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Experimental and Use-wear Examinations of Flint Knives: Reconstructing the Butchering Techniques of Prehistoric Lithuania

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The abundant quantity of flint blades with use-wear traces can be found within Lithuanian archaeological materials. These blades are frequently treated with various additional types of retouch techniques which provide more knowledge on the exploitation of those tools. An absence of organic material makes it extremely difficult to understand the real purpose of those artifacts. Suchlike flint blades, which typologically are considered as knives, are frequently found in Lithuania during excavations in the Late Neolithic–Early Bronze Age sites. Their exclusive technological specifics denote a particular function. In this paper, on the basis of flint knives from Lithuanian Late Neolithic and Early Bronze Age sites, we try to reconstruct the prehistoric technologies of animal butchering. In order to accomplish this task, both the experimental and use-wear methods were used. Our research results provided new insights on the use of flint knives and the effectiveness of metal tools in the animal butchering process.

Keywords: flint knives, use-wear, experimental archaeology, prehistoric technologies, Late Neolithic–Early Bronze Age, Lithuania.

Tiriant Lietuvos akmens amžiaus medžiagą, gausiai aptinkama titnaginių skelčių su utilizacinėmis žymėmis darbinėse kraštinėse. Dažnai skeltės būna papildomai apdorotos įvairių tipų retušu, kuris byloja apie dirbinio panaudojimą. Neišlikus organinės kilmės medžiagų, suprasti tikrąją dirbinio paskirtį tampa itin nelengva. Tokių titnaginių skelčių, kurios tipologiškai išskirtos kaip peiliai, Lietuvoje randama tyrinėjant vėlyvojo neolito–ankstyvojo bronzos amžiaus paminklus. Jų išskirtiniai technologiniai gamybos ypatumai konstatuoja tam tikrą dirbinio funkciją. Šiame straipsnyje, remiantis Lietuvos vėlyvojo neolito ir ankstyvojo bronzos amžiaus paminkluose rastais titnaginiais peiliais, siekiama atkurti priešistorės gyvūnų skerdimo technologijas. Tikslui įgyvendinti taikyti eksperimentiniai ir trasologiniai tyrimo metodai. Remdamiesi tyrimo rezultatais, pateikiame naujų įžvalgų apie titnaginių peilių naudojimą ir metalo dirbinių efektyvumą apdorojant gyvūnų skerdeną.

Reikšminiai žodžiai: titnaginiai peiliai, trasologija, eksperimentinė archeologija, priešistorės technologijos, vėlyvasis neolitas–ankstyvasis bronzos amžius, Lietuva.

INTRODUCTION

Hunting, fishing, and gathering – these are the main economic fields which prevailed in the territory of Lithuania throughout the entire Stone Age period. With the help of the mentioned economic branches, prehistoric people were able to provide for themselves all the necessities for living: food, clothes, tools, and other kinds of resources (Daugnora, Girininkas, 1998, p. 229–230; 2004; Girininkas, Daugnora, 2015, p. 67–80, 96, 138–139; Rimantienė, 1992, p. 110; 1996, p. 96–99; 2005, p. 385–386). Dynamical changes within the environment that occurred through the Late Pleistocene, Early and Middle Holocene periods in the territory of Lithuania (Stančikaitė, 2004, fig. 9) created good living conditions for various species of fauna, which satisfied the nourishment resource gathering needs of local communities. The resources were supplemented by fishing and gathering. Thanks to a convenient economic model, the prevailing economics in the territory of Lithuania during the Late Neolithic and Early Bronze Age remained to be hunting, fishing and gathering.

In Lithuanian archaeological material research, one of the less studied remains the field of tools used for animal butchering in prehistory. An abundance of animal bones is obtained during archaeological excavations, some of the bones bearing clear cutting marks (Leduc, 2012, p. 66; Luik, Piličiauskienė, 2016, p. 190; Mannermaa, Storå, 2006, p. 441; Ritchie *et al.*, 2013, p. 57). Usually, this reflects traces of butchering technology. Archaeological field studies sometimes identify specific animal butchering sites, or "slaughter places". One of these slaughter sites with wild and domestic animal bone remains was found during the archaeological examinations of the Kretuonas 1C settlement (Švenčionys district, eastern

Lithuania) (Daugnora, Girininkas, 2004a, fig. 1, table 1; Girininkas, 2012, fig. 3). These results led us to believe that during the settlement's existence time it was inhabited by a specific type of people who specialized in animal butchering (Daugnora, Girininkas, 2009, p. 48). The archaeological excavations of Stone Age and Early Bronze Age settlements in Lithuania frequently present an abundant flint tools inventory which demonstrates specific economic activities of the site.

Currently, experimental and use-wear analysis methods allow us to present more relevant data about various prehistoric processes. With the help of latter methods, the present article aims to represent experimental and use-wear analysis results, which were obtained by experimenting with meat and fish processing tools – flint and bronze knives. Experiments were performed on wild and domestic animals. An accomplished use-wear analysis allowed to look more into knife manufacturing technology, its importance within prehistoric economics and function. The received results supplemented additional data about the economic model of Late Neolithic – Early Bronze Age communities in the territory of present Lithuania.

MATERIALS AND METHODS

This study is based on experimental and use-wear analysis methods. Experimentally made flint knives were used for animals processing. These tools were made of blades and flakes, which typologically replicates knives used during the Late Neolithic – Early Bronze Age (Girininkas, 2013, fig. 55). For the comparison of butchering efficiency, a bronze knife was also manufactured and used on the same animals. The effectiveness of flint and bronze knives was compared through the recordings of work productivity and use-wear analysis.

Knives were used for domesticated goat (*Capra aegagrus hircus*), bison (*Bison bonasus*), and pike (*Esox lucius*) carcass processing. During the experimental work, we tried to prepare meat and fish for daily consumption, possibly like the prehistoric communities during the Stone – Early Bronze Age did. All processes were arranged into steps. First, the furs of all animals were skinned off, later their limbs were separated. All useful material – skin, long bones, and tendons – were saved and kept for future experiments.

The next stage of research was performed by use-wear analysis. This method was used for the studies of the working edges of flint and bronze knives. The use-wear analysis was conducted in the Experimental Archaeology and Traseology Laboratory at Klaipėda University. *Olympus SZX16* microscope with an attached *Olympus DP72* camera was used for image recording. *Image-Pro express version 6.3* software was used for processing traseological photos. The use-wear traces of skinning, sawing and stabbing on the working edges of knives were best obtained between 10x-80x magnification.

EXPERIMENTAL WORK

Flint knives were made of raw material from southern Lithuania, Rügen island (north-eastern Germany), and France. There are many similarities between raw flint material from southern Lithuania and Rügen Island. The visually noticeable ones are color (grey or black, often with chalk inclusions), and quality of knapping. Raw material from France has light brown/yellowish colour. This type of flint was appropriate for knapping as well. Knapped blades and flakes were sharp and of suitable shape; thus, this type of flint was acceptable for the experiments. Only massive blades and flakes were knapped for knives manufacturing. The ones who had at least one sharp edge and were suited for bigger mammal butchering were selected. Some parts of knives were retouched perpendicularly. This way, the working hand was protected from serious injuries (Tsirk, 2014, p. 27). Similar types of flint knives were collected during the archaeological excavations of Late Neolithic – Early Bronze Age periods settlements of Barzdžio miškas, Karaviškės 6, Kretuonas 1C, and Papiškės 4 (Brazaitis, 2004, fig. 15, 16; Girininkas, 2013, fig. 55; Piličiauskas, 2004, fig. 18; Rimantienė, 1999, fig. 18).

The bronze knife was made by casting a copper alloy strip, which was heated up to 600–800°C and cooled off in 10–15°C water. Metal was forged in order to form blade and handle. The blade was formed in a V shape, whilst the handle was made to be of rectangular shape. The cooling-off was repeated every 2–3

Fig 1. Experimental bronze knife. Photo by T. Rimkus and G. Slah.
1 pav. *Eksperimentinis bronzos peilis. T. Rimkaus ir G. Slah nuotrauka*

minutes. The last stage of bronze knife production was polishing. The knife blade was polished with sandpaper and cattle hide (Fig. 1). This was done to shape a clear working surface, so as all microscopic traces from bones, cartilages, and soft tissues could be easily detected during use-wear examinations (Dolfini, Crellin, 2016; Molloy *et al.*, 2016).

The processing of a domesticated goat began with skinning (Fig. 2). First, a flint knife was used to cut both rear legs toward the udder. Second, the belly was cut from the lower part toward chest. A straight cut was made beginning with the front legs to the chest line, where an incision was made before. The line was continued toward the neck up to its arteries. After that, the skinning process continued with other flint knives. Blades or flakes of curly shape were perfectly fit for skinning. After skinning, the udder was removed from the skin, and later from the whole body. Skinning continued from the belly toward ribs. Further skinning continued with skin removal from the back. The tail was cut and split from pelvis, sacrum, and waist bones. After reaching the front limbs, further work was related with the chest. Skinning of the chest continued toward front limbs and back, and later carried out from the shoulders toward the nape and neck. After this, skinning process was finally accomplished.

Flint knives were also used to remove bone, muscle tissues and internal organs. After the removal of internal organs, foot bones within wrists were also separated. A flint knife was used to cut joints and tendons. Later, back and chest muscles were removed. This was done so as to separate shoulder bones from the front leg (Fig. 3). The same action was repeated on the other front leg. When front legs were removed, vertebra bones were separated from the waist. The whole process was accomplished with a flint knife cutting through joints. The whole lower part of the body was separated. Rear legs and waist were separated from the pelvis, the nape – from chest bones, the muscle group – from vertebra bones. The butchering of a goat was then concluded.

Flint knives were used on bison butchering. The animal was about 1,5 years old. This time, different skinning knives were used, i.e., ones made of flint and bronze. A bronze knife was also used to cut the bison's Achilles tendons and the quadriceps femoris muscle. The bison skinning process started with an oval cut from the heel bones and continued toward the ventral part of the belly. The next cut was made from the animal's sternum up to its pubis (*Ossa coxae*). The front limb skin was cut in an oval incision around the wrist joint, and then the process continued with cutting the inner front leg surface toward the second segment of sternum. After the right half of the animal was skinned, the bison was rolled over and the other half was processed as well. When the skinning process was completed, the animal's head was separated from the first vertebra (*Atlas*).

Carcass processing began with the front limbs. A flint knife was used to cut the inner half muscles and shoulder cartilages which connected the front limbs

Fig. 2. A moment from a domestic goat (*Capra aegagrus hircus*) skinning process using a flint knife. Photo by A. Girininkas.

2 pav. *Naminės ožkos* (Capra aegagrus hircus) *odos dyrimas titnaginiu peiliu. A. Girininko nuotrauka*

Fig. 3. A moment from a domestic goat (*Capra aegagrus hircus*) front leg separation process. Photo by A. Girininkas.

3 pav. *Naminės ožkos* (Capra aegagrus hircus) *priekinės kojos atidalijimo procesas. A. Girininko nuotrauka*

Fig. 4. Flint knive for pike (*Esox lucius*) butchering. Photo by T. Rimkus and G. Slah.

4 pav. *Titnaginis peilis skirtas / naudotas lydekai* (Esox lucius) *pjauti. T. Rimkaus ir G. Slah nuotrauka*

with the chest. When the shoulder bow and deep chest muscles were removed, then both of the front limbs were separated. The separation of rear limbs from the animal's body was completed when the loins, rear leg muscles and tendons were cut off. Tail skin was removed after tail separation. Neck and back parts were split into several pieces: neck, chest, waist and sacrum. The chest was split by separating the sternum with the rib cartilages section, and with the cutting of intercostal muscles. After cutting the joint ribs tubercle surface and bending the bone section of the ribs, both sides of the rib head that held ligaments and proximal intercostal muscles were separated.

A pike (about 800 g in weight) was used in the third butchering stage. For this process, only a single flint knife used (Fig. 4). Butchering began with scale peeling. Later, the fish underbelly was cut and all internal organs were removed. The cut was made from the gills toward the anal flipper. After separating the head, the fish body was separated into three parts. The process lasted about 10–15 minutes.

USE-WEAR ANALYSIS OF FLINT KNIVES

The butchering of a goat, bison and pike required 37 flint knives and 1 bronze knife in total. After the process, all knives had visually noticeable use-wear traces. These traces were fixated in detail with an *Olympus SZX16* microscope. Knives designed for different tasks (skinning, limb separation, etc.) had different use-wear marks.

Only flint knives were used for goat butchering. They were made from flint blades. Two shapes of these knives were used: a straight and curved blade (Fig. 5). For the animal skinning process, the curved knives were the best. The curved part functioned as the main work spot, thus most of the use-wear traces were concentrated there. Working with these knives had lasted between 20 to 40 minutes. When the working knife blade was magnified with a microscope between 20x and 40x, minor utilization traces had been detected in the obverse and reverse halves. Small cleavages, minimal polish traces, and more intensive use-wear traces were noticed in the reverse part (Fig. 6). Although work duration was quite long and the use-wear traces were noticeable, the working parts of the knives had remained quite effective even after the accomplished work.

A flint knife made of light grey flint was used for goat butchering. The knife's proximal part (handle) was wrapped in birch bark (Fig. 7). Before wrapping, birch bark was soaked in hot water. This way, the bark's elastic characteristics were improved. This knife was used for about 27 minutes (in cutting the leg muscles, separating the shoulder bone from the animal body and separating the body from the waist). A use-wear analysis showed small serrations on the distal part of the blade. Also, after magnifying the image by 25x, polish traces on small sharp edges were visible (Fig. 8). Use-wear traces on this knife were more evident than the ones on the knife used for skinning.

Fig. 5. Flint knife with a curved blade for domestic goat (*Capra aegagrus hircus*) skinning. Photo by T. Rimkus and G. Slah.

5 pav. *Titnaginis peilis su išlenktais ašmenimis, skirtas naminės ožkos* (Capra aegagrus hircus) *odai dirti. T. Rimkaus ir G. Slah nuotrauka*

Fig. 7. Flint knife with a straight blade used for separating the leg muscles and vertebra of a domestic goat (*Capra aegagrus hircus*). Photo by T. Rimkus and G. Slah.

7 pav. *Titnaginis peilis su tiesiais ašmenimis, naudotas naminės ožkos* (Capra aegagrus hircus) *kojų raumenims ir stuburui atidalyti. T. Rimkaus ir G. Slah nuotrauka*

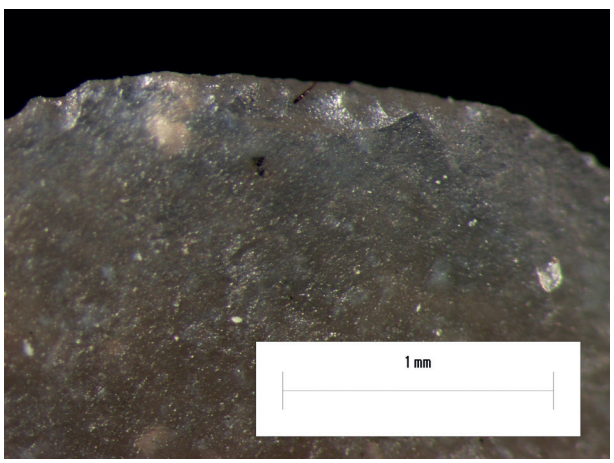

Fig. 6. Use-wear traces from domestic goat (*Capra aegagrus hircus*) skinning. Magnification 20x. Photo by G. Slah.

6 pav. *Darbo pėdsakai, likę nudyrus odą naminei ožkai* (Capra aegagrus hircus). *Objekto vaizdas padidintas 20 kartų. G. Slah nuotrauka*

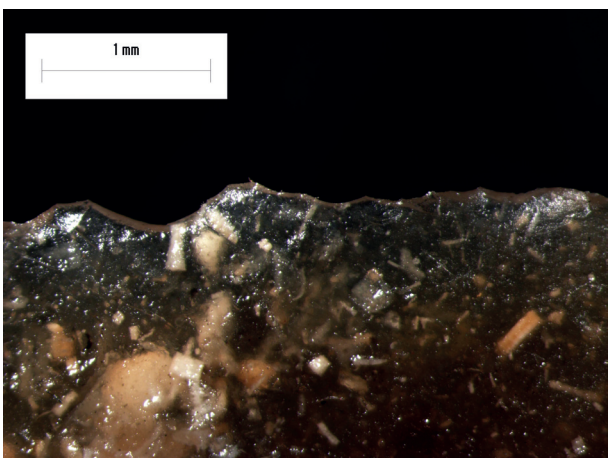

Fig. 8. Use-wear traces of a flint knife with a straight blade. Magnification 16x. Photo by G. Slah.

8 pav. *Darbo pėdsakai, aptikti ant peilio su tiesiais ašmenimis. Objekto vaizdas padidintas 16 kartų. G. Slah nuotrauka*

Fig. 9. Flint knife with a curved shape for bison (*Bison bonasus*) skinning. Photo by T. Rimkus and G. Slah.

9 pav. *Titnaginis peilis su išlenktais ašmenimis, skirtas stumbro* (Bison bonasus) *odai dirti. T. Rimkaus ir G. Slah nuotrauka*

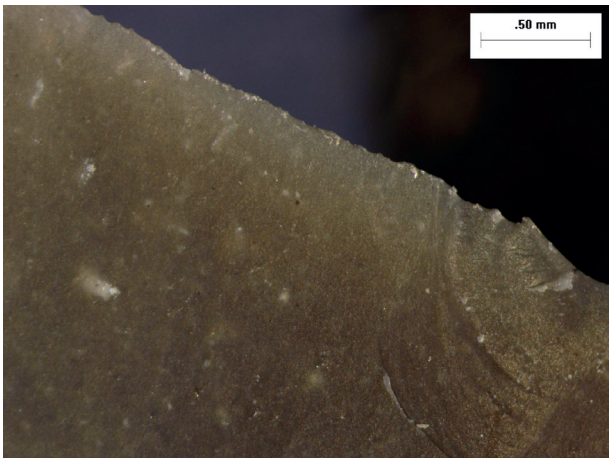

Fig. 10. Use-wear traces from bison (*Bison bonasus*) skinning. Magnification 16x. Photo by G. Slah.

10 pav. *Darbo pėdsakai, likę nudyrus stumbro* (Bison bonasus) *odą. Objekto vaizdas didintas 16 kartų. G. Slah nuotrauka*

Flint and bronze knives were used for bison butchering. A flint knife, which was used for bison skinning process, was manufactured from dark grey flint (Fig. 9). The skinning process with this knife lasted about 30 minutes. A use-wear analysis showed regular micro retouch with polished spots on blade traces (Fig. 10). Other evident use-wear traces not detected. This kind of utilization is similar to the tools used for goat skinning.

Use-wear traces of the bronze knife had formed after about 20 minutes of work. This knife was used for skinning and tail vertebra cutting. During the skinning process, the bronze knife was fairly handy; however, with it we were not able to cut the bison's skin. Joint cutting with this knife was not very smooth either. This part of the process had required considerable effort.

A magnified image of the bronze knife showed some clear use-wear traces. Some of them had formed from polishing (during the knife manufacturing process), while others originated from the cutting and skinning process. In the area of the working part, use-wear traces of dullness were apparent (Fig. 11). These traces formed after unsuccessful efforts to cut the animal's skin. Other use-wear traces were related with cartilage and bone cutting. A deformation of metal was noticed in the area of the blade (Fig. 12). This kind of metal deformation remains undetectable without the help of a microscope.

In comparing the knives made of flint and bronze, some similarities of use-wear traces can be observed. Flint knives, which were used for cartilage and bone cutting, had very similar use-wear traces in the blade area (Fig. 13). However, due to material differences, the flint blade had cracked, whilst the metal blade only deformed. It is important to note that during the work process, the bronze knife frequently became dull; therefore, it required re-sharpening. As was noticed during the experiments, the flint knives were much better suited for the butchering process.

The last experiment was related with fish butchering. Fish cutting and scale peeling required only a single flint knife. The tool was made from a light brown

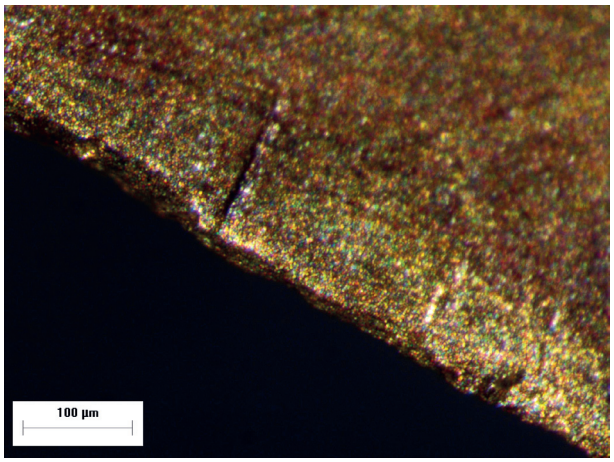

Fig. 11. Use-wear traces of a bronze knife. Magnification 80x. Photo by G. Slah.

11 pav. *Darbo pėdsakai ant bronzos peilio. Objekto vaizdas padidintas 80 kartų. G. Slah nuotrauka*

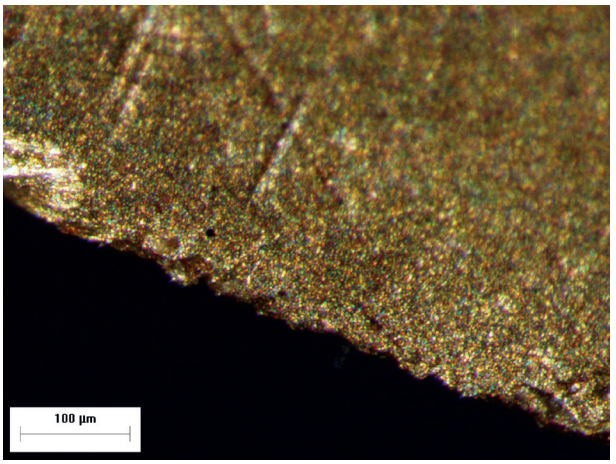

Fig. 13. Use-wear traces of a bronze knife. Magnification 80x. Photo by G. Slah.

13 pav. *Darbo pėdsakai ant bronzos peilio. Objekto vaizdas padidintas 80 kartų. G. Slah nuotrauka*

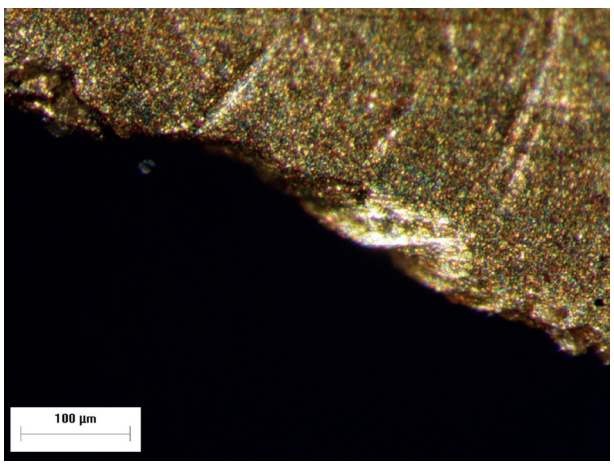

Fig. 12. Use-wear traces of a bronze knife. Magnification 80x. Photo by G. Slah.

12 pav. *Darbo pėdsakai ant bronzos peilio. Objekto vaizdas padidintas 80 kartų. G. Slah nuotrauka*

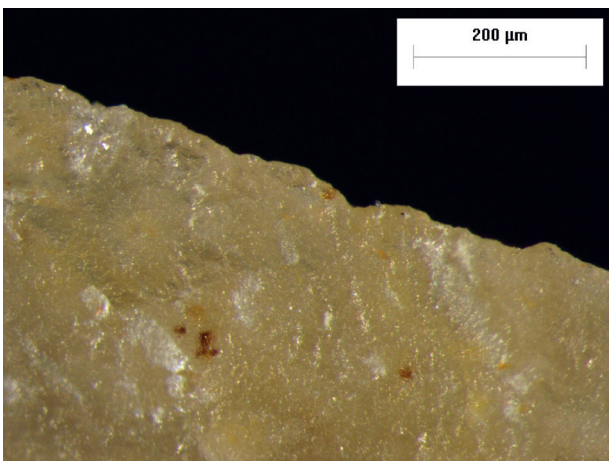

Fig. 14. Use-wear traces from pike (*Esox lucius*) butchering. Magnification 62x. Photo by G. Slah.

14 pav. *Darbo pėdsakai, likę paskerdus lydeką* (Esox lucius). *Objekto vaizdas padidintas 62 kartus. G. Slah nuotrauka*

flint blade. The knife partly was covered with cortex; however, that did not affect the work process at all. The butchering process lasted about 20 minutes. More intensive use-wear traces were noticed on the knife's blade area, after magnifying it by 16x. Use-wear traces seemed quite hard, with big splits and micro retouch. Polishing was visible after magnifying image by 63x (Fig. 14). Utilization was detected on both halves of the blade.

DISCUSSION AND FINAL REMARKS

So far, not many studies on experimental use-wear analysis were conducted in Lithuanian scientific works (Rimkus, 2016, p. 31–33). The present article holds data on the function of flint and metal knives, which enables us to supplement more information about the usage of these tools in prehistoric animal butchering techniques. Flint tools were prevailed in Lithuanian

Fig. 15. A flint knife from the 1st Katra settlement. Photo by T. Rimkus and G. Slah.

15 pav. *Titnaginis peilis, rastas Katros 1-ojoje gyvenvietėje. T. Rimkaus ir G. Slah nuotrauka*

Fig. 16. Use-wear of soft organic material. Magnification 25x. Photo by G. Slah.

16 pav. *Darbo pėdsakai, likę nuo minkštos organinės kilmės medžiagos. Objekto vaizdas padidintas 25 kartus. G. Slah nuotrauka*

territory during the Late Neolithic – Early Bronze Age. According to archaeological data, knives were made of massive blades or flakes, constantly producing them with a hard percussion technique (Girininkas, 2009, p. 166). Based on this provision, similar experimental flint knives were manufactured as the representatives of a latter chronological period.

During experimentation, it was noticed that the work process was strongly influenced by the shape of the tools. For the skinning, the knives which were of a curved blade were more appropriate. The curvature of the blade had enabled the skinning process to be more effective. The same can't be said about the knives with a straight working blade. After 20 minutes' work with curved shape tools, they still could have been used for more work. Observed use-wear traces were typical for soft material.

Knives with a straight working blade were used for various muscle groups, as well as the separation of cartilages, internals, joints and limbs. Knives used for softer tissues (muscles) had use-wear traces typical to meat processing. This class of instruments had sharp splits with polish. Archaeological parallels found during use-wear examinations of the Katra 1 settlement flint inventory (Varėna district, southern Lithuania) (Girininkas, 2000, p. 12–14). One of the archaeological knives was made from the blade (Fig. 15). Use-wear traces were detected only on the one edge that was used for work. A microscopic analysis showed that in this part of the tool, use-wear traces characteristic to soft material can be seen (Fig. 16). It is important to express that in the distal part of the tool, use-wear traces characteristic to hard material carving were found as well. This led us to believe that this tool served as a double function knife.

Another very similar knife from the Katra 1 settlement had similar use-wear traces (Fig. 17). The distal part of the working blade had parallel utilization as the knives used for the experiments (Fig. 18). It is interesting that on tools proximal we had encountered hafting traces (Fig. 19). Like the one from the experiment, this knife could have been also wrapped in tree splint, skin, birch bark or other organic material.

Hard material (bones, joints, etc.) sawing traces were detected while analyzing a flint knife from the Janapolė 2 settlement (Telšiai district, western Lithuania). This tool was obtained during an archaeological survey and

Fig. 17. A flint knife from the 1st Katra settlement. Photo by T. Rimkus and G. Slah.

17 pav. *Titnaginis peilis, rastas Katros 1-ojoje gyvenvietėje. T. Rimkaus ir G. Slah nuotrauka*

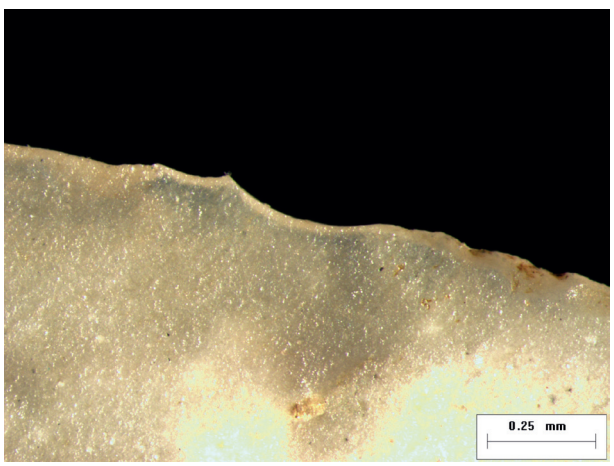

Fig. 18. Use-wear of soft organic material. Magnification 40x. Photo by G. Slah.

18 pav. *Darbo pėdsakai, likę nuo minkštos organinės kilmės medžiagos. Objekto vaizdas padidintas 40 kartų. G. Slah nuotrauka*

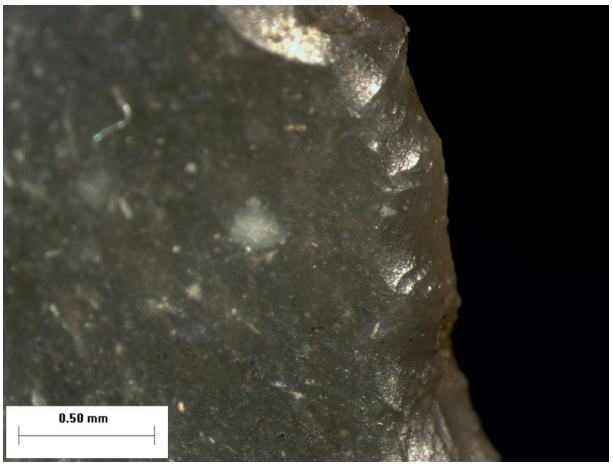

Fig. 19. Hafting traces. Magnification 32x. Photo by G. Slah.

19 pav. *Įtvėrimo pėdsakai. Objekto vaizdas padidintas 32 kartus. G. Slah nuotrauka*

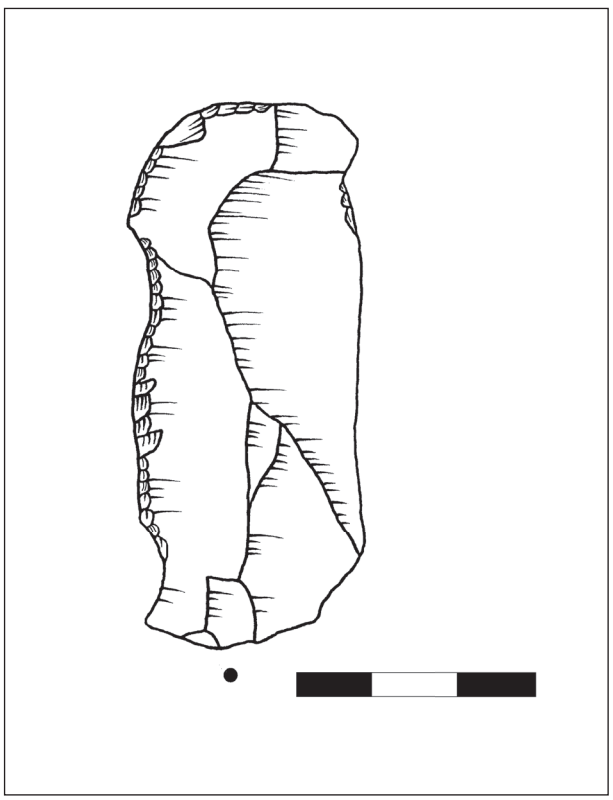

Fig. 20. A flint knife from the 2nd Janapolė settlement. Drawing by T. Rimkus.

20 pav. *Titnaginis peilis, rastas Janapolės 2-ojoje gyvenvietėje. T. Rimkaus piešinys*

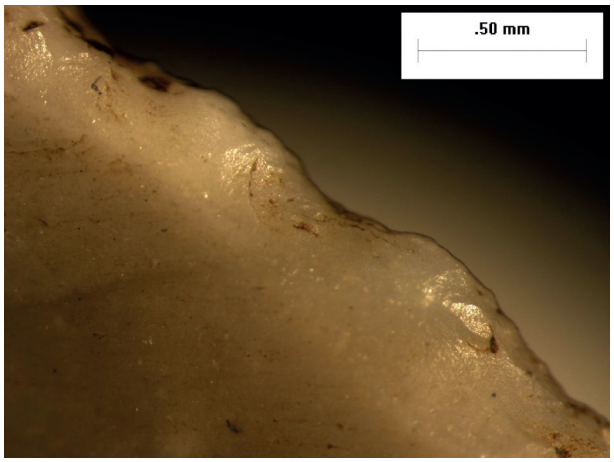

Fig. 21. Sawing traces of hard material. Magnification 25x. Photo by G. Slah.

21 pav. *Kietos medžiagos pjovimo pėdsakai. Objekto vaizdas padidintas 25 kartus. G. Slah nuotrauka*

is made from a massive blade (Butrimas, 1980, pp. 3–6; 1998, pp. 121–125) (Fig. 20). During use-wear analysis, traces with hard material (possibly bone) sawing were detected (Fig. 21). On the basis of utilization intensity, we think that this knife was used for quite a long time. A longer usage of this artifact is denoted by one of its edges that is retouched by semi-flat retouch. This part was probably used for hafting. It is quite possible that this knife was used for animal butchering and the production of various osseous tools.

Knives made of flint and metal were used for bison butchering. Thus, two different materials were compared in the work process. The bronze knife was used for skinning, as well as cutting the Achilles tendons and the quadriceps femoris muscle. In our opinion, this knife was not good enough for these tasks. Even a sharpened bronze knife was not that effective as the flint ones. Furthermore, this knife's working blade became dull very rapidly, thus the work process was not productive. However, flint tools functioned much better. Even a novice craftsman with respective knapping skills could manufacture them quickly and easily. During the work process, each of us had additional copies of knives and raw material for quick production. After the flint knifes' blades became dull, we simply changed them with another ones, or renewed them with the help of retouch. This way, the work process was more effective.

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LITERATURE

Brazaitis D. 2004. Papiškių 4-oji durpyninė gyvenvietė. *Lietuvos archeologija,* 25, p. 187–220.

Butrimas A. 1980. Biržulio ež. apylinkių (Telšių raj.) akmens amžiaus gyvenviečių tyrinėjimai 1978 ir 1979 metais. *Archeologiniai tyrinėjimai Lietuvoje 1978 ir 1979 metais*, p. 3–6.

Butrimas A. 1998. Biržulio baseino ir Žemaičių aukštumos akmens amžiaus tyrinėjimų apžvalga. *Lietuvos archeologija*, 15, p. 107–131.

Daugnora L., Girininkas A. 1998. Stock breeding in the Baltic culture area. *Archaeologia Baltica,* 3, p. 223–234.

Daugnora L., Girininkas A. 2004. *Rytų Pabaltijo bendruomenių gyvensena XI–II tūkst. pr. Kr*. Kaunas: Lietuvos veterinarijos akademija.

Daugnora L., Girininkas A. 2004a. Kretuono 1C gyvenvietės bendruomenių gyvensena. *Lietuvos archeologija,* 25, p. 233–250.

Daugnora L., Girininkas A. 2009. Butchery in the Early Bronze Age (Kretuonas 1C settlement data). *Archaeologia Baltica*, 12, p. 46–56.

Dolfini A., Crellin R.J. 2016. Metal work wear traces: the loss of innocence. *Journal of archaeological science*, 66, p. 78–87.

Girininkas A. 2000. Katros 1-oji gyvenvietė. *Archeologiniai tyrinėjimai Lietuvoje 1998 ir 1999 metais*, p. 12–14.

Girininkas A. 2009. *Akmens amžius. Lietuvos archeologija,* 1. Vilnius: Versus aureus.

Girininkas A. 2012. The structure of the economy and society in the Early Bronze Age in Lithuania. *Archaeologia Baltica*, 18, p. 28–42.

Girininkas A. 2013. Ankstyvasis metalų laikotarpis. *Lietuvos archeologija*, 2. Klaipėda: Klaipėdos universiteto leidykla.

Girininkas A., Daugnora L. 2015. *Ūkis ir visuomenė Lietuvos priešistorėje,* 1. Klaipėda: Klaipėdos universiteto leidykla.

Leduc Ch. 2012. Ungulates exploitation for subsistence and raw material, during the Maglemose culture in Denmark: the example of Mullerup site (Sarauw's island) in Sjælland. *Danish journal of archaeology,* 1 (1), p. 62–81.

Luik H., Piličiauskienė G. 2016. Bone tools at the Neolithic sites of Šventoji, Lithuania: raw materials and working methods. S. Vitezović (ed.) *Close to the bone: current studies in bone technologies*. Belgrade: Institute of archaeology, p. 188–200.

Mannermaa K., Storå J. 2006. Stone Age exploitation of birds on the island of Gotland, Baltic Sea: a taphonomic study of the avifauna on the Neolithic site of Ajvide. *International journal of osteoarchaeology*, 16, p. 429–452.

Molloy B., Wiśniewski M., Lynam F., O'Neil B., O'Sullivan A., Peatfield A. 2016. Tracing edges: a consideration of the applications of 3D modelling for metalwork wear analysis on Bronze Age bladed artefacts. *Journal of archaeological science*, 76, p. 79–87.

Piličiauskas G. 2004. Akmens ir bronzos amžiaus stovyklos Karaviškėse (Karaviškių 6-oji gyvenvietė, plotai II ir IV). *Lietuvos archeologija*, 25, p. 157–186.

Rimantienė R. 1992. The Neolithic of the Eastern Baltic. *Journal of World Prehistory*, 6 (1), p. 97–143.

Rimantienė R. 1996. *Akmens amžius Lietuvoje* (2-as papildytas leidimas). Vilnius: Žiburio leidykla.

Rimantienė R. 1999. Barzdžio miško gyvenvietė. *Lietuvos archeologija*, 16, p. 171–208.

Rimantienė R. 2005. *Akmens amžiaus žvejai prie pajūrio lagūnos. Šventosios ir Būtingės tyrinėjimai*. Vilnius: Lietuvos nacionalinis muziejus.

Rimkus T. 2016. Microliths in fisheries? Use-wear and experimental study of composite tools of the Mesolithic South Lithuania. *Archeoloģija un etnogrāfija*, 29, 31–45.

Ritchie K.C., Gron K.J., Price D.T. 2013. Flexibility and diversity in subsistence during the Late Mesolithic: faunal evidence from Asnæs Havnemark. *Danish journal of archaeology*, 2 (1), p. 45–64.

Stančikaitė M. 2004. Gamtinės aplinkos kaitos ypatumai vėlyvojo ledynmečio ir holoceno laikotarpiu. *Lietuvos archeologija*, 26, p. 135–148.

Tsirk A. 2014. *Fractures in knapping*. Oxford: Archaeopress.

EKSPERIMENTINIAI IR TRASOLOGINIAI TITNAGINIŲ PEILIŲ TYRIMAI. SKERDIMO TECHNOLOGIJŲ PRIEŠISTORINĖJE LIETUVOJE REKONSTRUKCIJA

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Santrauka

Šis straipsnis skirtas titnaginių ir metalinių peilių eksperimentinei trasologijai analizuoti. Naudojant titnaginius ir vieną iš bronzos pagamintą peilį, buvo paskersti trys gyvūnai – naminė ožka (*Capra aegagrus hircus*), stumbras (*Bison bonasus*) ir lydeka (*Esox lucius*). Straipsnio tikslas yra atlikti eksperimentinių peilių trasologinę analizę, taip pat palyginti titnaginių ir metalinių peilių efektyvumą skerdžiant gyvūnus. Šie tyrimai leidžia pateikti naujų duomenų apie vėlyvojo neolito–ankstyvojo bronzos amžiaus bendruomenių ūkį.

Paskerstiems naminei ožkai ir stumbrui pirmiausia buvo diriama oda. Pradėta buvo nuo užpakalinių kojų ir pjūvis tęsiamas link gyvūno krūtinės. Nuėmus odą, pereita prie vidaus organų ir raumenų pašalinimo. Kitas etapas buvo pašalinti gyvūnų galūnes. Visa eksperimentų metu praversianti žaliava – ilgieji kaulai, oda, sausgyslės – buvo išsaugota ateities moksliniams bandymams.

Iš žuvų apdoroti pasirinkta europinė lydeka, 800 g svorio. Šiam darbui naudotas tik vienas titnaginis peilis. Pirmiausia buvo nuskusti žvynai. Prapjovus papilvę, buvo pašalinti vidaus organai. Pjūvis atliktas nuo žiaunų iki analinio peleko. Žuvies kūnas, atskyrus galvą, padalytas į tris dalis. Visas procesas užtruko apie 10–15 min.

Antrajame tyrimo etape buvo atlikti trasologiniai tyrimai. Šie tyrimai leido pažvelgti į gyvūnams skersti skirtų titnaginių peilių utilizacinius pėdsakus. Tai įgalino ieškoti paralelių tyrinėjant archeologinius dirbinius. Su identiška arba panašia utilizacija titnaginių peilių pavyko aptikti tyrinėjant Katros 1-ąją ir Janapolės 2-ąją akmens amžiaus gyvenvietes. Bronzos peilio trasologinė analizė parodė ašmenų deformacijos pėdsakų, kurių atsirado po kontaktų su stumbro oda bei kremzlėmis.

Eksperimentų metu pavyko nustatyti, kad itin svarbų vaidmenį skerdžiant gyvūną vaidina paties dirbinio forma. Tai pastebėta eksperimentuojant su titnaginiais peiliais, kurie turėjo darbinių ašmenų išlinkimą. Tokios formos titnaginiai peiliai puikiai tiko odai dirti. Tiesiais darbiniais ašmenimis peiliai geriau tiko raumenims, sąnariams, galūnėms dalyti. Taip pat aptiktas titnaginių peilių pranašumas prieš metalinius. Mūsų naudotas bronzinis peilis darbo metu nebuvo našus. Jis greitai atbukdavo, todėl tai lėtino ir stabdė procesą. Titnaginiai peiliai atbukdavo ne taip greitai. Svarbu paminėti ir tai, kad juos lengva pagaminti, todėl eksperimentų metu šalia buvo turima po keletą papildomų kopijų, kad prireikus būtų galima dirbinį pakeisti. Titnaginių peilių darbiniams ašmenims atnaujinti buvo pasitelktas retušas.

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