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ANTLER BOLT SHAFT PLANE – A RARE TOOL FROM THE STRONGHOLD IN MUSZYNA

Abstract: An antler bolt or arrow shaft plane is a tool rarely found in the archaeological materials. Even if one is discovered, it is probably incorrectly interpreted as a part of a musical instrument (a recorder or a pipe). Furthermore, it is believed that apart from the bone, stone and antler arrow or bolt shaft planes were also made of hardwood, which have not been preserved until today. It is a reason why in Poland we know only a few examples of this type of tool – the one discussed from the stronghold in Muszyna and one from the collection of Royal Castle in Warsaw. Therefore, this paper attempts to explain how the planes look like, how they were used and how to distinguish them from a musical instrument in order to avoid misinterpretations in the future, and maybe, to start a bigger work based on a larger number of relicts.

Keywords: Muszyna, antler, bolt shaft plane, arrow shaft abrader, musical instrument

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The stronghold in Muszyna was located on a hill at the very top of the mountain range between two tributaries of the Poprad River: the Muszynka and the Szczawnik, in the immediate vicinity of the city. Digital elevation model analysis of the structure and its close surroundings based on the results of airborne laser scanning showed dry moats on both southern and northern sides of the stronghold (Fig. 1).


The hillfort was accessed from the north through a bridge and a gate (Fig. 2), remains of which were discovered during archaeological excavations in 2018. At the top of the hill there was a defensive structure consisting of two wooden walls standing parallel to each other and filled with clay and stones. On the southern side of the hill, a structure partially carved out in rock and partially built of stones and clay was discovered. These are probably remains of a defensive tower. In the central and northern parts of the parade ground there was a rocky flattening, approximately on the same level

as the gateway, which – also taking into account the artefacts found in cultural layers – could be the location of the residential building. The gate itself was about 140 cm wide and was located in the northernmost part of the hill (Fig. 3).

Until now, it was thought that the stronghold was founded on the initiative of Jan Muskata,¹ but now, after the latest excavations, we think that it was one of many fortifications built by Casimir the Great.² There is no doubt that in the 14th century the hillfort was an administrative and military centre. In the early 15th century, all its functions were taken over by the castle in Muszyna built on the initiative of the bishop of Cracow, Zbigniew Oleśnicki.

After that, the function of the stronghold is not entirely clear. Based on the artefacts obtained during the last archaeological expedition, it seems that it served as a castle borough which could not have the traditional form because of the mountainous terrain. The inner part of the hillfort became an area of craft and manufacture. This is evidenced by numerous finds, including a collection of

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¹ Ginter 2014, 23; Ginter and Majorek 2019b, 69-83.

² Ginter 2019, 199-201; Ginter and Majorek 2019a, 93-109.



Fig. 1. Digital elevation model with plan of the excavation trenches. Elaborated by A. Ginter.

lead bullets for medieval firearms at various stages of production (including semi-finished products in the form of lead cylinders), scissors, carpentry tools, several shards of copper sheet with traces of processing, a very large number of animal bones and a small antler object which is the main subject of this article.

The stronghold was destroyed in 1474 during the Hungarian invasion. After that, it was probably never rebuilt and lost its borough functions. Among the archaeological remains discovered at the Muszyna site, one was shaped in a way that particularly interested the researchers. This artefact was found in the excavation trench number 7, located in the northern part of the stronghold near the gate, and was initially identified as a part of a musical instrument (a recorder or a pipe). After preliminary conservation treatment, it was established that it was an antler arrow or bolt shaft plane, which together with a narrow, single-beveled knife, formed a plane. This tool was used for very accurate surface treatment of circular cross-section wooden objects.

This artefact was found in the same excavation trench where four crossbow bolts were discovered

(unfortunately almost all layers on a stronghold – including trench 7 – were redeposited during cleaning and levelling hill after Hungarian invasion, so we have a few scientific conclusions based on stratigraphy). The presence of the plane as well as the many crossbow bolts (including dozens found in castle) may suggest that a specialised craftsman might have lived and worked there.

According to an Arabic ethnographic source, *Arab Archery. An Arabic Manuscript of about A.D. 1500. A Book on the Excellence of the Bow and Arrow and the Description thereof*, arrow shaft planes of this type were generally employed to polish the shafts of arrows.³ This activity was aimed at obtaining the desired shaft diameter and at the same time it allowed to get rid of all inaccurately removed splinters that could otherwise hurt the hand of an archer holding the bow during the shooting. It also seems that the perfectly smooth

³ *Arab Archery*...Book 44: "Such an arrow is made by shaving a shaft evenly and forcing it through a ring so that it emerges perfectly uniform".

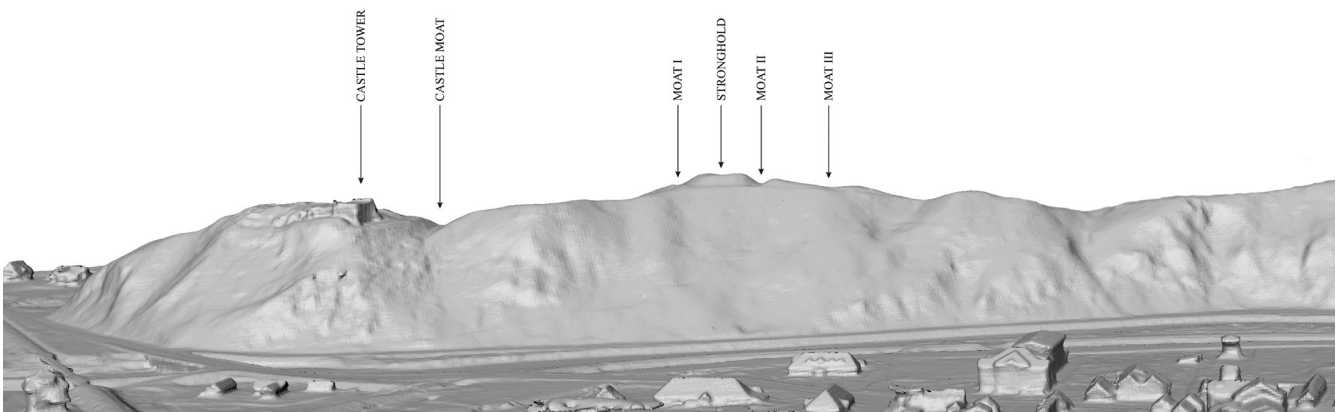


Fig. 2. Digital elevation model. Elaborated by A. Ginter.



Fig. 3. Northern view of the stronghold and of the moat. Photo A. Ginter.

shaft surface could have an impact on improving the accuracy of archer's aim.

The construction and the manner of use of such an arrow or bolt shaft plane did not differ significantly from the way contemporary wooden hand planes are used. The arrow or bolt shaft planes were usually made of long bones or (less frequently) antlers. We also know the artefacts made of hard varieties of wood, but with the younger chronology.⁴

The first step of making the tool consisted in cutting a piece of bone to the length and then in splitting it lengthwise into two pieces, the edges of which were smoothed carefully. The next step to remove the spongy

tissue filling the interior of the bone or antler. In a small, gutter-shaped object thus obtained a hole characteristic for planes was made from the outer side of the bone.⁵ It was used for an iron knife that would be placed in the hole during work. Slots were cut at the right angle or diagonally towards the outer surface of the arrow shaft plane. Experiments conducted by Russian reenactors demonstrated that, when working on smoothing the shaft, one hole was usually used, while the others served as an alternative: should the bone crack so that the hole became too large for the knife, the next hole was used.⁶

⁵ Serhyeyeva 2010, Fig. 10. This figure shows the scheme of using a bone as a raw material of different items, including the arrow shaft plane.

⁶ Spasov, *Kostyanye struhy*.

⁴ See Zykov 1989, 79; *Narody Sibiri* 1956, Fig. 2 on page 168 and Figs. 10-11 on page 744.

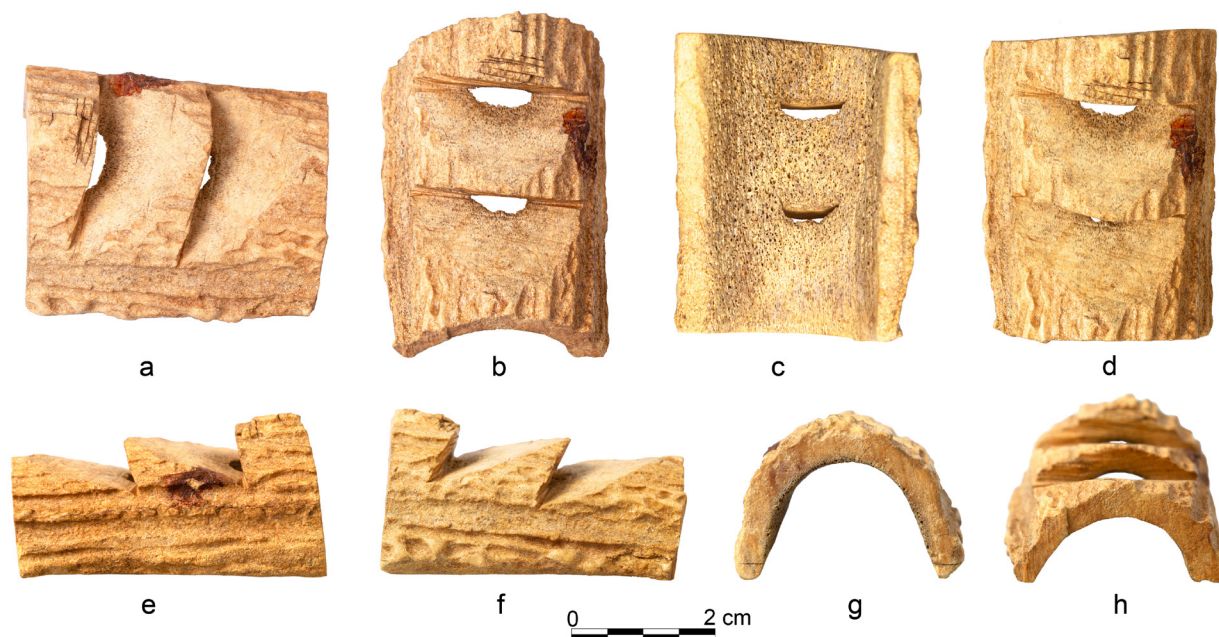


Fig. 4. Bolt shaft plane – different views. Photo A. M. Garstka and A. Ginter.



Fig. 5. Arrow shaft plane at work. Photo A. Ginter.

The first of them, which is partially preserved, comes from a Sarkel site in Russia and was dated to the 10th century.⁷ The second arrow shaft plane, found during archaeological excavations in Kiev, was dated to the

10th-12th century. This arrow shaft plane has five holes with two opposite orientations. The last one, which is richly decorated, was made in the 19th century. Holes set in opposite directions are interpreted in a slightly different way – researchers think the purpose of such holes was to give a fusiform shape to the shaft.⁸ For this reason the shaft was whittled from the middle towards both ends. A straight shaft, on the other hand, was whittled from one end to the other. In both cases the tools were handled in the same way – the arrow shaft plane and the blade were held in one hand while the other hand held the smoothed shaft. It seems the arrow shaft plane from the Muszyna site is one of few which were found (or identified, as described below) in Poland.

It is unique not only due to its rarity, but also due to the material from which it was made. The majority of known (and correctly identified) artefacts are made of bone, while this one is made of antler. Observing its light structure lacking the characteristic beading, but with noticeable grooves (left by blood vessels supplying oxygen and nutrients to the growing bone) it can be concluded that the antler belonged to a roebuck (a male roe deer) or to a buck (a male deer).

Dimensions of our plane from the Muszyna site compared to the parameters of other artefacts of this type (length from 8 to 15 cm, diameter of the rounded part from 1.5 to 3 cm) allow us to consider it as a small

⁸ Here is another fragment of Book 44 in *Arab Archery...* “The sidewise arrow is made by carefully shaving the shaft so that both ends are tapered like a pencil, gradually increasing in size from the ends to the middle where it should be thickest”.

⁷ Medvedev 1966, 50, Tab. 11:19-20, 22.

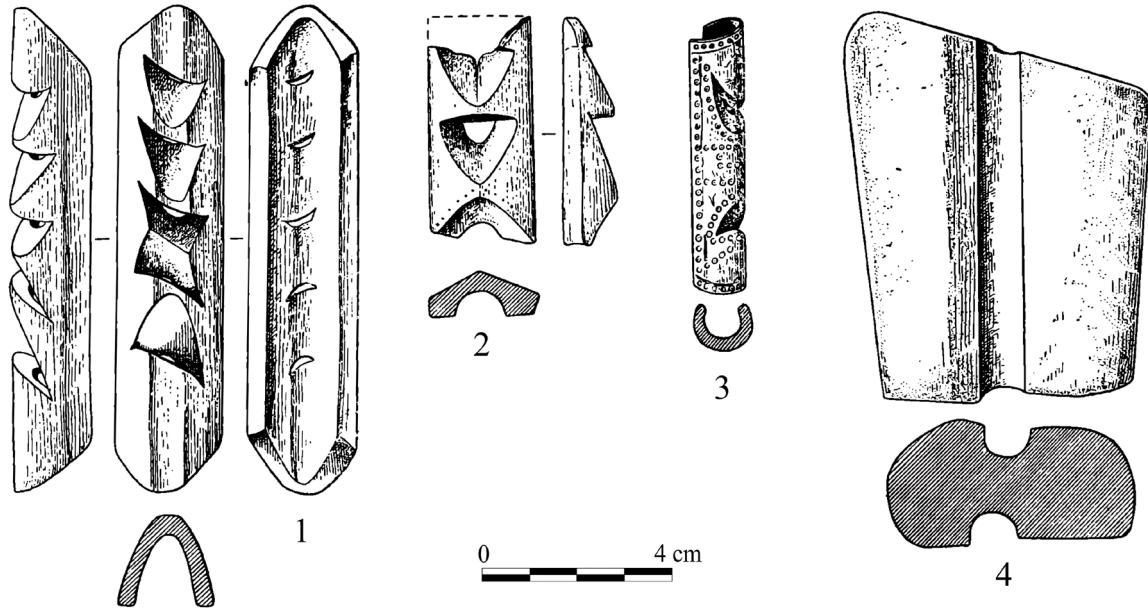


Fig. 6. Arrow shaft planes: 1 – Sarkela, 9-11th century; 2 – plane, 19th century; 3 – Kiev, 10-12th century and 4 – stone made arrow shaft abradar (Bereznyaki na Volke, 5-6th century). After Kirpichnikov and Medvedev 1985, Tab. 134.

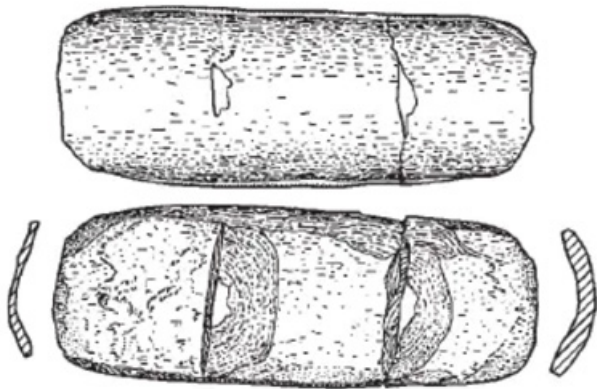


Fig. 7. Horn arrow shaft planes from the Church of the Tithes in Kiev. After Serhyeyeva 2010, Fig. 25:1.

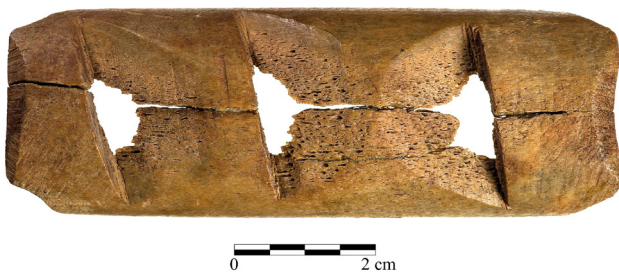


Fig. 8. Royal Castle in Warsaw. Arrow shaft plane, 14th century. After Mroczek 2007, Tab. 10:71.

one (Fig. 4:d,e,f,h). Its most noticeable difference is the length; the artefact from Muszyna is only 4.1 cm long. Its width is 3.3 cm, the thickness – 0.5 cm, and the diameter – 2.4 cm. Considering the diameter size

our plane was more likely used to polish crossbow bolts than arrow shafts.

Two holes were cut in its outer surface and have the same orientation, which allowed whittling the shaft in only one direction. When looking more closely at the artefact it can be observed that one hole is bigger than the other – there are numerous cuts at its edges (Fig. 4:a and 4:c).

Probably the first one was worn out, which is why the shallower second hole was made (Fig. 4:b). It is also possible that the first hole was used for more aggressive treatment of the surface while the shallower one was used to obtain the final effect.

The traces of cuts on the artefact are quite puzzling. The cuts mentioned above may have been created in the process of cutting the hole itself, although it does not seem to be very likely. They might have been cut on purpose to allow some support for fingers, however small it was. Yet in such a case the handpiece of the plane would have to look a bit different from what is seen on the below photo (Fig. 5).

The two cuts on the side surface of the artefact are also interesting (Fig. 4:g). To explain the purpose of these cuts, it would be necessary to reconstruct the whittling process, which is not possible at the moment.

Most of the similar arrow shaft planes known to us come from Russia. In his book, a Russian researcher A. F. Medvedev included a picture presenting three bone arrow shaft planes and one arrow shaft abradar (Fig. 6).

Archaeological excavations in the Church of the Tithes (Kiev) have revealed another interesting example



Fig. 9. Arrow shaft plane from Człuchów castle.
Photo A. M. Garstka.



Fig. 10. Part of early medieval recorder from Brańsk stronghold. After Stankiewicz 1994.

of the horn arrow shaft plane, which M. Serhyeyeva presents in her book⁹ (Fig. 7). This artefact was found in the archaeological layer corresponds to the 2nd half of the 10th century. It has two holes with the same orientation. The quality of construction is atrocious: its surface was carelessly cleaned. It is because, the tool was probably made in haste.

Two medieval analogies to the bone arrow shaft planes are also known from the burial of the Khazar period on the Lower Volga (c. 10th century)¹⁰ and from Trebišov.¹¹ In Poland, the only bone arrow shaft plane known comes from the collection of the Royal Castle in Warsaw¹² (Fig. 8). This tool has three holes oriented in the opposite directions. It has been discovered in the main courtyard of the Copper-Roof Palace in Warsaw. Thanks to the presence of other well dated artefacts, its chronology is set at the first half of the 14th century. Interestingly, it is twice as large as the one from the Muszyna site.

The interpretation of the arrow shaft planes found during the archaeological excavations is an important

issue which should also be addressed. We think that due to the rare presence of this type of tool in the archaeological materials and because of their shape resembling the mouthpiece of a recorder or a pipe, they are often wrongly classified. In order to avoid taking the tool for a musical instrument, two aspects should be considered: its shape and the number of holes as well as the way the edges were formed as the result of lengthwise and transverse division of raw material. In the case of arrow shaft planes, the holes take almost their entire width. A recorder, in turn, only has one, thin and elongated hole situated next to the labium, sometimes of a rectangular shape. The other holes are mostly round. An example of such an instrument from the Middle Ages is a flute found in Tartu, Estonia,¹³ as well as an artefact discovered in a latrine at the Elbląg site.¹⁴ The presence of more slots automatically excludes such an item as part of a recorder. It is also worth noting that most of the known flutes were made of wood.

The situation becomes more complex when an arrow shaft plane has only one hole, like in the case of the artefact from the museum exhibition in the Człuchów Castle (Fig. 9). It looks like a piece of a pipe at first, yet the smoothed edges in the place where the bone was cut dispel any doubts. What is more, the way of splitting into halves should also attract our attention – if it happened accidentally, the crack mark would run across rather than along the object, an example of which is a bone pipe from Brańsk¹⁵ (Fig. 10). It seems, therefore, that the artefact has been incorrectly interpreted, because it is actually an arrow or bolt shaft plane.

Even such a cursory attempt to tackle the subject of planes shows that it is a little more complex than it appears. As it turns out, it can not only be taken for musical instruments but also for bone loom shuttle (although, apart from the characteristic slot and the material - bone or antler - there are no other similarities with the known items).

However, the small number of arrow/bolt shaft planes in the archeological material cannot be attributed to their incorrect classification alone. Possibly, many of them were made of hardwood, which, considering the small size of the object, is the reason they have not been preserved until today. Certainly there were also stone arrow shaft planes used,¹⁶ known both from the Russian and Western European literature and fairly frequent among the archaeological artefacts (thanks to the sturdy material of which they were made).

⁹ Serhyeyeva 2010, 79, Tab. 25:1.

¹⁰ Fodorov-Davydov 1984, 90-91.

¹¹ Slivka 1984, 408, Tab. 3:24.

¹² Mroczek 2007, 63.

¹³ Tvauri and Utt 2007, 141-154.

¹⁴ Popławska 2004, 483-487.

¹⁵ Stankiewicz 1994, 93.

¹⁶ Medvedev 1966, Tab. 11:21.

This article does not nearly exhaust the subject of planes used for arrow or bolt shaping. However, it seems it may serve as a good introduction to a bigger work based on a larger number of relics. We would like

to encourage our readers, who might have come across similar artefacts but, for various reasons, have not yet published anything on the topic, to contribute.

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