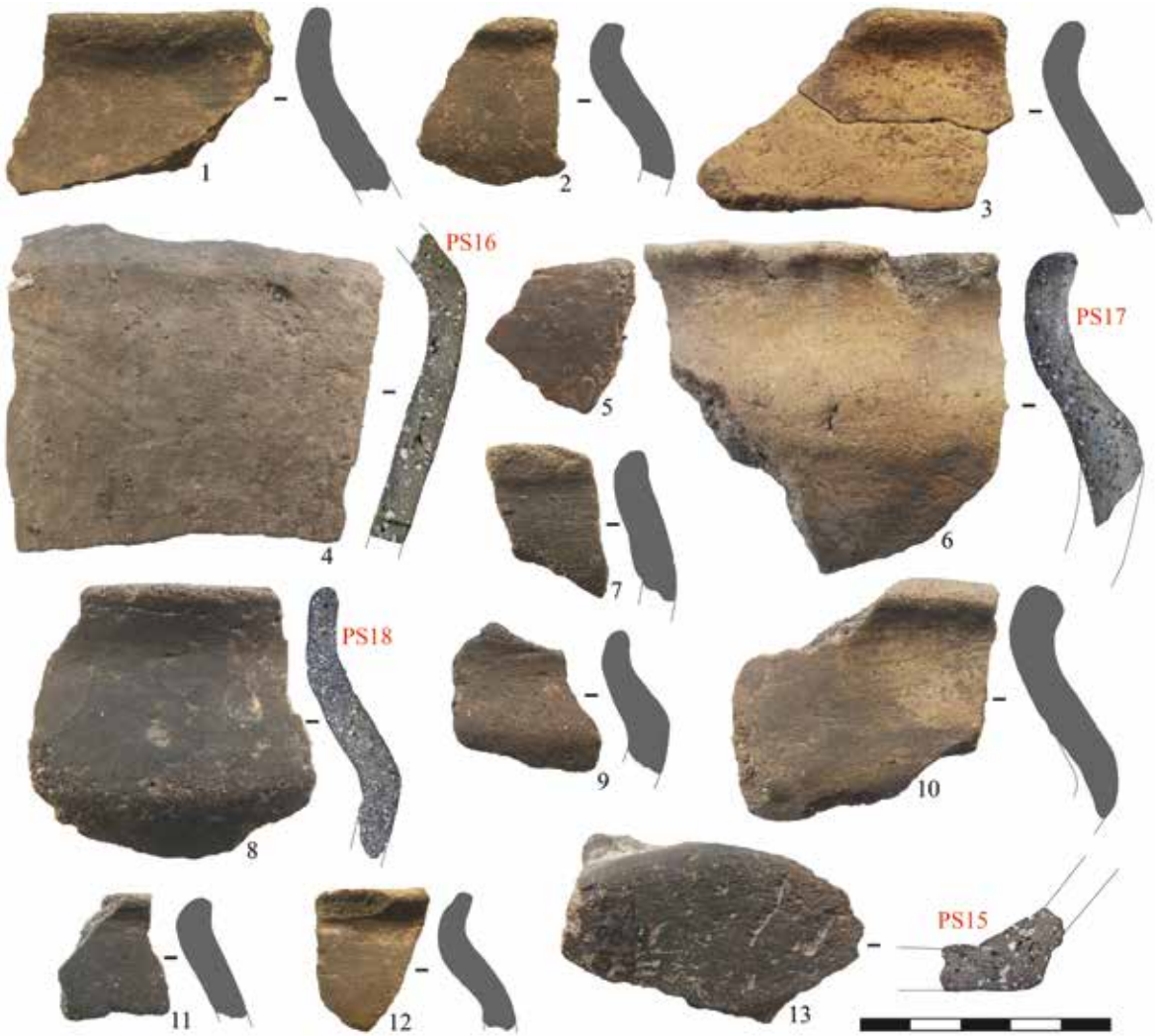

Fig. 14. Fine-grained reduced pottery (FRP). Field numbers: 1 – 127; 2 – 132; 3 – 134; 4 – 242; 5 – 297; 6 – 169; 7 – 21; 8 – 243; 9 – 188; 10 – 170; 11 – 167; 12 – 145; 13 – 59. The numbers of the thin-section samples are marked in red. *Photographs by R. Vengalis.*
14 pav. Smulkiagrūdė redukcinė keramika (*FRP*). Lauko numeriai: 1 – 127; 2 – 132; 3 – 134; 4 – 242; 5 – 297; 6 – 169; 7 – 21; 8 – 243; 9 – 188; 10 – 170; 11 – 167; 12 – 145; 13 – 59. Mikrošlifų mėginių numeriai pažymėti raudonai. *R. Vengalio nuotr.*

found. For this reason, it is receiving much more research attention than kitchenware, and is usually the principal focus when describing the pottery of a particular culture.

LSWC pottery is also in line with these pan-regional trends. The two categories of pottery mentioned above are clearly distinguishable: the kitchenware, which is coarse-grained, but with a striated rather than a coarse slipped surface, fired in an oxidising atmosphere; and the tableware, which is fine-grained, with a burnished surface, fired in a reducing atmosphere. The pottery of this culture has already been extensively discussed by various authors (Митрофанов 1978, 30–34; Васкс 1991, 67–76; Grigalavičienė 1995, 210–221; Медведев 1996, 37–46; Егорейченко 2006, 73–79; Vengalis 2009), but unlike in the cases of the other cultures, the main focus has been on the kitchenware. Fine-grained

burnished pottery makes up only a few percent of the total assemblages in the settlements, whereas LSWC graves are unknown, which is why it is only briefly mentioned in the discussions of LSWC pottery. The striated pottery is discussed in much greater detail, but the classification always focuses on the shapes of the vessels, neck variations and decoration, while the fabric is only briefly described, stating that it is varying. No attempt has yet been made to classify pottery on this basis.

While analysing the Skudeniai pottery, we realised that the variations of the fabric of the pottery with a striated surface are significant. It is not ''varying'' but of two types: coarse-grained and fine-grained. The latter is very similar to the burnished pottery. Therefore, in this paper we present a new classification of the LSWC pottery assemblage, distinguishing three main groups: coarse-grained oxidised pottery (COP) (Fig. 12), fine-grained oxidised pottery (FOP) (Fig. 13), and fine-grained reduced pottery (FRP) (Fig. 14). Knowing that the analysed pottery assemblage is from a short-term settlement, we can suggest that the differences between these pottery groups should not be determined by different chronologies, but by the different functions of the vessels.

Skudeniai pottery assemblage consists of about 4000 sherds (22.8 kg), most of which are small-sized. Approximately 1650 sherds could not be assigned to a specific pottery group due to their fragmentation. The remaining sherds were mostly up to 4 cm in diameter, with only a few dozen larger ones.

Among the three pottery groups, COP was the most abundant. In the different settlement zones it accounted for between 62 and 83 % of the total classified pottery (in terms of sherd count). FOP accounted for 14–32 % and FRP for 2–16 %. Individual sherds not belonging to either of the main groups were also present in the different zones, and these finds will be briefly discussed later.

The pottery fabric has received very little attention among the researchers of LSWC pottery so far, so when analysing the Skudeniai pottery, we investigated it in more detail by using a petrographic analysis. For this purpose, 19 sherds were selected: 5 COP (PS1–PS5), 9 FOP (PS6–PS14), 4 FRP (PS15–PS18). For comparison, a sample belonging to a different period was examined (PS19): a sherd with a coarse slipped surface found in Zone G, belonging to an earlier phase of the LSWC – the end of the 1st millennium BC (Table 2). FOP was sampled in the largest number, because to the naked eye its fabric appeared more varied than that of the other groups. From the selected sherds, vertical-sectioned standard 30 μm-thick thin-sections were prepared according to Humphries (1992) and Quinn (2013, 23). They were examined through a Leica DM750P polarising microscope with x40, x100, x200 and x400 magnification options.

For the characterisation of the composition of the fabric, the content of particles larger than 0.01 mm in diameter was calculated. Particles larger than 0.2 mm were counted on high resolution macroscopic photographs of fresh cuts. Meanwhile, particles with a diameter of 0.01-0.2 mm were counted in x100 microphotographs of a 1x1 mm area of thin-sections. All photographs were scaled and manually vectorised, which allowed accurate calculation of the diameter and area of each particle in a 2D section. The quantity of particles is given as a percentage of the area they occupy in the analysed section of the sherd. Here it should be borne in mind that the 2D section displays the particles smaller than they actually are, as the section usually does not pass through the largest particle diameter. For this reason, the results do not show the real amount of inclusions in the pottery fabric, however they are suitable for intercomparison of the samples (Velde, Druc 1999, 189). Nevertheless, it should be noted that this effect is more pronounced in coarse-grained pottery than in fine-grained. In the case of coarse-grained pottery, coarse inclusions occupy a significant part of the area, but their number is very

Sample	Field No. of the sherd	Pottery group	Size of the thin-section (cm2)	Natural inclusions in the raw clay (%)	Composition of the fabric (%)			Figure
					Clay (including <0,01 mm size particles)	Natural inclusions	Mineral temper	
PS1	66	COP	2,8	10,3	61,7	7,1	31,2	13:2
PS2	136	COP	2,9	9,6	68,9	7,3	23,7	
PS3	206	COP	5,1	10,8	63,1	7,6	29,3	18:2
PS4	313	COP	5,5	7,6	64,9	5,4	29,7	14:6
PS5	247	COP	1,5	9,3	74,9	7,7	17,4	13:4
PS6	65	FOP	3,9	17,8	70,4	15,2	14,4	14:17
PS7	88	FOP	2,6	13,7	69,1	11,0	19,9	18:3
PS8	102	FOP	1,7	7,3	77,8	6,2	16,0	14:6
PS9	137	FOP	2,2	9,1	76,0	7,6	16,4	14:2
PS10	156	FOP	1,9	9,1	73,8	7,4	18,9	14:10
PS11	226	FOP	3,2	11,7	70,1	9,3	20,6	14:3
PS12	64	FOP	4,9	7,1	77,7	6,0	16,3	
PS13	266	FOP	3,6	8,9	78,5	7,7	13,9	14:7
PS14	289	FOP	2,4	7,7	71,0	5,9	23,1	14:4
PS15	59	FRP	2,2	8,6	75,7	7,1	17,3	15:13
PS16	242	FRP	4,7	9,4	77,0	8,0	15,0	15:4
PS17	169	FRP	3,2	24,9	67,9	22,5	9,7	15:6
PS18	243	FRP	3,7	7,3	58,2	4,6	37,2	15:8
PS19	296	COP	7,0	12,1	68,0	9,4	22,7	20:1

Table 2. List of the petrographic samples and estimated composition of the fabric.
2 lentelė. Petrografinių mėginių sąrašas ir apskaičiuota molio masės sudėtis.

small compared to the number of fine inclusions, which increases the likelihood that the 2D section will not be representative of coarse particles. This was the case for the COP sample PS5, which did not show a single particle larger than 3 mm in the section, even though the surface of the sherd exhibits many of them (Fig. 12: 4). Such non-representativeness would only be reduced by sampling a larger area, whereas in this case PS5 had the smallest area of all the samples, only 1.5 cm^2.

The mineral composition of the non-plastic particles is quite similar in all the samples analysed. The inclusions are dominated by coarser particles (up to 5–7 mm in diameter) of quartz (50–70 % of the particles), alkaline feldspars (15–30 %) and finer particles (generally up to 1 mm in diameter) of microcline (5–15 %), plagioclase (5–15 %), biotite (2–5 %), amphibole (<0.5 %), muscovite (<0.5 %) (Fig. 15). Most samples also contain alkaline feldspars or quartz in a single rock together with biotite and magnetite. The alkaline feldspars are often altered. Only a few samples (PS1, PS4, PS5 – all COP) contained polycrystalline quartz. Such mineral composition of the inclusions suggests that crushed overheated granite was generally used as a temper (MacKenzie and Adams 2013, 92).

The pottery fabric is made up of three main components – clay, naturally occurring inclusions, and additional inclusions added by the potter – temper. The region around the Skudeniai settlement

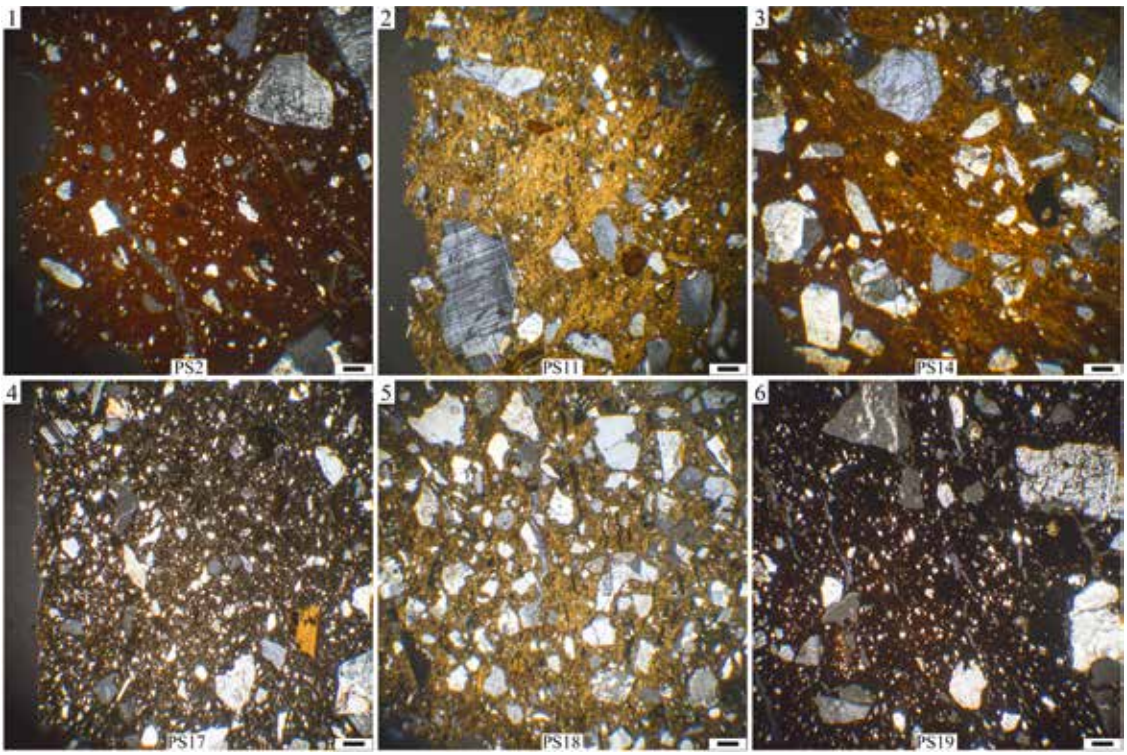

Fig. 15. The fabrics of the various pottery groups in the thin-sections: 1 – COP; 2–3 – FOP; 4–5 – FRP; 6 – COP with a coarse-slipped surface from the earliest occupation phase. Photographed under cross-polarized light (XPL), scale – 0.2 mm. *Photos by M. Valančius.*
15 pav. Skirtingų rūšių keramikos molio masė mikrošlifuose: 1 – COP; 2–3 – FOP; 4–5 – FRP; 6 – COP kruopėtu paviršiumi iš ankstyviausio apgyvendinimo etapo. Fotografuota kryžmai poliarizuojančioje šviesoje (*XPL*), mastelis – 0,2 mm. *M. Valančiaus nuotr.*

is dominated by morainic sediments, which are characterised by poor particle sorting – the pipeline surveys in the region have exposed clays and loams of widely varying plasticity. The purer, better sorted clays in this landscape can be found in the sediments of small palaeolakes that used to exist in the hollows. Probably they were the ones chosen for pottery production. In order to determine the plasticity of the raw clay used, it is necessary to distinguish which non-plastic particles in the fabric are natural inclusions and which are added as a temper. Since in this case there was no difference in mineral composition between the natural inclusions and the temper, the most reliable method of distinguishing between them is the analysis of the angularity and size frequencies of the particles (Rye 1981, 52; Rice 1987, 410; Velde and Druc 1999, 149–151; Santacreu 2014, 72). In almost all samples, the vast majority of particles up to 0.2 mm in size are much more rounded than the larger ones (Fig. 15). The bimodality observed in the histograms of the particle size frequencies also indicates a boundary between natural inclusions and temper at this size. Thus, it is reasonable to assume that if all particles up to 0.2 mm were classified as natural inclusions and the larger ones as temper, no significant error in the calculation of their ratios would be introduced. The only exceptions are PS18 (FRP) and PS19 (coarse slipped pottery), where the natural inclusions were finer, up to ca. 0.1 mm in size (Fig. 15: 5–6).

The separation of natural inclusions and temper allows a comparison of the fabric recipes between the samples. The majority of the samples showed very similar plasticity of the raw clay (clay to natural inclusions ratio). The median content of natural non-plastic particles (counting only particles from 0.01 mm diameter) in the samples was 9.3 (IQR = 8.1 11.2) %. Two samples were outliers, where the raw clay was significantly less plastic: PS6 (FOP) had a natural inclusion rate of 17.8 % and PS17 (FRP) 24.9 % (Fig. 15: 4). PS18 and PS19, with finer natural inclusions, do not stand out from the general group in terms of raw clay plasticity (Table 2).

The results show that the different groups of pottery were produced from the similar raw clay. Meanwhile, when analysing the quantities and size frequencies of the temper particles, significant differences between these groups become apparent (Table 2). COP was tempered most abundantly. All of its samples are similar, except for PS5, which is considered unrepresentative. The median content of temper is 29.3 (IQR = 23.7–29.7) %, while the median content of clay in the fabric prepared for moulding decreases to 64.9 (IQR = 63.1–68.9) %. FOP and FRP can be grouped together in this respect. The median temper content of their samples is 16.4 (IQR = 14.9–19.9) %, which is significantly lower than for COP. Remarkably, in samples PS6 and PS17, which had a significantly higher content of natural inclusions in the raw clay, this excess was compensated by a lower content of temper (14.4 and 9.7 %). Thus, despite the choice of a different clay, the final plasticity of the fabric is no longer different from that of the general group of fine-grained pottery, which has a median clay content of 73.8 (IQR = 70.1–77) %. The most obvious outlier is the FRP sample PS18, which contains as much as 37.2 % temper and only 58.2 % clay.

The differences between coarse-grained and fine-grained pottery were most pronounced when analysing the amounts of temper particles of different size categories (Fig. 16). The COP samples are all similar in this respect (again, with the exception of PS5), being characterised by an abundance of coarse particles (2–5 mm), with a median content of 15.1 (IQR = 13.7–16.1) %. Medium-sized particles (1–2 mm) are slightly less abundant at 9 (IQR = 7.3–11.2) %, and fine particles (0.2–1 mm) are the least abundant at 4.7 (IQR = 3.9–5.1) %. The FOP and FRP samples have more diverse particle size distributions. Coarse particles (2–5 mm) are either absent or sporadic. Typically, fine and medium particles (0.5–2 mm) make up the largest proportion of 11.5 (IQR = 8.9–19.7) % of the fabric, while very fine particles (0.2–0.5 mm) make up a small proportion of only 2.3 (IQR = 1.8–2.8) %. Significantly, the amount of fine particles (0.2–0.5 mm, partly 0.5–1 mm) is very similar in both coarse-grained and fine-grained pottery. This indicates that the granite was crushed in the same way for all three groups, with only the fine-grained pottery having coarser particles sieved out. In contrast, PS18 (FRP) demonstrates a very different tradition of granite preparation, with a very high number of 0.1-1 mm particles, indicating that much more effort was put into the crushing of the granite, and that the coarser particles were removed by a more thorough grinding process rather than by sieving. The high number of fine particles may also be an indication of sand being added as a temper, but in that case the particles should be rounded, which is not observed in this sample (Fig. 15: 5).

Sample PS19, derived from coarse slipped pottery of the earlier period, although on the basis of temper particle size undoubtedly belonging to coarse-grained kitchenware, shows a different tradition of the fabric preparation from that of the COP samples. It shows a bimodal distribution of particle sizes, with a lack of 2–3 mm particles, which is unusual in other samples. This distribution indicates that it is likely that the finer and coarser impurities were prepared separately for this pottery.

Another property of pottery related to its production and functional performance is porosity. As is usual for hand-made pottery, the sherds examined

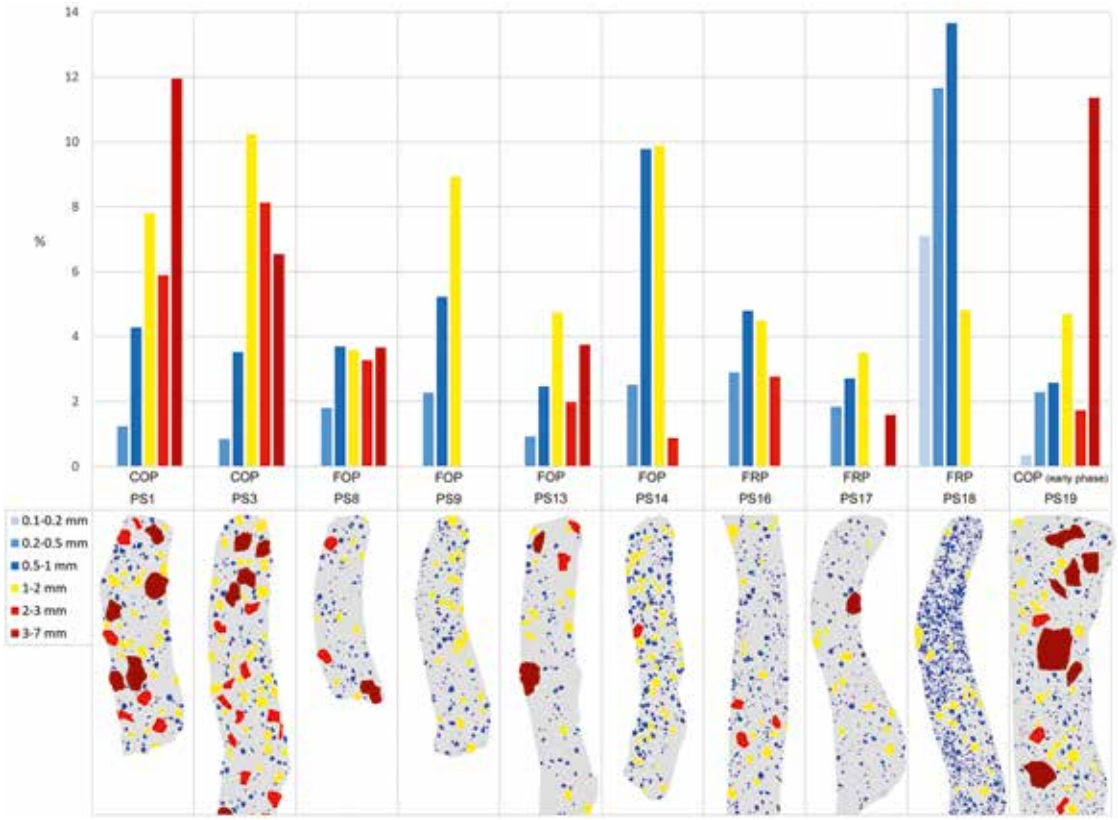

Fig. 16. Histograms of the temper particle size frequencies and the fabric textures. *Drawing by R. Vengalis.*
16 pav. Įdėtų priemaišų dydžių histogramos ir molio masės tekstūros. *R. Vengalio brėž.*

were porous, with pores visible in all samples. In 2D sections, the pores represent 1–3 % of the area and are mostly narrow (<0.15 mm) and elongated (0.25–3 mm), oriented parallel to the walls (Fig. 15:1, 5, 6). These pores are formed by drying the vessel prior to firing, and their direction is perpendicular to the pressure applied to form the vessel (Quinn 2013, 61). It can be noted that the most abundant and coarse pores of this type, visible to the naked eye, are characteristic of COP. In this group, cracks are also abundant on the surface of the walls (Fig. 12), which is almost absent in the other groups. This may be related to the less plastic fabric used: perhaps more water was used to increase its plasticity, and the higher evaporated water content leads to a significant shrinkage of the clay mass. Some of the samples (all FRP, some FOP) also contained a small number of rounded or elongated pores with darker edges, which are the result of the firing of organic substance. However, the question of whether these are natural inclusions or temper requires more in-depth investigation.

Pottery firing conditions were assessed by the colours of the fresh cuts and surfaces. The results show that all three pottery groups were fired differently. COP is characterised by a brownish grey colour of the section, gradually becoming lighter towards the outer surface (Figs. 12: 2, 4; 17: 2). This indicates that the vessels were fired in an oxidative atmosphere, but very briefly, and the organic content did not have time to burn off even near the surface. A similar poor firing is characteristic of the FOP sample PS9 (Fig. 13: 2). FOP vessels were also fired in an oxidative atmosphere, but

the time of firing was much longer. This is indicated by the light brownish-yellow colour of the sections (Fig. 13: 4, 6, 7, 10), indicating that the organic content in the clay mass is either completely burnt out or remains only in the core. Samples PS6 and PS11 have a brownish yellow outer part of the section up to the core and a dark grey inner part of the section (Fig. 13: 3, 17). This effect is obtained when vessels are fired upside-down in an oxidising atmosphere, thus depriving the interior of the vessels of oxygen and causing them to be fired under reducing conditions (Velde and Druc 1999, 123–124).

FRP was fired exclusively in a reducing atmosphere – all these samples are uniformly dark grey throughout the section. Only the colour of the surface of these sherds differs, with PS15 and PS18 having a black surface (Fig. 14: 8, 13) and PS16 and PS17 having light grey and brown surfaces (Fig. 14: 4, 6). The latter two samples indicate that these vessels were fired in a reducing atmosphere but rapidly cooled under oxidising conditions after firing. In this case, a thin oxidised layer with a very sharp margin in section is formed on the surface of the vessel (Rye 1981, 116–118). Such a 1 mm thick layer is very clearly visible in the thin-section of PS17 (Fig. 17). Evidence of firing in a reducing atmosphere, with oxidation of only the very surface, has also been observed in pottery from other groups, such as the FOP samples PS7 and PS9, and the earlier coarse slipped pottery sample PS19.

Surface treatment. The outer surfaces of COP and FOP are almost always striated, with only occasional cases of plain or coarse slipped surfaces. The striations are typical of LSWC pottery: horizontal above the shoulders, vertical below them, quite sharp and parallel. The inner surface of the FOP is mostly smooth, with only occasional slight striations or unevenness. The inner surface of COP, on the other hand, is mostly without additional treatment, being uneven and showing the impressions left by fingers during moulding. In a few cases it has been smoothed or horizontally striated.

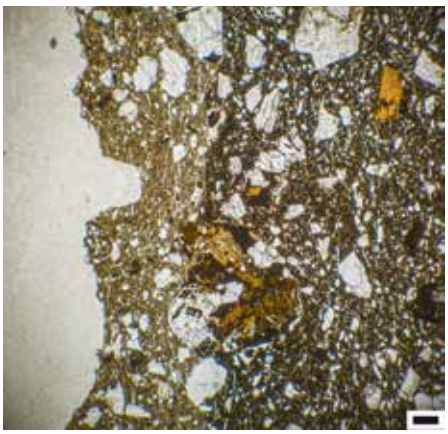

Fig. 17. Thin-section (PS17), demonstrating thin oxidized layer with a sharp margin, indicating that the vessel might have been fired in the reducing atmosphere and cooled rapidly in air. Photographed under plane polarized light (PPL), scale – 0,2 mm. *Photograph by M. Valančius.*
17 pav. Mikrošlifas (PS17), kuriame išsiskiria plonas oksiduotas sluoksnis su ryškia riba, rodantis, kad indas galėjo būti išdegtas redukcinėje aplinkoje ir staigiai atvėsintas oksidacinėje aplinkoje. Fotografuota plokščiai poliarizuojančioje šviesoje (*PPL*), mastelis – 0,2 mm. *M. Valančiaus nuotr.*

Noteworthy are the sherds with a coarse slipped surface, several of which occurred among both COP and FOP (Fig. 18). One shattered pot with such a surface was found in the pit in Zone D. This pot was made in the tradition of LSWC pottery, having a coarse-grained fabric, a striated surface, and decorated shoulders, but below the shoulders the surface was additionally covered with a thin layer of sandy clay, which gave it a coarse texture (Fig. 18: 2). In this way, it resembles early rusticated pottery, which is characterised by the application of an additional layer of clay on a surface that has been previously treated according to the LSWC tradition, i.e. striated and in some cases even decorated (Vengalis 2007, 117). However, there are important differences. In early rusticated pottery, the entire surface of the vessel is covered with an additional layer, and the applied clay mass is fluid and without temper. Whereas the pot from Skudeniai was covered with an additional layer only below the shoulders, not completely, and

Fig. 18. Late Striated Ware Culture pottery with a coarse slipped surface: 1–2 – COP; 3 – FOP. Field numbers: 1 – 155; 2 – 206; 3 – 88. The numbers of the thin-section samples are marked in red. *Photos by R. Vengalis.*
18 pav. VBKK keramika kruopėtu paviršiumi: 1–2 – COP; 3 – FOP. Lauko numeriai: 1 – 155; 2 – 206; 3 – 88. Mikrošlifų mėginių numeriai pažymėti raudonai. *R. Vengalio nuotr.*

the clay mass applied was sandy and dry. A much larger number of sherds with a coarse surface were found in Zone G in the earlier LSWC horizon dated to the end of the 1st millennium BC. Sporadic sherds with a coarse slipped surface also occur among the striated pottery at other LSWC sites in E Lithuania (Vengalis 2007, 124).

In terms of surface treatment, FRP is the most distinctive of the other groups. Its surface is either smoothed or thoroughly burnished (Fig. 14). The intensity of the burnishing varies considerably, but surfaces burnished to a gloss were rare, with poorly burnished pottery predominating. The inner surfaces are usually only smoothed, less often burnished, but the intensity of burnishing is always lower than on the outer surface. Sherd PS18, which is distinguished from the others by its atypical fabric, is also unique in its surface treatment, which is exceptionally carefully burnished to a high gloss. Moreover, both surfaces are free of inclusions, which indicates that a thin layer of liquid clay has been added before burnishing (Fig. 14: 8), which is unusual for the other sherds of the FRP of Skudeniai.

Vessel forms. It is very complicated to reconstruct the shapes of the Skudeniai vessels because of the fragmentation of the pottery. The least information is available on vessel sizes. The diameter of the orifice could only be determined in one case: the COP vessel with a coarse slipped surface, discussed above, had an orifice diameter of about 340 mm and a base diameter of about 300 mm. The base of another COP vessel was 200 mm in diameter (inventory No 207). There was also one small, coarse-grained vessel with a smooth surface and a bottom diameter of 40 mm (inventory No 274).

The size of the vessel usually correlates with the thickness of the walls, so it is only possible to compare the size of the vessels of different groups by comparing their wall thickness. Wall thickeness was measured on 150 sherds of classified wares and

the results show quite clear differences between the pottery groups. The thinnest walls are found in FRP, with a median of 7 mm (n = 19), and all the measured sherds fell in the range of 6–8 mm. The median wall thickness of FOP is also 7 mm (n = 43), but the distribution is wider, ranging from 5 to 9 mm. The median wall thickness of COP was 8 mm (n = 88) and the range was between 6 and 12 mm. Thus, in this respect, COP stands out from the other groups, with slightly thicker vessel walls and presumably larger vessels.

The shapes of the vessels follow the tradition of the LSWC: the pots are bucket-shaped, with straight walls and a widening of the vessel from the base to the orifice. The shoulders are formed 2–5 cm below the orifice and are characterised by a sharp, ridge-forming bend (Grigalavičienė 1995, 210-212). As the shape of the vessels is simple and the walls are straight, the angle between the base and the wall provides information about the proportions of the vessels. The median angle for COP vessels is 107.5° (IQR = 104.8–113°, n = 8), for FOP vessels 110° (106–116°, 5) and for FRP vessels 130° (129–132°, 3). Thus, in this respect, the similarities are greater between COP and FOP, while FRP distinctly differs from them – the latter must have had proportionally wider orifices, thus being more bowl-shaped. However, these figures are not statistically very reliable, as only 16 sherds were suitable for measuring this angle.

The steepness of the ridge at the shoulders also clearly varies between pottery groups. Very slight, obtuse-angled shoulder ridges are characteristic of COP (Fig. 12: 3, 6, 10–13), although some steeper ones occasionally occur (Fig. 12: 8, 9). The shoulders of FRP are much more pronounced and usually rounded. FOP vessels are intermediate between the first two groups, and the steepness of the angle is more variable (Fig. 19). Some authors who have studied the LSWC pottery have pointed out that the steepness of the shoulder ridge may be a chronological indicator (Митрофанов 1978, 32; Grigalavičienė 1995, 212; Vengalis 2009, 54–56), but they did not specify any exact measurements. The graph in Fig. 19 shows that the variation of shoulders is also quite significant in contemporaneous pottery. In order to reliably assess the chronological factor, it would be necessary to compare such data of the Skudeniai pottery with those of the other periods of the LSWC, but no such published data are available so far.

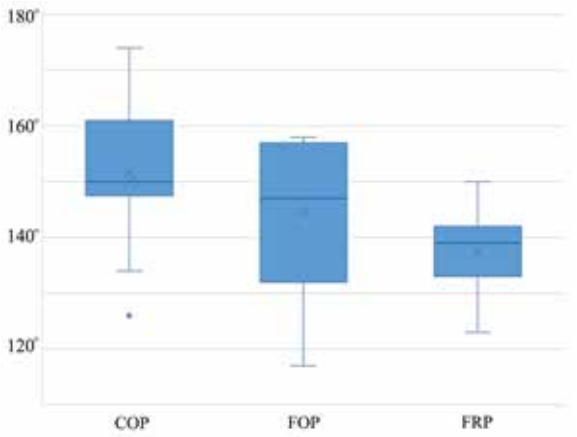

Fig. 19. Variation of the steepness of the ridge at vessel shoulders in different pottery groups. The boxes represent the interquartile range (IQR: Q3–Q1), the central line indicates the median, the whiskers represent Q1 – 1.5 IQR and Q3 + 1.5 QR and the circle represents an outlier. *Drawing by R. Vengalis.*
19 pav. Petelių kampo statumo variacija skirtingose keramikos grupėse. Stačiakampiai žymi tarpkvartilinį intervalą (IQR: Q3–Q1), centrinė linija – medianą, ūsai – intervalą tarp Q1 – 1,5 IQR ir Q3 + 1,5 IQR, taškai – išskirtis. *R. Vengalio brėž.*

Researchers who have classified LSWC pottery have paid much attention to the necks and rims of the vessels (Васкс 1991, 70–72; Медведев 1996, 39–43; Егорейченко 2006, 75). In the case of Skudeniai, it is evident that the shape of the neck is directly related to the steepness of the shoulder ridge – vessels with blunt shoulders tend to have straight necks, while those with more pronounced shoulders have slightly curved outwards necks, so making the rim itself close to vertical. The rims vary, but the flat (some with an outward squeeze) ones are clearly predominant among the COP and FOP vessels, while the rounded ones among the FRP ones.

Decoration is restricted to COP and FOP, while no decorated sherds were found among FRP. As is typical of LSWC pottery, the decoration is restricted to the vessel shoulders. Approximately 80 % of the vessels were decorated and this figure is very similar between COP and FOP. The decorative elements are of only two types: (1) formed by fingers – impressions of fingertips, fingernails and pinches; (2) impressed by a tool – usually an irregularly shaped stamp, possibly the end of a bird's long bone (Fig. 12: 4, 6, 10, 11, 14). There are only a few cases of regular circular impressions, probably made with a flat-ended wooden stick (Fig. 13: 9). Finger-formed elements are more frequent than tool-impressed ones, occurring on 63 % of the COP and 76 % of the FOP decorated vessels. Design motifs are very simple and in all cases consist of only one type of element. The tool impressions are always arranged in a single row on the shoulder of the vessel. The finger-formed elements are slightly more varied, with vertical, horizontal, diagonal or herringbone-shaped arrangements, in one case twisted (Fig. 13: 12), only the nail impressions are always vertical (Figs. 12–13). However, even in these cases, only one type of element is used per vessel, and almost always in a single row on the shoulders. The only exception is the three FOP sherds, one of which has a two-row composition, while the other two have additional zonal or vertical compositions below the shoulders (Fig. 13: 3, 4, 16).

Pottery from other periods. In addition to the main complex, pottery from other periods was also found, but it is remarkable that the finds from different periods were not intermixed and were found in different contexts. Finds from a period earlier than the main complex were found in the lower archaeological layer of Zone G. According to the ^{14}C dates, this occupational horizon is dated to the 2nd–1st centuries BC, and is therefore, similarly to the main complex, assigned to the LSWC. Approximately 400 potsherds were found in this layer. Pottery is typologically identical to the main complex, and the same pottery groups are distinguishable. The main difference observed is that in the lower layer as many as 25% of the COP sherds had a coarse slipped surface (Fig. 20: 1). These sherds were also distinctive for their thick walls (12–14 mm). One sherd was examined petrographically (PM19), indicating that this pottery may also have differed in its fabrics.

Several sherds from a later period than the main complex have also been found. 13 sherds of early rusticated pottery were identified (Fig. 20: 2), which are typologically dated to the 3rd-4th century AD (Vengalis 2007). Nine of these were found in Zone F, in paired postholes 68 and 69.

Possibly imported pottery. Several sherds are uncharacteristic of pottery from any period in E Lithuania (Fig. 20: 3-11), suggesting that they are contemporaneous with the main complex, but originating from other regions. The profile of one of them (Fig. 20: 4) is very characteristic of the pottery of the Bogaczewo culture (Szymański 2000). Such pottery is also occasionally found in Trans-Nemunas region (Grižas, Bitner-Wróblewska 2007). A few sherds with incised wavy line decorations (Fig. 20: 7–8) are somewhat reminiscent of the wheel-turned pottery of the 1st half of the 2nd millenium AD, but they are hand-made and their late dating is excluded by the locations of the finds in the sunken features and in the lower archaeological layer of Zone G. One other sherd was possibly wheel-turned (Fig. 20: 10). It is also distinctive for its inward-curved neck and its unusual rim formation. The rim was flattened, then folded back and pinched again.

To summarise, we can see that three main groups can be clearly distinguished in the Skudeniai pottery collection. COP differs from FRP in a very significant way, and it is more difficult to find similarities between them than differences. Meanwhile, FOP tends to take an intermediate position between the first two groups, in some respects being more similar to COP and in others to FRP. Previous researchers of the LSWC pottery, not paying enough attention to

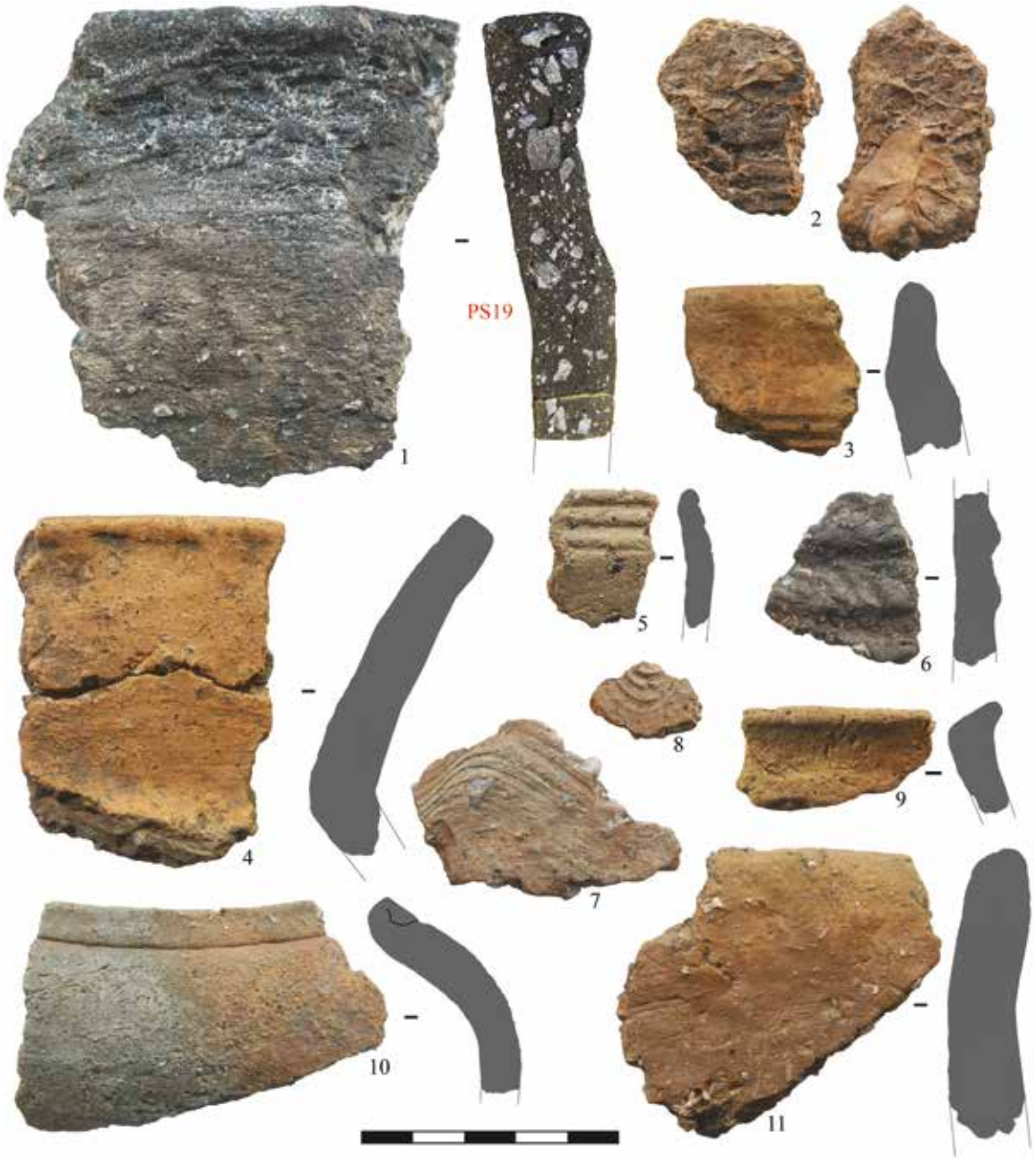

Fig. 20. Pottery from the first (1) and third (2) phases of occupation and possibly imported pottery (3–11). Field numbers: 1 – 296; 2 – 68; 3 – 83; 4 – 106; 5 – 278; 6 – 298; 7 – 288; 8 – 305; 9 – 219; 10 – 293; 11 – 107. The numbers of the thin-section samples are marked in red. *Photos by R. Vengalis.*

20 pav. Pirmo (1) ir trečio (2) apgyvenimo etapų keramika ir galimai importinė keramika (3–11). Lauko numeriai: 1 – 296; 2 – 68; 3 – 83; 4 – 106; 5 – 278; 6 – 298; 7 – 288; 8 – 305; 9 – 219; 10 – 293; 11 – 107. Mikrošlifų mėginių numeriai pažymėti raudonai. *R. Vengalio nuotr.*

the analysis of the pottery fabric, did not notice the differences between COP and FOP, but the analysis presented here has shown that these groups differ significantly. Even without detailed analysis of pottery from other settlements, it is now evident that these pottery groups are clearly distinguishable not only in Skudeniai, but also in any pottery collection from all the LSWC settlements.

It is almost clear that the differences between these three contemporaneous pottery groups are related to the functions of the vessels. Social factors are unlikely to be involved here, since the different settlement areas have similar proportions of these groups. The main function of the COP must have been cooking. Although this pottery appears to be cruder in appearance, and from our subjective point of view may seem to have been made with less effort or by a less skilled potter, the opposite is actually true: the moulding of a vessel from a coarse-grained fabric can often be more difficult than from a fine-grained one. The coarse temper, higher porosity and low firing characteristic to COP are properties that drastically increase a pot's resistance to thermal shock caused by the temperature differences between the inner and outer surfaces during cooking (Skibo 2013, 51–53, 102–103). The dominance of COP in the archaeological collection is most likely due to the shorter life span of these pots, which led to their more frequent replacement, rather than the greater number of vessels used at one time. The vessels of the FOP and FRP groups can be considered as tableware, but special studies are needed to identify their functions in more detail.

The petrographic analysis of the pottery showed that the vessels of the different groups, although different in appearance, were made by the same community, according to the same traditions of clay preparation. This analysis has also allowed the identification of vessels made in the different traditions. The fabric of the coarse slipped vessel (PS19) shows the differences between pottery from different chronologies, while the FRP vessel (PS18), which is contemporary with the main assemblage, must have been made by a member of another community.

OTHER FINDS

Other finds at Skudeniai are significantly fewer than pottery. Important finds are crucibles used for non-ferrous metallurgy, of which one intact and 14 fragments were found. They have a heavily vitrified outer surface with a red (Fig. 21: 1–3) or light grey (Fig. 21: 4–5) shade. The grey crucibles usually have a smaller wall thickness of 5–6 mm, whereas the red crucibles range from 7 to 14 mm thick. This may reflect their different function. The intact crucible was deformed by heat, cylindrical, round-bottomed, 42 mm in diameter and 40 mm high (Fig. 21: 1). The diameter of the orifice was 18 mm and the volume was estimated to be only approximately 6.5 ml. The diameters of the orifices of the fragmentary crucibles can only be approximated and appear to be similar to that of the intact crucible.

Apart from the crucibles, only one other find, definitely related to non-ferrous metallurgy, was recovered – a tiny 6x6 mm copper alloy droplet. Such droplets are usually lost during metal casting. Due to the preciousness of the metal, efforts had to be made to collect them, but they could not always be found, which is why some of them ended up in an archaeological context. It is a *de facto refuse*, i.e. a lost item rather than a discarded one. Such small droplets are evidence that metal casting took place at the exact place where they were found. In contrast, the crucible fragments are useless waste and are intentionally discarded. Thus they may be disposed at different place than where they were used (Vengalis 2010, 81–82).

Another find, only potentially related to metal-casting activities, is a copper alloy stick. It is rectangular in cross-section (4x4 mm), 42 mm

long, with both sides broken off. It could either be a preform or semi-finished product that has been cast at this place, or a wreckage of a finished product ready to be remelted.

All the non-ferrous metallurgy-related finds were found in a compact area within 8 m radius around Feature 1 and inside it. The area is located in Zone E, next to the building on its E side. It is likely that this location was a workplace of a jeweller. Such a clear accumulation of these finds suggests that a specific zone was dedicated to metalworking (or several zones, which may have been located outside the excavated area). However, the small number of finds related to casting does not confirm that metalworking was carried out here for an extended period of time, and may indicate only a single episode of activity.

Apart from the two copper alloy finds mentioned above, no other non-ferrous metal items were found. There were only 3 iron finds, all fragments of unidentifiable artifacts. It is not even clear whether these are really archaeological finds. They may be of recent date, as there were also isolated sherds of 19th–20th century pottery in the archaeological layer.

Fig. 21. Crucible finds. Field numbers: 1 – 46; 2 – 48; 3 – 47; 4 – 53; 5 – 18. *Photos by R. Vengalis.*
21 pav. Tiglių radiniai. *R. Vengalio nuotr.*

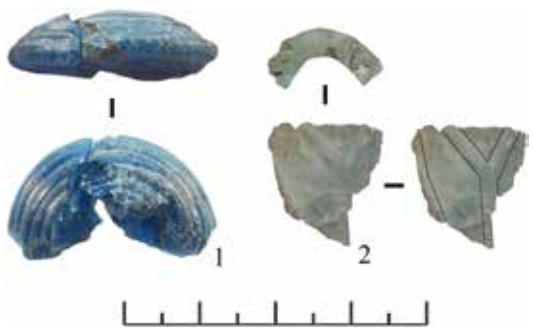

Fig. 22. Glass finds. Field numbers: 1 – 75; 2 – 33. *Photos by R. Vengalis.*
22 pav. Stiklo radiniai. *R. Vengalio nuotr.*

Exceptional are 2 glass finds, which are very rarely found in the material of Lithuanian RIA settlements. The first is a spiral bead, made of translucent blue glass, 29 mm in diameter and 8 mm high (Fig. 22: 1). Typologically, the bead belongs to type 186 of group TM XIX, which dates from periods B2 and C1. The beads of this type are most abundantly found in the Wielbark Culture region and are quite rare elsewhere (Tempelmann-Maczyńska 1985, 45–47). In Lithuania, a similar bead, only green, was found in the Baitai burial site, Klaipėda district (Banytė-Rowell 2000, Fig. 5). Another glass find in Skudeniai is most likely a fragment of a flask or unguentarium neck. Unfortunately, the fragment is too small to be reliably identified. It is only possible to say that it is made of white opaque glass, with an embossed decoration of uncertain design, and that the diameter of the neck

must have been approximately 18 mm (Fig. 22: 2). Glass containers are extremely rare in Lithuanian RIA settlements. Only 3 finds have been known so far: two in Semeniškiai 2 (Лухтанас 2001, 25–26; Vengalis 2006, 60) and one in Bakšiai (Steponaitis 1996) settlements. In Skudeniai, a fragment of a flask was found in Zone E, a bead in Zone D. Both finds were found close to the buildings.

A total of 72 flint finds were collected in the excavated area. These are predominantly flakes made of local Baltic erratic small-sized flint pebbles (n = 71). Some flakes showed indications of bipolar percussion. Only one flint can be classified as an irregular blade. There were no retouched tools. Six flakes were overheated. The flint finds at Skudeniai were scattered evenly throughout the archaeological layer and did not form any distinct accumulations. The low number of flint finds and the absence of retouched tools at Skudeniai confirm that the flint working industry was already completely degraded at the beginning of the Common Era and its importance was minimal.

Only 3 stone tools were found – two intact polishers and one fragment. The polishers were made of sandstone and the intact ones measure 95x55x49 and 77x64x36 mm (386 and 277 g). They fit comfortably in the hand and have one flat polished plane. They were found in the E part of the settlement, one in Zone F and two in Zone G.

Bone material was better preserved only in Zone A. Here, 2 bone finds with signs of processing were found. One was a blade fragment of a small scraper-type tool made of sheep/goat long bone, the other was a fragment of an unidentifiable tool.

Clay plaster was relatively scarce in the excavated area, with 186 pieces (530 g) collected. These pieces are small, with no primary faces preserved. Almost all of the clay plaster (~85%) was found in a single location, in a 5 m diameter area in Zone D, coinciding with the accumulation of pottery (Fig. 8). Beyond this area, only isolated pieces of clay plaster were found in the whole excavated area.

Overheated stones of 5–20 cm in diameter were present in the archaeological layer, but the amount varied considerably from zone to zone. Zones A, B and E were almost devoid of stones. In Zone D, a small number of stones were found, but they were accumulated only in the 3 m diameter area, the same place where the pottery and clay plaster were most abundant. In contrast, both archaeological layers in Zone G were especially rich in stones, with as many as several dozen per square metre. Here, the stones were accumulated near the shore of the former lake, while in the deepest part they were almost absent.

ARCHAEOBOTANICAL DATA

19 soil samples ranging from 10 to 25 litres (328 l in total) were collected for archaeobotanical analysis. The samples were taken following a sampling strategy described as *probabilistic sampling* (d'Alpoim Guedes and Spengler 2014), from sunken features with organic-rich deposits. 7 and 6 samples were taken from Zones D and E respectively, 1–2 samples from each Zone A, B, C and F, and Zone G was not sampled. Samples were processed using machine-assisted flotation tank powered by municipal water supply. The floating fraction was collected using steel sieves with mesh size of 300 μm. Heavy fraction and small artefacts were retrieved using glass-fibre net with 1.4 mm aperture. Dried material was sorted and examined under a binocular microscope with x10 to x120 magnification. Plant macrofossils were identified using botanical atlases and identification keys (Grigas 1986; Latałowa 1999; Cappers *et al.* 2012; Neef *et al.* 2012), and comparative collections of fossil and modern plants. Archaeobotanical taxonomy is given according to Zohary *et al.* (2012).

The samples contained 526 charred plant macrofossils (Table 3). The majority of these were cultivated plants (78%, n=411), which were absent only in Feature 74. The identified crops belong to 5 taxa – *Hordeum vulgare*, *Panicum miliaceum*,

Sample		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Settlement zone		E	E	E	E	E	E	F	A	A	B	C	C	D	D	D	D	D	D	D
Feature		1	12	14	17	18	19	69	85	84	74	77	78	32	33	35	38	39	40	41
Sample volume (l)		25	20	20	20	20	20	10	20	20	20	10	10	20	20	20	20	11	10	12
Taxon	Type of remains																			
Cultivated plants																				
cf. *Avena* sp.	grain fr.	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Hordeum vulgare var. *vulgare*	grain	-	-	-	-	-	-	-	-	-	-	18	-	2	3	-	-	-	3	5
Hordeum vulgare L.	grain	7	4	6	3	4	8	2	29	13	-	15	4	5	3	-	9	1	5	4
Hordeum/Triticum sp.	grain fr.	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Panicum miliaceum L.	grain	-	-	-	1	1	-	1	-	-	-	4	-	-	1	-	1	-	1	-
Pisum sativum L.	seed	1	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
cf. *Pisum sativum* L.	seed fr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Secale cereale L.	grain	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cf. *Secale cereale* L.	grain fr.	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-
Triticum dicoccon Schrank ex Schübl.	grain	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2	-	-	-	-
Triticum dicoccon Schrank ex Schübl.	glume base fr.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Triticum cf. *spelta* L.	grain	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Triticum sp. (hulled)	grain	2	2	-	-	-	-	-	-	-	-	2	1	-	-	-	1	-	2	-
Triticum sp.	grain	-	-	-	-	-	-	-	-	-	-	3	-	-	1	-	-	-	-	-
cf. *Triticum* sp.	grain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Cerealia	grain fr.	4	5	13	3	2	15	4	19	11	-	65	4	9	21	5	7	5	6	10
Fabaceae (cultivated)	seed fr.	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	2	-
Wild plants																				
cf. *Carex* sp.	fruit	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Chenopodium album L.*	seed	-	-	-	-	10	49	2	2	-	-	3	-	-	-	-	-	-	-	-
Corylus avellana L.	shell fr.	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-
Galium mollugo L.*	fruit	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Fallopia convolvulus L.*	fruit	2	-	4	1	3	-	-	1	2	-	4	-	-	1	-	-	-	-	-
Persicaria lapathifolia L.*	fruit	-	-	1	-	-	-	-	1	-	-	2	-	1	3	-	1	-	-	-
Polygonum aviculare L.*	fruit	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rubiaceae	fr.	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Thlaspi arvense L.*	seed	2	1	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Vicia cf. *cracca* L.*	seed	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neapibūdinta	fr.	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	1	-	1	-

Table 3. Charred plant macrofossils from Skudeniai settlement. * marks weed/ruderal taxa.
3 lentelė. Degusios augalų makroliekanos iš Skudenių gyvenvietės. Žvaigždute pažymėtos piktžolėms/ruderalams priskirtinos augalų rūšys.

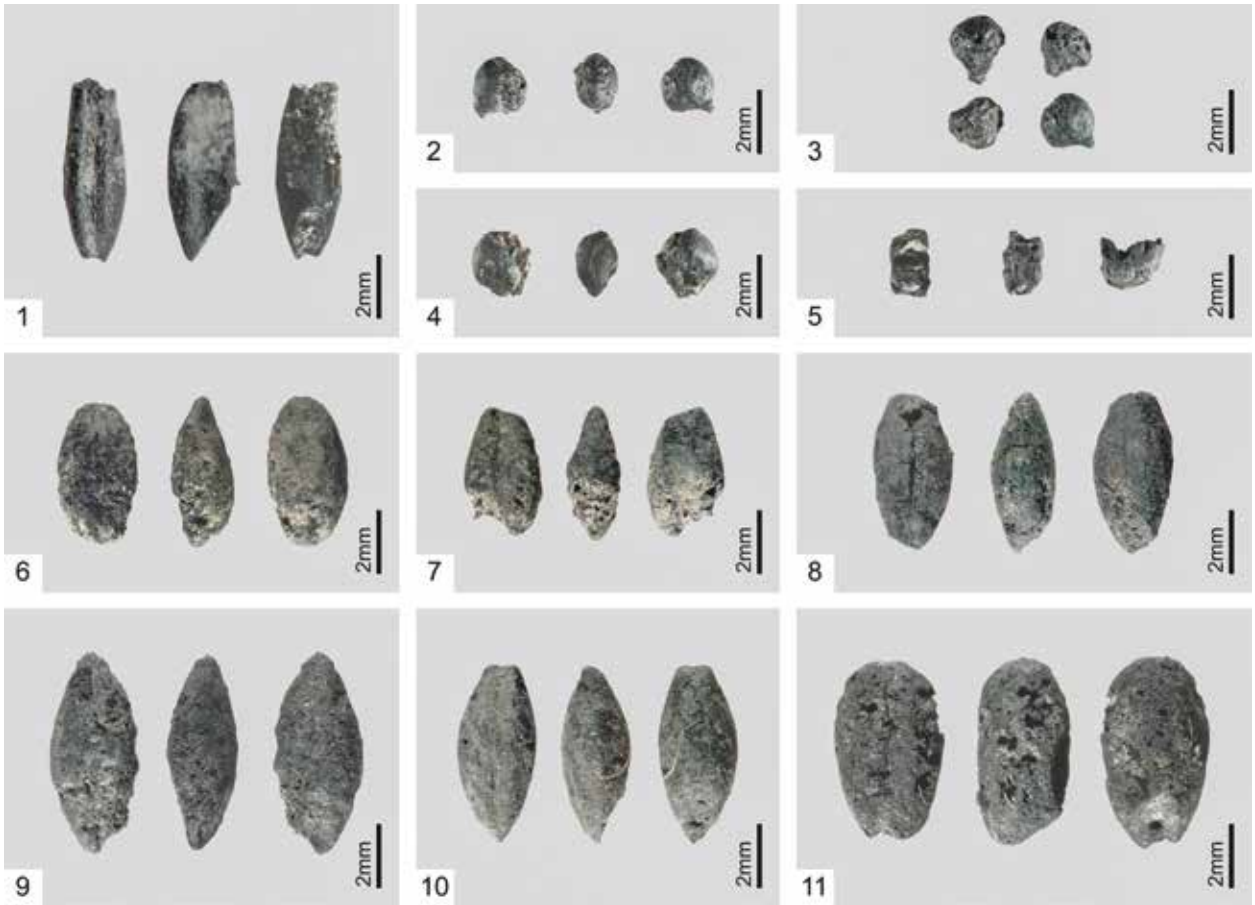

Fig. 23. Charred plant macrofossils from Skudeniai settlement: 1 – Secale cereale (rye) grain; 2–4 Panicum miliaceum (broomcorn millet) grains; 5 – Triticum dicoccon (emmer) glume base fragment; 6–10 – Hordeum vulgare var. vulgare (hulled barley) grains; 11 – Triticum cf. spelta (spelt) grain. *Photos by K. Minkevičius.*
23 pav. Degusios augalų makroliekanos iš Skudenių gyvenvietės: 1 – *Secale cereale* (sėjamojo rugio) grūdas; 2–4 *Panicum miliaceum* (tikrosios soros) grūdai; 5 – *Triticum dicoccon* (dvigrūdžio kviečio) varpažvynio fragmentas; 6–10 – *Hordeum vulgare* var. *vulgare* (lukštinio paprastojo miežio) grūdai; 11 – *Triticum* cf. *spelta* (speltos) grūdas. *K. Minkevičiaus nuotr.*

Pisum sativum, *Secale cereale* and *Triticum dicoccon* (Fig. 23). Samples are predominated by cereals, with legumes making up only a minor fraction (2%, n=8). Barley grains constitute the majority of cereals (82%, n=153). One *Hordeum* variety, *H. vulgare* var. *vulgare* was identified (20%, n=31). Broomcorn millet (5%, n=10), rye (1%, n=2) and wheat (11%, n=21) were found in significantly lower numbers. Part of the wheat macrofossils (23%, n=5) belong to *Tr. dicoccon*. The rest probably also belong to the hulled species (*Tr. dicoccon/spelta*).

The majority of the wild plant macrofossils found in the samples were classified as weeds and/or ruderal species (20%, n=105). Seven taxa belonging to this group were identified: *Chenopodium album*, *Galium mollugo*, *Fallopia convolvulus*, *Persicaria lapathifolia*, *Polygonum aviculare*, *Thlaspi arvense* and *Vicia cracca*. *Chenopodium album* (63%, n=66) and *Fallopia convolvulus* (17.14%, n=18) were predominant among them. However, only the seeds of *Thlaspi arvense* (6%, n=6) can be considered a more reliable indicator of environmental conditions. It prefers clay-rich soils

Species/bone	Cranium	Mandible	Teeth	Vertebrae	Radius	Pelvis	Femur	Tibia	Fibula	Phalanges	Long bone	Total	Total, %	Total, NISP, %	MNI	MNI, %
Cattle (*Bos taurus*)		2			1	1	1	2				7	14,3	35,0	1	25,0
Sheep/goat (*Ovis aries/Capra hircus*)			2		1		1	2		1	1	8	16,3	40,0	2	50,0
Pig (*Sus scrofa domesticus*)	1		2	1					1			5	10,2	25,0	1	25,0
Total	1	2	4	1	2	1	2	4	1	1	1	20	40,8		4	
Total, %	5,0	10,0	20,0	5,0	10,0	5,0	10,0	20,0	5,0	5,0	5,0			100,0		100,0
Large ungulate												4	8,2			
Small ungulate												9	18,4			
Undetermined												16	32,7			
Analysed in total												49	100,0			

Table 4. Animal bones from the Skudeniai settlement.
4 lentelė. Zooarcheologinės analizės rezultatai.

which may indicate the availability of heavier loams in the surrounding area, as is the case in Skudeniai. All of the wild taxa are fairly reliably associated with human habitation and/or economic activity, but the narrow taxonomic diversity provides very little information about the environmental conditions of the site.

ZOOARCHAEOLOGICAL DATA

Only 49 fragments of animal bones have been found in Skudeniai. Almost all specimens (45 pieces) were collected from Features 83–86 in Zone A, where the level of their preservation was quite good. In Zones B and E only 4 fragments were found, and in Zone G, with a thick and waterlogged archaeological layer, none were discovered. This distribution of bone material is undoubtedly not an unbiased reflection of the depositional processes that took place in the settlement, but is due to the unfavourable environment for the preservation of bone material.

The bones were identified using the reference collection of the Zooarchaeology Laboratory of Vilnius University. Age of the animals has been estimated on the base of teeth eruption and epiphyseal fusion by S. Silver (1969). The minimum number of individuals (MNI) was determined by applying White's methodology (1953).

Most of the bone finds were small fragments weighing 0.1–5 g, with only a few ones weighing 10–20 g. Eight of the bones were calcined. Most of the bone fragments show butchering marks, and a few were gnawed by animals. Out of the 49 analysed animal bone fragments, 20 (40.8 %) were identified to the species level (including sheep/goat). All identified specimens belonged to domestic animals, at least three species: cattle, sheep and/or goat and pig. Seven bone fragments were attributed to cattle, at least one adult individual. Eight bone and teeth fragments belonged to at least two sheeps and/or goats. One of these individuals was about 1.5 years old and the other was over 3 years old. Five bone fragments belonged to at least one pig. A recently erupted molar (M_2) belonged to a pig aged 12–16 months. 29 small bone fragments could not be identified to species level, but at least nine belonged to small ungulates and at least four to large ungulates (Table 4).

No.	Settlement zone	Context	Sample	Lab. code	^{14}C date BP	^{14}C date cal BC/AD (95.4 %)	δ13C, ‰ (SD=±0.15 ‰)	δ15N, ‰ (SD=±0.2 ‰)
1	G	archaeological layer	saturated wood (oak branch, last tree-ring)	FTMC-DG81-2	2153 ± 27	353–57 BC	-	-
2	G	archaeological layer	foodcrust from potsherd No. 296	FTMC-DG81-1	2071 ± 27	169 BC – 8 AD	-28,63	6,9
3	A	Feature 85	charred *Hordeum vulgare* grain	FTMC-UU26-5	1816 ± 26	131–329 AD	-	-
4	D	Feature 32	charred *Cerealia* grain	FTMC-UU26-6	1856 ± 25	125–239 AD	-	-
5	D	Feature 40	charred *Triticum* sp. (hulled) grain	FTMC-UU26-7	1867 ± 26	120–238 AD	-	-
6	E	Feature 1	charred *Triticum* sp. (hulled) grain	FTMC-UU26-4	1842 ± 26	125–248 AD	-	-
7	F	Feature 69	charred *Cerealia* grain	FTMC-DG81-3	1885 ± 27	81–232 AD	-	-

Table 5. AMS ^{14}C dates from the Skudeniai settlement.
5 lentelė. Skudenių AMS ^{14}C datos.

CHRONOLOGY

The stratigraphy and pottery typology allow us to identify three phases of occupation in the Skudeniai settlement. Two archaeological layers separated by a sterile interbed of lacustrine clay were distinguished in Zone G, indicating that there was a time gap between these phases of occupation. The pottery from these two occupation phases is typologically homogeneous and is clearly attributable to the LSWC. The third phase of occupation provided only very fragmentary traces within the excavated area: two postholes in Zone F yielded rusticated pottery attributed to the ELBC.

The chronology of these phases of occupation was refined by AMS ^{14}C. The dating was carried out at the Mass Spectrometry Laboratory of the Centre for Physical and Technological Sciences in Vilnius. The standard acid-alkali-acid (AAA) pre-treatment was used for all samples. The resulting dates were calibrated with OxCal v4.4.4 software and the IntCal20 atmospheric curve (Bronk Ramsey 2009; Reimer *et al*. 2020). The calibrated dates are presented at 95.4% probability. A total of 7 dates were obtained (Table 5).

Two samples for ^{14}C dating were collected from the lower cultural layer in Zone G to determine the chronology of the earliest phase of occupation (Table 5). The first sample was obtained from a massive oak branch lying in the base of the layer. The wood was saturated, very well preserved, with intact bark and without traces of woodworking. The last tree-ring was dated, which provided a date of 353–57 cal BC. A second sample was taken from the foodcrust from a massive potsherd with a coarse slipped surface (No. 296). The date obtained is 169 cal BC – 8 cal AD. Stable isotope measurements were carried out to assess the likelihood of a freshwater reservoir effect.

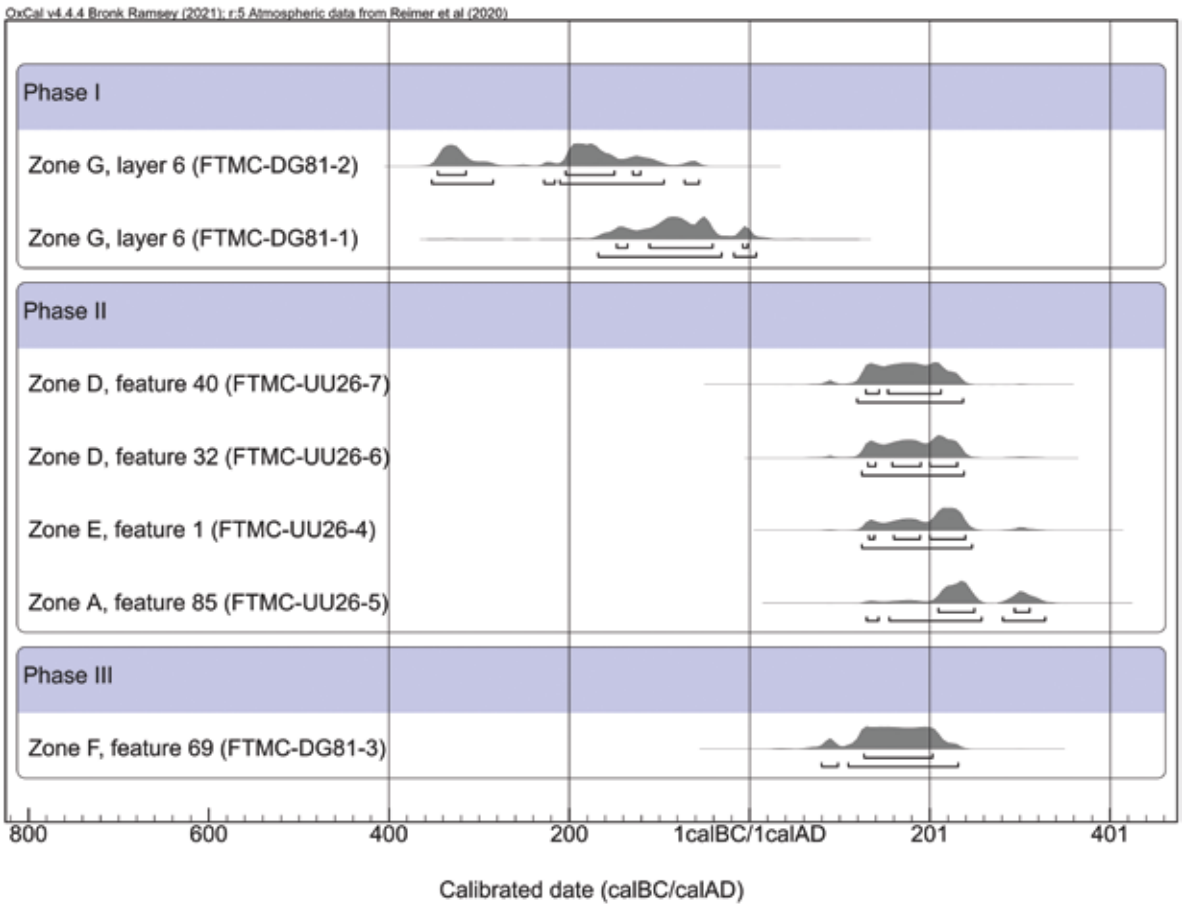

Fig. 24. Calibration plot of AMS ^{14}C dates from Skudeniai.
24 pav. Skudenių gyvenvietės kalibruotos AMS ^{14}C datos.

However, the δ^{15}N value of 6.9‰ is considered to be a threshold value between terrestrial and freshwater food and does not resolve this issue. Nevertheless, considering the context and comparing with the first date, we would suggest that the probability of a freshwater reservoir effect for this date is very low. Thus, the chronology of the earliest phase of occupation can be defined as ca. 170–60 cal BC, i. e. the interval covered by both of these dates (Figure 24).

Four ^{14}C dates from zones A, D and E were obtained to define the second, main phase of occupation (Fig. 5). All these samples were charred grains from sunken features (Table 5). The resulting dates can be considered statistically equivalent, as they all fall within the plateau of the calibration curve covering ca. 130–240 cal AD. Only one date, obtained from the sample from Zone A, also includes an inversion of the curve at ca. 280–330 cal AD (Fig. 24). However, this part of the calibrated date range can be discarded as it is already within the ELBC period. Thus, it is evident that the separate areas of the archaeological layer in Zones A–E are either contemporaneous or chronologically very close. The distribution of sunken features and finds, as well as the ^{14}C dates, indicate that these areas were formed during a single phase of occupation and are not the result of the intermixing of several phases. Although no dates were taken from the upper archaeological layer in Zone G, there is no reason to doubt that the latter is contemporaneous with the occupation phase of Zones A–E.

The third phase of occupation was dated by a charred grain found in a posthole in Zone F. This posthole contained 7 sherds of rusticated pottery and 9 small unidentifiable sherds, while no pottery with a striated surface was present. The dating of this phase is important not only in the context of the Skudeniai settlement, but also in the framework of the whole region of E Lithuania, as it marks the change of pottery from striated to rusticated ware, and at the same time, the termination of the LSWC and the emergence of the ELBC. The resulting date, 81–232 cal AD, falls essentially within the same plateau of the calibrationn curve as the dates of the second phase of occupation (Fig. 24). The earliness of the date may cast doubt on the possibility that grain from the second phase of occupation may have been deposited into the posthole. However, we would consider this unlikely, as only sporadic finds of striated pottery have been found in the postholes in this zone, suggesting that a substantial archaeological layer did not form here during the second phase of occupation. The reliability of the date is also enhanced by the fact that a very similar date, undoubtedly related to the rusticated pottery, has been obtained from the Semeniškiai 1 settlement in the Kernavė microregion. There, a charcoal from a compact pile of rusticated pottery sherds was dated. The date obtained is almost identical to that of Skudeniai – 1855±30 BP; 89–245 cal AD (Poz-95527) (Vėlius 2018). Thus, the plateau in the calibration curve allows the emergence of rusticated pottery to be dated quite broadly, only within the range ca. 130–230 cal AD. However, it would probably not be mistaken to argue that it must have occurred at the latter part of this interval.

SETTLEMENT STRUCTURE

Very little is known today about the structure of the unenclosed settlements of the LSWC. The only statements in the literature about these settlements are that the farmsteads were most likely scattered in a dispersed pattern, spaced quite far apart (up to 500 m) from each other (Vengalis 2009, 167; Vengalis 2016, 179). Such conclusions are based on the material from the Kernavė microregion (Kernavė, Semeniškiai 1 and 2 settlement sites), where pottery from this period is found in discrete accumulations of approximately 50 m in diameter (Vengalis 2012, 187–190). Until now, nothing more could be said, as all the other extensively excavated settlement sites revealed intermixed material from different periods in the same stratum. In such cases it is very difficult, if not impossible, to distinguish between sunken features of different periods. In contrast, the material from the Skudeniai settlement site, which almost entirely belongs to one short period between ca. 130 and 230 cal AD, provides a better understanding of the structure of the RIA settlements and is therefore of particular importance.

The areals of the unploughed archaeological layer preserved in the excavated area clearly correlate with the three major buildings in Zones B, D and E. This indicates that the most intensive activities (at least those that provide archaeological traces) were carried out in vicinity of these buildings. The only finds that could identify any specific activity were found in Zone E, namely crucibles and metal finds related to non-ferrous metallurgy. Apart from these finds, the archaeological layer contained almost exclusively pottery. The quantity of finds in the surviving unploughed layer is small and fairly constant, averaging 2–6 items per square metre, suggesting that waste was removed from these areas. This interpretation would also be supported by archaeobotanical assembleges from Zones D and E. Their composition is very uniform, with the majority of the identified plant remains consisting of charred crop macrofossils, while relatively few weeds and chaff fragments were found. Higher quantities of weeds are only evident in the two samples from Features 18 (67%, n=16) and 19 (65%, n=51) in Zone E

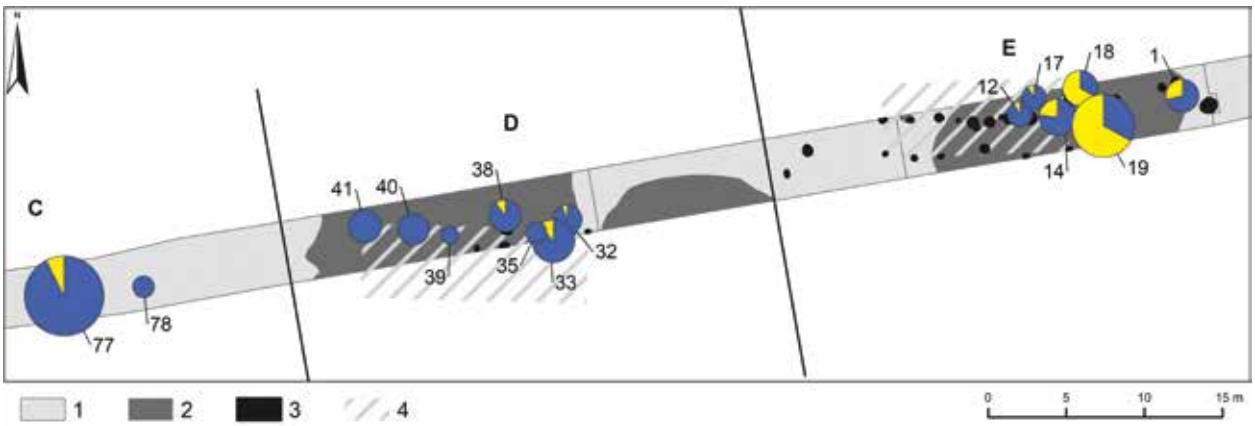

Fig. 25. Proportion of crop and weed/ruderal macrofossils in samples. Crops marked in blue, weeds/ruderals in yellow. Feature numbers are marked; size of diagrams is proportional to the total amount of macrofossils (min – 6; max – 122). 1 – excavated area; 2 – unploughed archaeological layer; 3 – sunken features; 4 – locations of possible dwellings. *Drawing by R. Vengalis.*
25 pav. Kultūrinių augalų ir piktžolių/ruderalų makroliekanų kiekio mėginiuose santykis. Mėlyna – kultūriniai augalai, geltona – piktžolės/ruderalai. Pažymėti objektų numeriai; diagramų dydis proporcingas bendram makroliekanų kiekiui (min – 6; max – 122). 1 – tirtas plotas; 2 – nesuartas archeologinis sluoksnis; 3 – įgilinti objektai; 4 – spėjamos pastatų vietos. *R. Vengalio brėž.*

(Fig. 25). These features, i.e. pits of undetermined function, are located on the exterior of the building. The low count of plant macrofossils coupled with the lack of crop processing waste suggests that this area was not used for refuse disposal. It is thus most likely that the plant remains came here directly from the surroundings and therefore reflect the immediate vegetation on the exterior of the building.

Plant macrofossils found in the postholes of the buildings suggest that Zones D and E were closely linked to the domestic activities. While large accumulations of plant remains could indicate different activity areas, such as refuse disposal, storage or residential zones, a lack of weeds and chaff is usually indicative of food products that have already been cleaned and prepared for consumption. These are likely to be deposited into the archaeological context as a result of cooking or other daily activities (Fuller *et al.* 2014). Routine activity is also suggested by the low overall macrofossil density. It reaches 0–2.2 n/l and could therefore be attributed to *primary refuse* of food preparation. Higher densities, usually more than 100 n/l, could indicate that the material analysed is *de facto* refuse generated by fire or other disaster (Grabowski 2020). In addition, the abundance of crop remains in building postholes may also be related to the maintenance activities. Thus, both the archaeobotanical data and other finds indicate that the formation of the archaeological layer in Zones D and E was most likely caused by the cooking activities typical for the residential area. The finds from Zone B are less convincing in this respect, as only the very edge of the areal of archaeological layer was excavated. However, the similarity of the context to these in Zones D and E (density of finds and the accumulation of postholes) suggests that Zone B also can be interpreted as the residential area with a building. In conclusion, we believe that these three buildings can be interpreted as dwellings, although their forms are not precisely identified and no traces of hearths were found. The hearths may have remained beyond the excavated area, or they may have not survived if they were situated in the higher horizon that has been ploughed.

Among these residential areas, the area with a high density of finds stands out in Zone D. It is

highly clustered, approximately 4 m in diameter (Fig. 8). Potsherds, clay plaster and overheated stones were much more abundant here than elsewhere. The potsherds clearly belong to different vessels, they do not refit, are no larger than in other places, and their post-depositional wear is quite variable. These attributes make the assemblage most reminiscent of *secondary refuse*, i.e. sherds of elsewhere broken vessels were piled up here together with other refuse. This place can therefore be interpreted as a refuse disposal area. However, the postholes suggest that this was the location of the dwelling. The site of the dwelling is unlikely to have generated such an accumulation of refuse during its use, but after the abandonment of the dwelling, its ruins may have been used for waste disposal (cf. Vengalis 2010, 79–80). The possibility that the refuse disposal area and the dwelling are not contemporaneous is further supported by archaeobotanical data. Composition of posthole fills within the area are similar to the ones from the outside, indicating similar routine activities in their vicinity (Fig. 25). It can therefore be assumed that the archaeobotanical material from the postholes reflects an earlier phase, i.e. the occupation of the dwelling, rather than that after the transformation of this place into a refuse disposal area.

Zone G on the E margin of the settlement should be interpreted as the settlement's water supply site. As mentioned before, lacustrine sediments have been detected in this area, indicating the presence of a small lake. It was the nearest and most easily accessible source of water, so there is no reason to doubt that this would have been used for the needs of the settlement. The significance of this site is also reflected in the fact that the chronology of the finds in this zone, as well as in the adjacent Zone F, is broader than that of the finds in Zones A–E. This suggests that the location of the residential area has shifted over time, while the water supply site has remained the same. There are also some differences in the formation of the archaeological context between the different phases of occupation. Significant number of potsherds in the lower archaeological layer were relatively large (20–80 g) and their distribution pattern was highly clustered. These characteristics suggest that this layer was formed as a context of *primary refuse*, with sherds found here having been abandoned at the locations where the vessels broke. This nature of the refuse can be linked to the activities characteristic of the water supply site. If the vessels were washed and filled up with water here, some of them could have been broken accidently. The pottery from the upper archaeological layer, on the other hand, was highly fragmented and the sherds were scattered, thus it is more reminiscent of *secondary refuse*. Overheated stones are also to be considered as *secondary refuse*, as they must have been deposited here after being collected elsewhere. Therefore, it seems that a refuse disposal area may have also formed at the location of the water supply site during the second phase of occupation.

Zone F also clearly differs from residential areas in Zones B, D and E. There was no archaeological layer detected here, and the small-diameter postholes probably indicate the location of lightweight ancillary buildings or shelters (Fig. 10). The activities that took place here did not result in the formation of a substantial archaeological layer, but they did cause erosive processes, which are indicated by the accumulation of delluvium deposit in Zone G. Zone F could be hypothetically linked to husbandry, since livestock need a lot of water and logically could be kept close to the water source.

Features 82–86, located in the E part of Zone A, are most likely to be linked to the homestead of Zone B (Fig. 10). The pottery and animal bones deposited in the fillings of these pits are considered to be *secondary refuse* typical of refuse disposal zones. The archaeobotanical samples collected here are clearly dominated by crop remains (89–92 %) belonging to a single taxon – barley. The assemblage could be related to the residential area, or the refuse generated by maintenance of the dwelling space. However, it

is unclear whether single crop species is more likely to indicate routine or episodic activities. While the primary purpose of the pits remains uncertain, it is likely that these were subsequently filled with waste from the dwelling space generated by food processing and/or consumption.

Zone C showed very scarce archaeological traces, with only two postholes and no evidence of an archaeological layer (Fig. 5). It could be assumed that this may be an open space between two residential areas, where no intensive archaeological layer-forming activities have taken place. However, this interpretation is contradicted by the material from Features 77–78. A high count of charred plant macrofossils were found in the posthole fills. The majority of these belong to cultivated plants (Fig. 25). This suggests the presence of human activity in the area despite that fact that its nature is obscured by the absence of surviving archaeological layer. Nevertheless, high taxonomic diversity could provide some further insights. For example, this could be caused by depositional and post-depositional intermixing usually associated with storage space (Kofel *et al.* 2017; Tarongi *et al.* 2020). These areas usually lack a thick, more intense archaeological layer which further supports such interpretation. However, it is also possible that the primary function of this area was different, but its traces were destroyed by modern ploughing.

Thus, considering the entire territory of the settlement, the data obtained in the excavated area suggest that the residential area occupied the western and central part of the settlement. In the E part of the settlement there was a water reservoir, ancillary buildings and possibly livestock has been kept here. Hence, it seems likely that this part was used for subsistence purposes. The residential areas in Skudeniai are quite densely distributed, separated from each other by distances of 10 and 40 metres. In Kernavė, for example, the arrangement of the residential areas of this period is much more sparse (Vengalis 2012). If a similar density of residential areas in Skudeniai is also present to the S and N of the excavated area (Fig. 2), the total number of farmsteads here would be quite high. However, this by no means indicates that a large number of farmsteads could have existed simultaneously. Given the social structure of the agrarian communities in the forest zone of the E Baltic during this period, the existence of larger settlements is unlikely. Even in the cultures of the West Balt Circle, where the population density was higher than in E Lithuania, settlements consisting of only a few farmsteads are typical (Szymański 2007, 172). It is most likely that the residential areas identified in Skudeniai represent non-contemporary farmsteads. Post-and-beam buildings may have lasted a couple of decades at most, and when they started to decay, the inhabitants had to build a new dwelling next to the old one or further away. Such narrow chronological differences in the archaeological material can only be detected in exceptional cases, i.e. when the material suitable for dendrochronological dating is present. In the case of Skudeniai, the ^{14}C dates of features from different residential areas are not statistically significantly different, so we cannot substantiate the claim that the farmsteads are not contemporaneous.

CULTURE, SETTLEMENT PATTERN AND ECONOMY

Although the LSWC is named after the predominant pottery surface treatment, the main characteristic of this culture is recognised to be fortified hilltop settlements. It is the abandonment of these settlements, rather than the replacement of striated pottery with rusticated one, that has been considered the criterion for the end of the LSWC (Лухтанас 2001; Егорейченко 2006). This seems quite logical – the type of settlement is closely related to the social structure of a society, subsistence system, and other cultural dimensions,

while the surface treatment of pottery is merely one step in the *chaîne opératoire* of pottery production. Obviously, the surface appearance of the vessels had an aesthetic and perhaps ideological function, but the dominance of pottery among archaeological finds has often led archaeologists to overestimate the significance of its appearance, giving it a greater importance than it may have been given in the living community. Nevertheless, defining a culture solely in terms of the dominant settlement type is also an oversimplification of the reality, hindering insight into the complexity of a culture's settlement system. It is unlikely that in any culture a settlement system could have consisted of only one type of settlements with the same functionality.

In fact, the unenclosed settlements attributed to the LSWC are known and have been excavated. It has been argued that the unenclosed settlements of the LSWC are rare, and they have been treated as an exception among the prevalent fortified hilltop settlements (Егорейченко 2006, 63–64). In E Lithuania, where a considerable number of LSWC unenclosed settlements have been excavated, they have all been associated with the final phase of LSWC. They were considered to be a short-term phenomenon, reflecting the decline of this culture and the formation of the ELBC (Лухтанас 2001; Vengalis 2009, 166). Such claims were based on the data available at the time. All the better typologically dated finds found in these settlements were attributable to the 2nd – early 3rd centuries AD. Moreover, the striated pottery was almost always found intermixed with the rusticated pottery dating from the 3rd century, whereas the ^{14}C dates were not yet obtained.

However, all of the LSWC settlement system models proposed so far are subject to major adjustments in the light of the new data from 2020 research in E Lithuania. The archaeological surveys and excavations carried out at the construction grounds of the GIPL pipeline and the RailBaltica railway have uncovered dozens of new archaeological sites, many of which were specifically unenclosed LSWC settlements. Apart from Skudeniai, an extensive archaeological layers with rich collections of finds were found in the settlement sites of Grikapėdis, Kurmagala, Pakertai, Vilūnai, Vilūnai 2 and Varpiai. The substantial number of ^{14}C dates proved that unenclosed settlements existed throughout the entire period of the LSWC existence, from the 3rd/2nd century BC to the 2nd/3rd century AD (Dobeikienė 2021; Pranckėnaitė *et al*. 2021; Šatavičė 2021a; 2021b; Šatavičė, Kliaugaitė 2021; Šatavičė, Šatavičius 2021). Thus, at this point it is now clear that the unenclosed settlements in the LSWC settlement system were certainly not sporadic and do not date only to the period of the abandonment of the fortified settlements. They were a widespread type of settlement, undoubtedly playing an important role in the LSWC settlement system. The fact that this is not just a local phenomenon in this culture is also evidenced by the unenclosed settlements found in SE Latvia (Vasks 1995). Furthermore, there is a third type of LSWC settlements – lake island settlements. These have not been excavated so far, although it is clear that they were not rare either (Zabiela, Stončius 2012). It can therefore be stated that the time has come to reconsider the concepts of the LSWC settlement system, and perhaps also the definition of this culture itself.

Radiocarbon dating revealed that the Skudeniai settlement, dated to ca. 130–230 cal AD, represents the final phase of the LSWC, just before its tranformation to the ELBC. The short-term occupation horizon recorded at Skudeniai appears rather exceptional in the context of other settlements of this period. Most other settlements exhibit much longer periods of occupation. It can be noted that the unenclosed settlements of the LSWC were mostly established in new locations, with no traces of preceding occupation. However, in most cases the striated pottery is accompanied by rusticated pottery, which is often even more abundant. This indicates the continuity

of the settlement system established in the late Pre-Roman Iron Age and early RIA with that of the late RIA and the Great Migration period. It is quite common to find traces of LSWC settlements under the 3rd- to 4th-century barrows (Kurganai, Eitulionys, Moša, Staviškės, Pilviškės, Semeniškiai 1). The barrows indicate that at the time of their construction the population was settled somewhere in the vicinity (Kurila 2017). Thus, the occupational layers found underneath of barrows do not indicate abandoned settlements, but only individual farmsteads that have moved to new locations in the same micro-region. Such ephemerality of farmsteads was particularly characteristic of the whole Northern Europe until the end of the 1st millennium (Hamerow 2002, 104–106). The finds of early rusticated pottery from the Zone F of the Skudeniai settlement indicate that the settlement was not abandoned during the transformation of the LSWC into the ELBC, but only its residential areas moved away from the location where the excavations took place. Thus, the Skudeniai settlement differs from the others more by the fact that the farmsteads of the later periods have not returned into exactly the same places as those occupied in 130–230 cal AD, but not by the real short-term nature of this settlement.

Archaeobotanical research in Lithuania is just at its beginning, and there is still a serious lack of data from reliably dated, not chronologically intermixed contexts to be able to build a model of the development of agricultural systems (Minkevičius 2020). Therefore, the data from Skudeniai are of particular importance in this respect. The available archaeobotanical data from the RIA indicate that the cultivation of the main crops of the 1st millennium BC – barley, millet and hulled wheat species – was continuing (Minkevičius *et al*. 2020). Data from RIA settlements studied so far (Bakšiai, Bilionys, Gabrieliškės, Lieporiai) reveal that the 2nd-3rd centuries witnessed a significant shifts in agriculture, with the introduction of new species such as *Avena sativa* and *Secale cereale*, and the decline in the importance of millet (Minkevičius 2020). The archaeobotanical data from Skudeniai also confirm these trends. Cereals constitute the majority of crops, mainly barley (ca. 40%), with a smaller share of millet and hulled wheat species.

However, the Skudeniai material reveals a certain regional distinction. The most striking difference is observed in the amount of rye grain found in the samples. In other studied RIA settlements rye constitutes a significant part of the finds – in Bakšiai and Lieporiai 10–20%, in Gabrieliškės – more than 70% of all identified cultural plant macrofossils (Minkevičius 2020). Whereas in Skudeniai, only sporadic rye grains were found, amounting to only 1% of the identified crops. It is likely that such variation may have been caused by the local natural environment. The region around Skudeniai is dominated by moist, clayey soils, which provide favourable conditions for the cultivation of spring-sown cereals, especially barley. Cultivation of autumn-sown species, including rye, in such environment causes certain risk and challenges posed by the poor drainage properties of the soil. However, these could be avoided making rye cultivation more economically viable on well-draining, sandy soils (Mikkelsen 1986; Mikkelsen, Nørbach 2003).

Animal bones at Skudeniai were scarce and preserved almost exclusively in Zone A. However, it can be noted that in terms of species diversity, the zooarchaeological material from Skudeniai is quite similar to the E Lithuanian fortified settlements from the Late Bronze Age to the RIA (Mineikiškės, Garniai, Antilgė). The zooarchaeological material from the sites mentioned, was also dominated by the remains of domestic animals, with small ungulates, such as pig and sheep/goat bones, being the most abundant (60–80%). Cattle bones accounted for about 10%, while horse remains are absent or account for only a few percent. In contrast, the remains of large ungulates, such as cattle and horses, predominate in the settlements of W Lithuania of the same period (Bliujienė *et al*. 2020). The observed differences

allow us to make cautious assumptions about the different nature of animal husbandry in E and W Lithuania, at least until the RIA. In later periods, cattle bones steadily increase among the faunal remains, and by the Medieval period, their part in the zooarchaeological material of E Lithuania usually reaches about 50% (Piličiauskienė, Blaževičius 2018).

Finds of crucibles indicate that non-ferrous metallurgy was practised in Skudeniai. Finds related to non-ferrous metallurgy are quite common in the unenclosed settlements of the LSWC – they have been found in Semeniškiai 2, Kernavė, Pilviškės, Staviškės, Bakšiai, and Bačkininkėliai (Vengalis 2010; Bliujienė 2012, 188–189). Interestingly, in the settlements of later periods, where only rusticated pottery is found, such finds are very rare. It would be hard to believe that non-ferrous metallurgy were no longer practised in later periods, as this is contradicted by the abundance of jewellery found in the burial sites. It is more likely that in the RIA these activities were carried out in the residential area, as the Skudeniai case shows, while later they may have been moved somewhere further apart.

A very significant feature of the Skudeniai material is that not a single piece of iron slag has been found here. Iron slag finds are typical of the archaeological layers of later Iron Age settlements. In any settlement site with rusticated pottery in E Lithuania, if at least a dozen square metres is excavated, slag is found virtually in all cases. Moreover, it is characteristic of these settlements that slag finds are not only scattered in the vicinity of the iron smelting furnaces, but are also abundantly dispersed throughout the whole area of the archaeological layer. This dispersion must have been caused by some specific treatment of this waste, but this issue has not yet been addressed by researchers. Such trends observed in other settlements suggest that if a sufficiently large area of Skudeniai has not revealed a single slag find, it is likely that its inhabitants did not engage in ferrous metallurgy. This is a very important difference from the later settlements of the ELBC. At the same time, it raises questions about ferrous metallurgy in other, contemporaneous with Skudeniai, and earlier settlements of the LSWC – could it be that iron production in E Lithuania became widespread only with the ELBC, or is Skudeniai an exception in this respect, and elsewhere it was practiced earlier? Previously, it was suggested that iron smelting was a widespread phenomenon in the LSWC, as slag is found in almost all settlements (Егорейченко 2006, 103–104). However, given that many settlements also exhibited occupations from later periods, such claims should be taken with caution. Most of the slag finds may be of later date. These questions cannot yet be answered reasonably and require a dedicated study, critically selecting contexts in which the LSWC material is not intermixed with later periods.

Not only slag was absent in Skudeniai, but also some other finds that are common in RIA settlements: Dyakov-type weights, iron tools, like knives, sickles, awls, and iron ornaments, such as pins and fibulas. However, as in the case of the iron slag, whether this is a trend of the period or a case of a single settlement should be answered by a detailed study of other settlements of the same period.

There were also some finds indicating interactions with neighbouring tribes. Glass finds and a few potsherds are most likely imports from the SW neighbours, the Bogaczew and Wielbark cultures. Usually, finds associated with foreign origins are very rare in the settlement material and are mostly found in burial sites. However, such finds are comparatively frequent in LSWC unenclosed settlements, e.g. Semeniškiai 2 and Bakšiai (Vengalis 2006; Bliujienė 2013, 190–191). Finds from other settlements indicate the same exchange directions – the Bogaczew and Wielbark cultures (Grižas, Bitner-Wróblewska 2007; Bliujienė 2013, 190–193). Single finds of LSWC pottery with a coarse slipped surface found in Skudeniai and other settlements in E Lithuania also suggest the social influence of the above-mentioned

cultures – such pottery was produced locally, but in imitation of vessels made by these neighbours (Grižas, Bitner-Wróblewska 2007).

CONCLUSIONS

Excavations in Skudeniai unenclosed settlement, carried out during the construction of the gas pipeline, have provided significant insights regarding the LSWC in E Lithuania. Until now, it had been assumed that people of this culture lived almost exclusively in fortified hilltop settlements. New evidence indicates that this is not the case and that unenclosed settlements played an important role in the settlement system. However, unenclosed settlements have hitherto been poorly studied. Many of them have been excavated, but most of them have been occupied for a long time and the material from the LSWC has been intermixed with more abundant finds from later periods. This severely reduced the informativeness of the data, thus pure short-term complexes were in great demand.

Most of the excavated area of the Skudeniai settlement has been inhabited for a relatively short period (up to 100 years), therefore, the archaeological material from the 2nd–3rd centuries is largely pure. These excavations provided new and important insights into the structure of the unenclosed settlements, their buildings, pottery assemblage, agriculture, metallurgy and trade. A trench crossing the entire settlement territory at its central part was uncovered. This provided data on the general spatial layout of the settlement. There was a small lake on the E side of settlement. It is supposed to have been the main source of water supply, although waste was also dumped into it. Residential areas covered the western and central parts of the settlement. They emerged as three separate areas of a dark organic-rich archaeological layer with diameters of 15–30 metres. In these areas accumulations of postholes were found, indicating the presence of post-and-beam buildings. Almost all the pits were also concentrated in these areas, and one of them also contained traces of non-ferrous metallurgical activities. Between the residential zones and the water supply site was an area where archaeological traces were scarce, with only postholes of small diameter and no archaeological layer. This zone may have contained small, lightly constructed ancillary buildings or shelters.

The short-term assemblage of pottery from Skudeniai provided a better understanding of the differences between the simultaneously used pottery groups. The petrographic method, applied for the first time in the analysis of LSWC pottery, also provided valuable insights. So far, the LSWC pottery has been divided into 2 groups: striated and burnished pottery. It is now clear that the two separate groups should be distinguished also for the striated pottery. We believe that the main criteria for differentiating these groups are the composition of the fabric and the firing technique, rather than the surface treatment (which is not necessarily striated and not necessarily burnished). Therefore, we propose to define the pottery groups of the LSWC as coarse-grained oxidised pottery (COP), fine-grained oxidised pottery (FOP), and fine-grained reduced pottery (FRP).

Archaeobotanical data from the LSWC unenclosed settlements in E Lithuania have not been available so far, therefore the Skudeniai assemblage plays a key role in understanding the development of agriculture. Most of the archaeobotanical material consists of charred barley and millet grains. In contrast, rye macrofossils were found in very limited quantities. This probably reflects the adaptation of the local community to the natural environment with heavy, clayey soils. The finds associated with non-ferrous metallurgy were all concentrated in one location. This indicates that this activity was carried out in the residential area, probably only episodically. In contrast, no iron slag was found, which raises questions about the significance of ferrous metallurgy in the LSWC settlements. The discovery of glass

items and some potsherds suggests that the Skudeniai people were in close contacts with neighbouring tribes.

Therefore, the Skudeniai material has provided a substantial amount of new information about hitherto poorly known unenclosed settlements of the LSWC. These data also raise a number of issues concerning the treatment of the culture as a whole, its settlement system and economy. A comparative analysis of the material from the other settlements is now necessary to address these concerns. Therefore, the material from other LSWC settlements that have been discovered and extensively excavated on the construction grounds of large infrastructure projects in E and S Lithuania in 2020–2021 raises high expectations.

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NAUJI DUOMENYS APIE VĖLYVOSIOS BRŪKŠNIUOTOSIOS KERAMIKOS KULTŪROS NEĮTVIRTINTŲ GYVENVIEČIŲ STRUKTŪRĄ IR EKONOMIKĄ: SKUDENIŲ GYVENVIETĖ PIETRYČIŲ LIETUVOJE

Rokas Vengalis, Gytis Piličiauskas, Karolis Minkevičius, Mantas Valančius, Miglė Stančikaitė, Giedrė Vaikutienė, Giedrė Piličiauskienė

Santrauka

Straipsnyje pristatomi Vėlyvosios brūkšniuotosios keramikos kultūrai (toliau – VBKK) priskirtinos Skudenių gyvenvietės tyrimų rezultatai. Tyrimai atlikti 2020 m., vykdant GIPL dujotieko statybas.

Skudeniai yra PR Lietuvoje, Nemuno ir Neries tarpupyje (Kaišiadorių r.), šiaurinėje Aukštadvario aukštumos dalyje, paribyje tarp dviejų tipų kraštovaizdžio – glaciodepresijos ir moreninio kalvyno (1 pav.). Gyvenvietė įkurta ant išraiškingos 10–15 m aukščio terasos. Stratigrafija ir diatomėjos rodo, kad R gyvenvietės dalyje būta nedidelio ežerėlio (2–3 pav.).

G zonoje užfiksuoti du archeologiniai sluoksniai, atskirti plono sterilaus ežerinio molio sluoksnio (3 pav.). Jie susiformavo skirtingais apgyvenimo etapais. Kitose gyvenvietės dalyse (A–F zonose) tik penkiuose atskiruose arealuose buvo išlikęs nesuartas archeologinis sluoksnis (5 pav.) – nestratifikuotas, homogeniškas, sudarytas iš tamsiai pilko priesmėlio arba priemolio (6, 7 pav.). A–F zonų medžiaga rodo, kad archeologinis jų sluoksnis atskleidžia buvus tik vieną apgyvenimo etapą.

Tirtame plote identifikuoti 86 įgilinti objektai – įžemio horizonte išryškėjusių duobių kontūrai, kurių didžioji dalis laikytini didesnių ir mažesnių pastatų bei ūkinės paskirties pastatėlių ar stoginių stulpavietėnis (9-10 pav.). B, D ir E zonose išsiskiriančios stulpaviečių grupės sietinos su pastatų liekanomis. F zonoje aptiktos 16 stulpaviečių išsidėsčiusios rečiau nei kitur ir išsiskiria mažesniu skersmeniu (10 pav.). Galima spėti šioje gyvenvietės zonoje buvus keleto nedidelių, lengvos konstrukcijos ūkinės paskirties pastatėlių ar stoginių.

14 ūkinių duobių išsidėstymas rodo, kad daugiausia veiklų, kurioms buvo reikalingos šios duobės, vykdytos šalia minėtų pastatų. Vienas objektas – greičiausiai žaizdro duobė – sietinas su spalvotąja metalurgija (11: 2 pav.).

Skudenių gyvenvietėje surinktą keramikos kolekciją sudaro apie 4000 šukių (22,8 kg), daugiausia smulkių. Keramika analizuota ne tik makroskopiškai, bet ir taikant petrografinę analizę (2 lentelė). Tai leido pateikti naują VBKK keramikos kolekcijos klasifikaciją, išskiriant tris pagrindines grupes: stambiagrūdės oksidacinės (COP) (12 pav.), smulkiagrūdės oksidacinės (FOP) (13 pav.) ir smulkiagrūdės redukcinės (FRP) keramikos (14 pav.). Petrografinė analizė parodė, kad nors visų grupių indų išvaizda ir skiriasi, jie gaminti tos pačios bendruomenės pagal tas pačias molio masės paruošimo tradicijas.

Kitų radinių Skudeniuose rasta gerokai mažiau nei buitinės keramikos. Paminėtini su spalvotąja metalurgija susiję radiniai – vienas sveikas tiglis ir 14 jų fragmentų (21 pav.), vario lydinio lašas ir strypelis. Visi jie rasti kompaktiškame areale – spėjamo žaizdro duobėje ir kelių metrų spinduliu aplink ją. Išskirtiniai du stikliniai radiniai, labai retai pasitaikantys Lietuvos romėniškojo geležies amžiaus gyvenviečių medžiagoje – stiklo karolio ir buteliuko kaklelio fragmentai (22 pav.). Taip pat aptikta titnago nuoskalų, molio tinko, po kelis geležinių, akmeninių, kaulinių dirbinių fragmentus. Pažymėtina, kad nerasta nė vieno gabalėlio šlako.

Augalų makroliekanų analizė (3 lentelė) parodė, kad dižiausią dalį sudarė kultūriniai augalai su vyraujančiais javais, tarp kurių dominuoja miežių grūdai, kur kas mažiau kviečių, sorų, rugių. Ankštiniai augalai sudaro tik nedidelę dalį (1,9 %). Gyvūnų kaulų aptikta tik 49 fragmentai. Visi identifikuoti priklausė naminiams gyvuliams, mažiausiai trims jų rūšims – galvijui, aviai ir/arba ožkai bei kiaulei (4 lentelė).

Pagal stratigrafiją ir keramikos tipologiją Skudenių gyvenvietėje išskirtinos trys apgyvenimo fazės. Jų chronologija tikslinta AMS ^{14}C metodu, iš viso buvo padarytos 7 datos (5 lentelė). Ankstyviausiai apgyvenimo fazei – maždaug 170–60 cal BC – priklauso G zonoje fiksuotas apatinis archeologinis sluoksnis. Antrai, pagrindinei, apgyvenimo fazei priskirtini archeologinio sluoksnio arealai ir didžioji dalis įgilintų objektų A–F zonose bei viršutinis archeologinis sluoksnis G zonoje. Gautos keturios ^{14}C datos patenka į kalibracinės kreivės plokščiakalnį, apimantį maždaug 130–240 cal AD. Trečia apgyvenimo fazė apčiuopta labai fragmentiškai – ji išskirta pagal F zonos dviejose stulpavietėse aptiktą ankstyvąją grublėtąją keramiką. Vienoje rastą javo grūdą datavus ^{14}C metodu, gauta data 81–232 cal AD, iš esmės patenkanti į tą patį plokščiakalnį, kaip pagrindinės apgyvenimo fazės datos (24 pav.).

Duomenys įgalina pateikti įžvalgų, susijusių su gyvenvietės struktūra. B, D ir E zonose išlikę nesuarto archeologinio sluoksnio arealai aiškiai koreliuoja su trimis didžiaisiais pastatais. Manome, kad šiuos tris pastatus aiškiai galima įvardyti gyvenamaisiais.

R gyvenvietės pakraštyje esančią zoną G, kurioje būta ežerėlio, reikėtų interpretuoti kaip vandenvietę. F zonos archeologiniai požymiai akivaizdžiai skiriasi nuo gyvenamųjų zonų. Čia ūkinė veikla nesuformavo archeologinio sluoksnio, tačiau sukėlė erozinius procesus – deliuvio akumuliaciją G zonoje. Galbūt F zoną galima sieti su gyvulininkyste; gyvuliams reikia daug vandens, todėl būtų logiška juos laikyti netoli vandenvietės.

Iki šiol buvo teigiama, kad VBKK žmonės gyveno beveik išimtinai tik įtvirtintose gyvenvietėse (piliakalniuose). Nauji duomenys rodo, kad taip nebuvo – neįtvirtintos gyvenvietės apgyvenimo sistemoje atliko svarbų vaidmenį. Jos iki šiol buvo menkai pažįstamos, kadangi tyrinėtuose kultūriniuose sluoksniuose dažniausiai buvo aptinkama susimaišiusi įvairių laikotarpių medžiaga. Skudeniai iš kitų VBKK gyvenviečių išsiskiria surinkta beveik gryna trumpo laikotarpio (~130–230 cal AD) medžiaga, todėl tyrimai suteikė naujų ir svarbių žinių apie VBKK neįtvirtintų gyvenviečių struktūrą, pastatus, keramikos kompleksą, žemdirbystę, metalurgiją, prekybinius ryšius. Šie duomenys kelia nemažai klausimų ir dėl visos kultūros traktavimo, jos apgyvendinimo sistemos, ekonomikos.

NEW DATA ON THE STRUCTURE AND ECONOMY OF UNENCLOSED SETTLEMENTS IN THE LATE STRIATED WARE CULTURE: THE SKUDENIAI SETTLEMENT IN SOUTHEASTERN LITHUANIA

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Summary

This article presents the results of investigations that took place in the Skudeniai settlement in 2020 during the the construction of the GIPL gas pipeline. The settlement belonged to the Late Striated Ware Culture.

Skudeniai is located in the Southeast Lithuania, in the Nemunas-Neris interfluve (Kaišiadorys district) located in the northern part of the Aukštadvaris Upland, on the margin between two landscape typologies: a glacial depression and moraine hills. The settlement is situated on a prominent terrace that is 10–15 metres high. Stratigraphy and diatomaceous earth findings indicate that a small lake had flown through the eastern part of the settlement (Fig. 1–3).

Two archaeological layers were recorded in Zone G, which were separated by a thin layer of sterile lacustrine clay (Fig. 3). These were formed during different phases of occupation. In other parts of the settlement (Zones A–F), the stratigraphy is very simple.

In many places, the ploughed layer is immediately underlain by natural soil. Undisturbed archaeological layers were found in only five areas (Fig. 5). These were unstratified, homogeneous, consisting of dark gray sandy soil, and clayey soil. Material collected from Zones A to F revealed that there was only one phase of occupation. A total of 86 features were identified, most of which were postholes, which suggest the remains of buildings (Fig. 9). The purpose of 14 features could not be identified. One of the features is assumed to have been used as a hearth for non-ferrous metallurgy (Fig. 11: 2).

The collection of pottery from Skudeniai consists of about 4000 sherds (22.8 kg), most of which small sherds. The pottery was evaluated macroscopically and subjected to petrographic analysis (Table 2). This resulted in a new classification of pottery belonging to the Late Striated Ware Culture, in which three main groups are distinguished: coarse-grained oxidised pottery (COP), fine-grained oxidised pottery (FOP), and fine-grained reduced pottery (FRP) (Fig. 12–13). The petrographic analysis shows that although the appearance of vessels differs between the groups, they were produced by the same community following the same tradition of clay fabric preparation.

Other finds at Skudeniai were much less numerous, most notably featuring objects related to non-ferrous metallurgy such as 14 fragments of crucibles (Fig. 21), one complete example, a drop of copper alloy, and a bar. All of them were found in the presumed pit of a hearth and its vicinity within a radius of several meters.

Two exceptionally rare glass finds (Fig. 22) in the material of Lithuanian Roman Iron Age settlements included fragments of a glass necklace and a bottleneck. Other finds included flint flakes, clay daub, and a few fragments of iron, stone, and bone artefacts. Notably, not a single piece of slag was found.

19 soil samples (with a total of 328 litres) were taken plant macro-residue analysis, which yielded 526 burnt plant remains (Table 3). The majority of these were crop plants (78.1%, n = 411). Remains of cereals predominated, with legumes (peas) accounting for only a small proportion (1.9%). Among cereals, barley

was found to be predominant (82.3%); whereas, wheat (11.3%), millet (5.4%) and rye (1.1%) were much less abundant (Fig. 23, 25). Only 49 fragments of animal bone were found, all of which had been domesticated animals (Table 4).

Three phases of occupation were distinguished in the settlement of Skudeniai based on the stratigraphy and pottery typology. Their chronology was adjusted by AMS ^{14}C and seven date ranges were determined. The earliest phase of occupation, ca. 170–60 cal BC, is represented by the lower archaeological layer recorded in Zone G. The second, or the main phase of occupation, includes archaeological layers and most of the sunken features in Zones A to F, as well as the upper archaeological layer in Zone G. The four ^{14}C dates fall within the plateau of the calibration curve, which spans from ca. 130–240 cal AD. The third phase of occupation is very fragmentary and was distinguished by the early rough surface pottery found in two postholes in Zone F. One of the postholes was found to contain a cereal grain, which was dated using the AMS ^{14}C and returned a date of 81–232 cal AD. The latter date falls into the same plateau as the dates of the main occupation phase (Fig. 24).

The data obtained provides insight into the structure of the settlement. In Zones B, D, and E, the preserved areas of the undisturbed archaeological layer correlate with the three larger buildings. This suggests that the most intensive activities that left archaeological traces were carried out in and around those three buildings Both the archaeobotanical data and other finds suggest that the formation of the archaeological layer in these areas was driven by activities typical of residential areas, such as cooking. Hence, we believe that the three buildings ought to be classified as residential.

Zone G, located on the eastern edge of the settlement, contained a small lake, which could be interpreted as a water point. The importance of this area is also evidenced by the fact that the chronology of contexts found in the former lake area and its shore is more extensive than those found in Zones A to E. The location of the habitation zone likely changed over time, while the water point remained the same. Archaeological features of Zone F are distinct from the residential areas. Here, farming activities have not formed an archaeological layer but have caused erosive processes, such as the accumulation of sediment in Zone G. Perhaps Zone F can be associated with livestock farming, since animals require ample water supply, thereby making it logical to keep them close to the water point.

Until recently, it has been argued that the people of the Late Striated Ware Culture lived almost exclusively in fortified settlements, such as hillforts. However, new evidence shows that this was not the case, as unfortified settlements played a similarly important role in the settlement system. Unfortified settlement systems remain poorly understood, as the cultural layers typically studied contain mixed material from different epochs. Skudeniai stands out from the other settlements of the Late Striated Ware Culture due to the practically undisturbed and unmixed material dated to a relatively short period (~130–230 cal AD), which has provided new and important insights into the culture's structure, buildings, pottery, agriculture, metallurgy, and trade relations. At the same time, this newly obtained data also raises a number of questions concerning the treatment of the culture as a whole – both in terms of settlement systems and their appurtenant economies.

Gauta: 2022 08 08
Priimta: 2022 10 18