

## Projectile weapons of the Late Bronze Age in Eastern Europe. The case of the Noua-Sabatinovka-Coslogeni cultural complex<sup>1</sup>

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**Abstract:** *The present paper aims to analyse projectile points of the Late Bronze Age Noua-Sabatinovka-Coslogeni cultural complex. They are produced mostly of bone and appear in large numbers in settlements, far less in hoards or graves. Metric analysis points at their improved efficiency in comparison to earlier projectile points of flint; several groups with different grades of efficiency can be distinguished. Their utilisation in warfare in times with altered mobility can be presumed. Even if they are not part of the depositional process like other weapons of bronze, and are neither deposited in graves, they seem to constitute an important element in warfare. More mobile battle tactics, which may imply also the invention of new forms of lighter bows, seem to become visible behind this find group.*

**Keywords:** *Bronze Age, Noua-Sabatinovka-Coslogeni, projectile points, warfare, metric analysis*

The celebrated has several times noticed a general preference of archaeologists towards the study of 'interesting' find categories, and a certain neglect towards others. He tried to avoid this bias by writing for example about Bronze Age spearheads of the Carpathian Basin (T. Bader, *Lanzenspitzen-eine vernachlässigte Fundgattung*, 2006 and T. Bader, *Die Lanzenspitzen in Rumänien-* forthcoming). As projectile points can be seen - with a little imagination - as the smaller relatives of the spearheads and at the same time represent an even more neglected category of finds, the choice of the topic for the present study in honour of Tiberius Bader has not to be substantiated any more.

### A general overview

The term 'Noua-Sabatinovka-(Coslogeni)-Complex' (NSC) refers to a Middle and Late Bronze Age archaeological phenomenon spread between Transylvania in the west, the Dniester and Dnepr in the east and the Black Sea in the south<sup>2</sup> (fig. 1). Generally, the term 'Sabatinovka Culture' (SC) encompasses the finds in the steppe regions north of the Black Sea, the term 'Coslogeni Culture' is used for the Romanian finds in the Dobruja, while the term 'Noua Culture' (NC) defines the finds in the area from the forest-steppe between Prut and Dniester westwards to Transylvania<sup>3</sup>. The opinions on the genesis and unity of this cultural complex differ, and a very long and complicated research history has arisen<sup>4</sup>; however this will not be the subject of the present article.

In fact, the study of the projectile points of the Noua, Sabatinovka and Coslogeni cultures in one place is mainly justified by their appearance in a special type of find context: the settlements with 'ashmounds'<sup>5</sup>, which are common in all mentioned groups. 'Ashmounds' are known as isolated instances also in other cultural milieus, but certain forms are restricted to the NSC area. 'Ashmounds' are round to oval heaps with a diameter of 25-30 m formed of greyish sediments. They were believed to be burnt houses, barns, waste dumps or ritual burning places<sup>6</sup>. In the last few years an extensive discussion on the function of this mysterious find group was generated by extensive excavations in sites like Rotbav, southeast Transylvania<sup>7</sup> or Odaia Miciurin, Moldavia<sup>8</sup>. Chemical analysis of the 'ash' has shown them to be formed in reality of earth and burnt lime<sup>9</sup>. Based on chemical analysis from Odaia Miciurin and

<sup>1</sup> It would not have been possible to write this article without the help of many colleagues and friends, who provided information and read earlier versions of this paper. I would like to express my gratitude to: Adrian Adamescu, Sorin Ailincăi, Nico Becker, Corneliu Beldiman, István Botár, Dan Buzea, Valeriu Cavruc, Vasile Diaconu, Oliver Dietrich, Sebastian Matei, Tobias Mörtz, Anca Popescu, Rita Németh, Bogdan Niculică, Tudor Soroceanu, Sándor Sztáncsu.

<sup>2</sup> Florescu 1964, Sava 1998 with further literature.

<sup>3</sup> f.e. Florescu 1991; Dergačev 1994, 54-71; Sava 1998, 2005, Gerškovič 1999.

<sup>4</sup> c.f. Sava 1998; 2002; 2005, with further literature.

<sup>5</sup> Dietrich 2011, 2012.

<sup>6</sup> Sava 2005a with further literature.

<sup>7</sup> Dietrich 2011, 2012.

<sup>8</sup> Sava/Kaiser 2011.

<sup>9</sup> Kaiser/Sava 2006

from Rotbav<sup>10</sup>, as well as a detailed examination of the ‘ashmound’ of Rotbav, I was able to show that the ‘ashmounds’ represent special, collectively used places constructed at the boundary of the settlement in round or oval basins, where extensive hide working, but also other activities like communal feasting, took place. I will come back to the interrelation of the function of the ‘ashmounds’ and the projectile points analyzed below later.

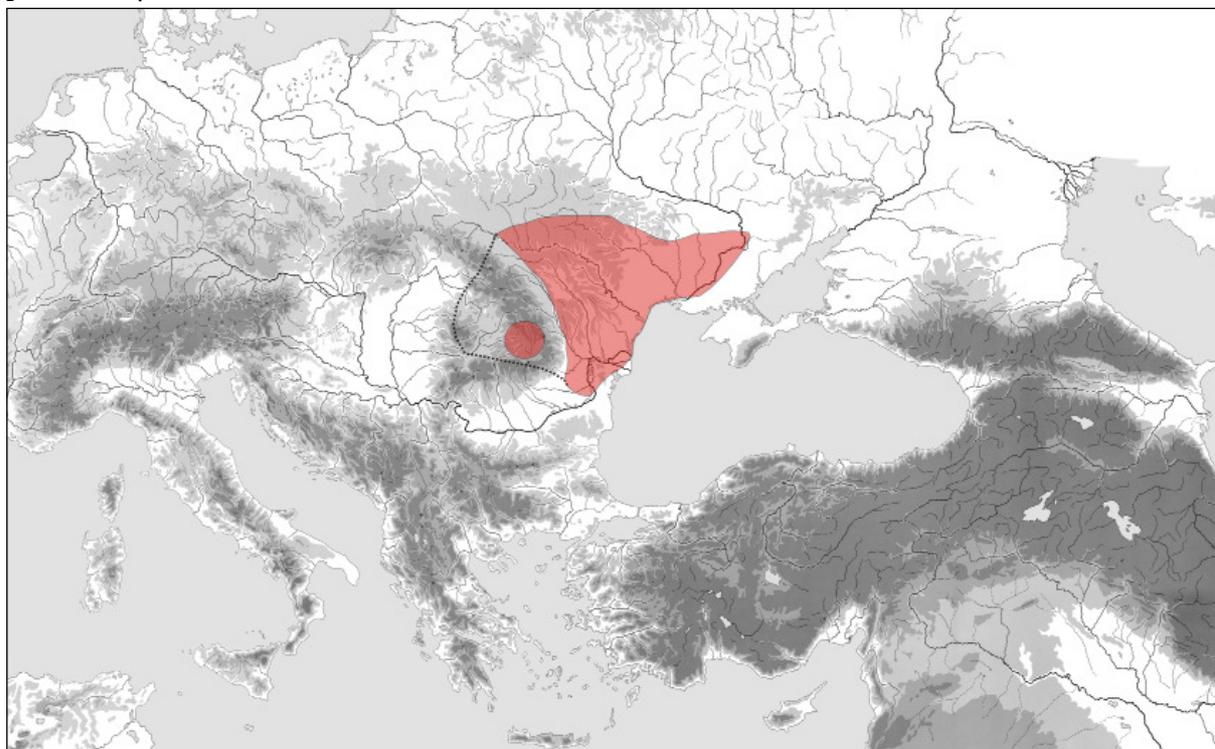


Fig. 1: Distribution of the Noua-Sabatinovka-Coslogeni Complex; settlements with ‘ashmounds’ (in red).

We do not have a very concrete image of the spatial distribution of settlements and the organization of cultural landscapes in the whole area of the NSC, but studies in southeast Transylvania<sup>11</sup> produced evidence for small, somehow uniformly distributed settlements with ‘ashmounds’ and cemeteries in their immediate proximity. It is yet not sure that this settlement model can be extended over the whole distribution area, albeit other regions seem to confirm the general impression<sup>12</sup>. A hierarchy of settlements is hardly discernable archaeologically. The graves, mostly plane in the NC and barrows in the SC<sup>13</sup> have very few grave goods, mostly pottery; they neither do reflect a hierarchy. The society seems to be based largely on lineages; elites are at least not easily discernible archaeologically<sup>14</sup>. Nevertheless some differentiation has to be assumed, as prestige objects seem to exist<sup>15</sup>.

With the NSC rich metalwork in form of numerous hoards as well as finds of casting moulds is associated<sup>16</sup>. The hoards have generally a complex structure, although sickles and socketed axes dominate. Nevertheless, also daggers and spearheads are present in considerable numbers in the NSC hoards<sup>17</sup>. Together with battle-axes, short swords and bow/arrows they seem to constitute the main weaponry of the NSC<sup>18</sup>. While weapons such as daggers and spearheads<sup>19</sup> as parts of hoard finds have been studied

<sup>10</sup> Dietrich 2013 forthcoming.

<sup>11</sup> Dietrich 2010.

<sup>12</sup> Bicbaev, Sava 2004.

<sup>13</sup> Sava/Agulnikov 2003; Gerškovič 1999.

<sup>14</sup> Dietrich 2010.

<sup>15</sup> e.g. Vulpe/Lazăr 1997.

<sup>16</sup> Dergačev 2002, Uşurelu 2006.

<sup>17</sup> Uşurelu 2006.

<sup>18</sup> Klochko 2001, 197-223; compare with the general remarks for the Carpathian Basin by Soroceanu 2011.

<sup>19</sup> Not to mention the PBF volume in preparation by Tiberiu Bader.

intensively from typological and chronological points of view<sup>20</sup>, the projectile points occupy generally a marginal position in lines of archaeological evaluation. They received some attention on one hand through Klochko's<sup>21</sup> extensive studies on Late Bronze Age weaponry and on the other hand through the detailed study of bone projectile points by Beldiman<sup>22</sup>, based on the finds of the NC settlement from Zoltan, southeastern Transylvania. Nevertheless, a synthesis comprising all finds as well as a metric analysis is yet missing.

I collected c. 200 projectile points of bone, stone and bronze from 48 find contexts of the NSC, mostly from settlements. However, an accurate number for the entire find group cannot be estimated yet, as in some publications the total number of finds was not specified and only a few of the around 600 settlements known so far for the NSC<sup>23</sup> have been excavated and/or published extensively.

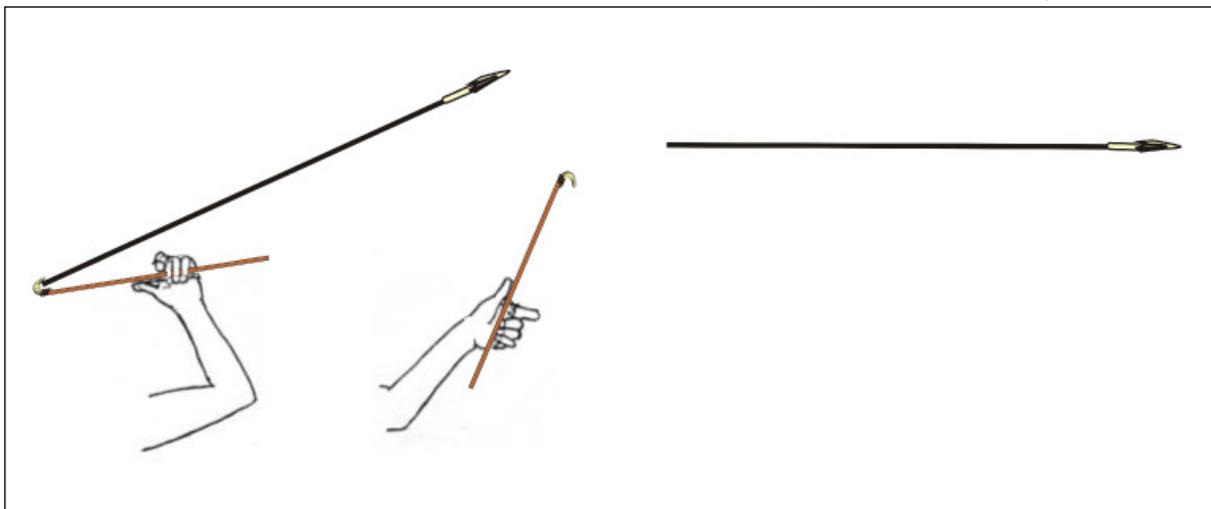


Fig. 2: Reconstruction of throwing process with an atlatl.

Nevertheless, the catalogue compiled for the present paper adds some new forms and types to those defined by Klochko<sup>24</sup> and Beldiman<sup>25</sup>; a new morphological classification including all types was necessary to reach consistency. Data like length, width and thickness, mostly based on the published drawings, have been taken and introduced into a metric analysis as basis of the classification. Only a part (55%) of the projectile points could be measured, but the results are statistically significant and can be applied to the whole find class. Unfortunately the weight, which is an important parameter, could not be added to the present analysis, since it is generally not given in publications; however a new project will aim at filling this gap<sup>26</sup>. A total of 5 types, each with several variants, could be differentiated. But, before presenting this classification, some terms and definitions must be explained.

#### **The finds**

A variety of research languages and traditions determined the development of divergent terminologies; the terms used to denominate projectile weapons have different meanings and connotations for example in German, English and Romanian.

Only regarding arrow heads (“Pfeilspitzen”, “vârfuri de săgeți”), projectile points that are shot with a bow, there is a general consensus in terminology. Similar in form with arrow heads, but using another throwing system are darts<sup>27</sup> (“Speerschleuderspitzen” in German, “săgeți” in Romanian). Darts are generally fixed into a flexible shaft and thrown by a spear thrower or ‘atlatl’ (c.f. reconstruction fig. 2). The typical atlatl is made of about an arm’s length of wood (approximately 50-60 cm) with a hook on

<sup>20</sup> e.g. Petrescu-Dîmbovița 1977; Dergačev 2002; Ușurelu 2006.

<sup>21</sup> Klochko 1993, 1995, 2001

<sup>22</sup> Beldiman 2002.

<sup>23</sup> c.f. Florescu 1991; Sava 2005a.

<sup>24</sup> Klochko 1992, 2011.

<sup>25</sup> Beldiman 2002.

<sup>26</sup> A project of the author is envisaged to start shortly.

<sup>27</sup> Not to be confounded with the projectiles used in the modern dart game, with which they have nothing in common.

the distal end<sup>28</sup>. The hook at the end can be made of bone or wood or a naturally formed tree branch can be transformed into it. Darts are very similar in shape to arrows; a separation can be made only based on parameters like neck or shoulder width, length, thickness and weight<sup>29</sup>. Atlatls were widely used, for example in America and Australia; they are also known from Paleolithic sites in France or Africa<sup>30</sup>. A certain technological supremacy of the bow as a launching system has to be taken into account, which led also to the replacement of the atlatl by the bow (although in many regions both weapons were used contemporaneously). Nevertheless, accuracy analysis has demonstrated that both weapons are to some degree comparably effective, although operating an atlatl demands more skill<sup>31</sup>. Generally the archaeological visibility of the atlatl is low, especially when it is completely made of wood; darts remain undiscovered between the arrowheads, when no metric analysis is conducted. For the Bronze Age the presence of this weapon has not even been taken into account so far, but it will be in the present paper.

Another type of projectile weapon is the spear (javelin). In German it is called 'Speer' or 'Wurfspeer', in Romanian 'suliță' or 'lance'. Broadly one can differentiate between throwing and thrusting spears, but an appropriate approach in this sense is missing for the NSC, as well as use wear or metric analysis. Using an exact definition, only throwing spears can be classified as projectile weapons. Multi-functionality is also possible. Since use wear analysis is not available for NSC projectile points, only a small control group of definite spear heads was included in the present study.

The majority of the analyzed finds is constituted of smaller projectile points of bone and stone; bronze is also present, but is not frequent. Two classifications were made, a first one based on morphological traits, a second one based on metrical data. Five morphological groups could be separated, each with a few variants, the criteria being the general shape, shape of the blade and the shafting mode (fig. 3).

***Type 1. Bullet-shaped projectile points (bone and bronze)***

The body can be faceted or rounded. Projectile points of this type have lengths between 2 and 3,5 cm, and widths up to 0,7 cm; the thickness is the same as the width.

This type was mentioned by Florescu<sup>32</sup> for some NC settlements and was defined by Klochko<sup>33</sup>. Nevertheless, the function of some of these objects as projectile points is still questionable. An almost identical object from the Noua-Settlement from Rotbav was identified as a needle support ('Nadelhalter'), because it was found together with a similarly decorated needle<sup>34</sup>. However, we cannot exclude that some of these pieces could have been projectile points; further analysis should concentrate on the use-wear.

***Type 2. Elongated flat projectile points (bone)***

Characteristic for this type is that the shaft and the blade are not separated from each other, only a few pieces have on one side a cut which suggests a separate blade. Projectile points of this type have lengths between 3 and 7 cm, widths up to 1,3 cm and they are usually very thin (0,2-0,5 cm). Three variants could be recognised, anyway it is not sure if objects of variant C are really projectile points or awls. Even if the form suggests this, the exact function should be assured by use-wear analysis.

A. Basic form, wider or narrower, most times asymmetrically elongated, although also symmetrical pieces (with the biggest width in the middle) occur.

B. With 'barbs' in the middle.

C. With 'barbs' in the lower part.

The first two variants were defined by Beldiman<sup>35</sup> based on the NC Settlement from Zoltan. Furthermore, Beldiman reconstructed the hafting possibilities of this type of projectile points<sup>36</sup>, which are either strapped to or inserted into the shaft.

***Type 3. Triangular tangless projectile points (bone and flint).***

<sup>28</sup> Modern reconstructed atlatls can be seen for example here: <http://www.worldatlatl.org/>; <http://www.grinnell.edu/academic/anthropology/jwweb>; <http://www.speerschleuder.de/>.

<sup>29</sup> e.g. Thomas 1978, Shott 1997; O'Shea 2006; Bretze *et al.* 2006.

<sup>30</sup> e.g. Thomas 1978; Shott 1997; O'Shea 2006; Bretze *et al.* 2006; Ames *et al.* 2010; Whittaker 2009.

<sup>31</sup> Whittaker 2013.

<sup>32</sup> Florescu 1991, 73, fig. 142, 2-5, 7-10.

<sup>33</sup> Klochko 1993, 43, fig. 3/14-16; 2001, 201, fig. 79/9-12

<sup>34</sup> Dietrich 2010 with fig. 1.

<sup>35</sup> Beldiman 2002, 117, fig. 11/1, 11/2, type 1 and 2.

<sup>36</sup> Beldiman 2002, Fig. 15/I.1, I.2.

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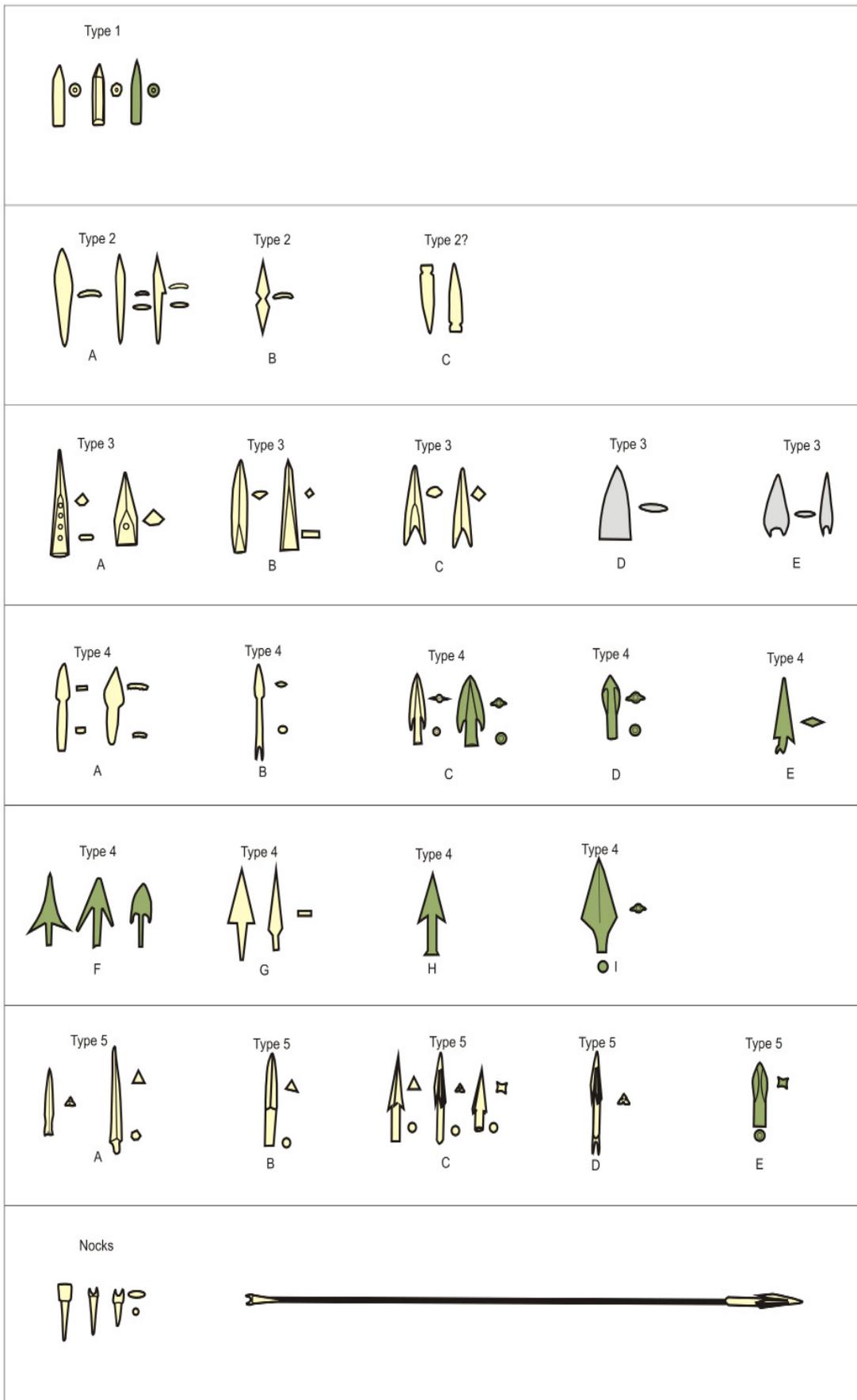


Fig. 3: Types of projectile points and nocks of the Noua-Sabatinovka-Coslogeni Complex.

Their faceted or flat blade is more or less triangular, with a straight or rounded cutting edge. Some of the variants have hafting plates; some others are hafted at the lower part of the blade. Projectile points of this type have lengths between 3 cm and 6,4 cm and widths up to 2,2 cm.

Five variants could be identified:

A. With rivet holes on the hafting plate (bone). Projectile points of this variant can be elongated, with a triangular hafting plate and up to four rivets, or shorter, with a polygonal plate and one rivet. The hafting plate forms nearly half of the total length, so that the hafting was presumably very stable. The blade is faceted (up to four facets).

B. With hafting plate and straight base, without rivet holes (bone). The hafting plate is triangular and can be shorter or longer, the blade has up to four facets.

C. Faceted, with a concave base (bone). Projectile points of this variant have faceted blades and can have an extra facet in the upper part of the concave base, probably for a better hafting or imitating the retouches of flint points; the resulting two pointed barbs strengthen the hafting.

D. Flat, without hafting plate, with straight base (flint).

E. Flat, with concave base (flint). The barbs are curved to the inside.

The flint variants D and E are very common in the whole geographic area under discussion and have a very long tradition starting from the Neolithic. Both variants were mentioned by Florescu<sup>37</sup> for the NC. Klochko<sup>38</sup> assumes a replacement of the traditional flint points by bone and bronze projectile points in the Late Bronze Age. However, one can see that they are still present in the NSC.

The bone variant C was also defined for the NC by Klochko<sup>39</sup> under the name 'hollow arrowheads'. The variants A and B with hafting plates were illustrated by Florescu<sup>40</sup>.

***Type 4. Triangular tanged or socketed projectile points with a wide blade (bone and bronze)***

These projectile points have a wide triangular blade which is mostly flat-oval in diameter, and a clearly delimited lower part in form of a tang or a socket, which can be longer, shorter or of equal length with the blade. Some variants of type 4 are quite long (up to 8 cm), the width varies between 0,8 cm and 2,2 cm.

A. Long, flat and wide tang with straight base and triangular blade (bone).

B. Similar form, but the base is concave (bone).

C. Socketed projectile points with triangular blade and barbs (bone and bronze).

D. Socketed projectile points with oval blade (bronze).

E. Tanged projectile points with protruding barbs (bronze).

F. Thin tanged and pointed barbs (diverse variants of shape are known based on casting moulds only).

G. Elongated blade and short tang.

H. Tang in form of a 'T'.

I. Socketed projectile points with triangular faceted blade.

Variants A and B were defined for the NC by Beldiman<sup>41</sup> based on the finds from Zoltan. The tangs can be strapped to the wooden shaft or inserted in it; possibilities for hafting are illustrated by Beldiman<sup>42</sup>.

The socketed projectile points of variants C and D were defined by Klochko<sup>43</sup> and illustrated also by Florescu<sup>44</sup>. Also the tanged projectile points of variants E and F ('Kherson type' and 'Slobodka type') and H and I ('Sovorovo type') were defined by Klochko<sup>45</sup>.

***Type 5. Narrow faceted tanged or socketed projectile points (bone or bronze)***

Projectile points of this type have mostly three, sometimes four facets and are longer in

<sup>37</sup> Florescu 1991, 73, fig. 163/3, 6, 10.

<sup>38</sup> Klochko 2001, 199-202, especially 202.

<sup>39</sup> Klochko 2001, 199, fig. 79/1-3.

<sup>40</sup> Florescu 1991, fig. 142, 8/10.

<sup>41</sup> Beldiman 2002, 117/3, 5, types 3 and 5.

<sup>42</sup> Beldiman 2002, fig. 16/II-III.

<sup>43</sup> Klochko 2001, 202, fig. 79/16.

<sup>44</sup> Florescu 1991, fig. 112/1, 2; 141/2.

<sup>45</sup> Klochko 2001, 201, ba, bb, bc, bd and be fig. 79/13-15.

comparison to all other variants (up to 11 cm). They may look more slim and narrow than other projectile points, but due to the barbs sticking out considerably they are in reality quite wide and have a high penetration force.

- A. Small shaft, three facets (bone).
- B. Long shaft, three facets (bone).
- C. Long shaft and barbs, three and four facets (bone).
- D Concave base (bone).
- E. Socketed projectile points, four facets (bronze).

All variants can be found under different names in the works of Klochko<sup>46</sup>, and Beldiman<sup>47</sup> and were mentioned by Florescu<sup>48</sup>.

#### **Nocks** (Fig.3., bottom)

Florescu<sup>49</sup> classified these objects as 'arrowheads' and Klochko<sup>50</sup> as 'bone rings for straightening bowstrings'. It is probable that the objects have to be interpreted as nocks, i.e. the part of the arrow where the bowstring enters. Nocks can be made simply by grooving the wooden rearmost end of the arrow, but nocks made separately of bone or wood and set into the arrow are also known (reconstruction fig. 3, below)<sup>51</sup>. This has the advantage that not the whole arrow splits when high forces act on the notch.

All types and variants are spread in the whole area of the NSC, without visible concentrations. However this image should be treated with reservation, as it is clearly biased by the state of research and publication. Origin and analogies of the projectile points were discussed in detail by Klochko<sup>52</sup>. Most of the forms are of local origin<sup>53</sup>, being already used in the Early and Middle Bronze Age in this region<sup>54</sup>, for others an eastern origin can be assumed<sup>55</sup>. However, not the origin of different forms of projectile points will be discussed here, although this subject should be further analysed in a separate study integrating the data on all weapon types. Of high interest is a metrical analysis, which can offer insights into the function of the projectile points and the launching systems.

#### **Metrical analysis**

A large number of studies deal with the possibilities of separating arrow heads from dart points. Various attributes are used, like for example width, neck width, thickness and weight<sup>56</sup>, neck width, shoulder width, thickness and length<sup>57</sup>, or weight, tip cross sectional area (TCSA) and tip cross sectional perimeter (TCSP)<sup>58</sup>. Of particular interest is the so called *tip cross sectional area*, which is measured based on the maximum width and thickness of a point<sup>59</sup>, using the formula:  $TCSA = ([1/2 \text{ thickness}] \times \text{width})$ . The TCSA reflects the force necessary to penetrate a target to a lethal depth, measured in the size of the impact hole, and represents a mechanical rather than a stylistic argument<sup>60</sup>, the TCSP in change takes into account not only the area, but also the point's margins<sup>61</sup>.

This metric analysis was applied successfully to projectile point collections from America and to Palaeolithic finds from Africa and the Near East, but never to artefact collections of the Bronze Age.

<sup>46</sup> Klochko 2001, 199, fig. 79/4-6 as 'three petal hafted arrowheads'; 201, fig. 79/7 as 'three faceted bush based arrowhead'.

<sup>47</sup> Beldiman 2002, 117, fig. 11/6, type 6.

<sup>48</sup> Florescu 1991, fig. 140/2, 5-6, 8-9, 141/1.

<sup>49</sup> Florescu 1991, fig. 141/3-7, 10-12.

<sup>50</sup> Klochko 2001, 232, fig. 92/6.

<sup>51</sup> On nocks see for example Eckhardt 1996, 74, Riesch 2002, 49.

<sup>52</sup> Klochko 1993, 2001, 199-202.

<sup>53</sup> Using the term „local“ seems to come somehow in contradiction with the assumption of an eastern origin of the projectile points, but that depends in fact on our definitions of the cultural processes in the Early Bronze Age of Eurasia. As some forms are already attested in the region in the Middle Bronze Age, the term 'local', in the sense of continuity from Middle to the Late Bronze Age, can be used. Where some specific forms were invented is another topic that must be discussed in relation to other weapons, considering cultural processes like diffusion, communication and migration during the Early and Middle Bronze Age.

<sup>54</sup> Klochko 1993; 2001, 158-163; 179-183, especially 193, fig. 77.

<sup>55</sup> Malov 1991, Fig. 4; Malov 2002, Fig. 4.

<sup>56</sup> Thomas 1978.

<sup>57</sup> Shott 1997.

<sup>58</sup> Hughes 1998.

<sup>59</sup> see Hughes 1998, Shea 2006, Ames *et al.* 2010, Sisk/Shea 2011.

<sup>60</sup> Sisk/Shea 2011, 2-3.

<sup>61</sup> Sisk/Shea 2011, 3, fig. 1.

TCSA in  $\text{mm}^2$  was chosen as a differentiating parameter; TSCP requires very detailed measurements<sup>62</sup>, which cannot be taken from drawings. However, the results presented here can serve as guidelines until a more accurate dataset can be produced based on a large number of original finds<sup>63</sup>. Parallely a classic examination of the combinations between lengths and widths has been conducted. Only the maximal length, not the length of the blade was used, because with some types the leaf and the shaft cannot be clearly separated<sup>64</sup>. Consequently, the calculation of the length parameter in this way does not describe the differences in the penetration depth, but a combined value for penetration depth and shafting. Nevertheless, this issue does not affect the TCSA which does not include length.

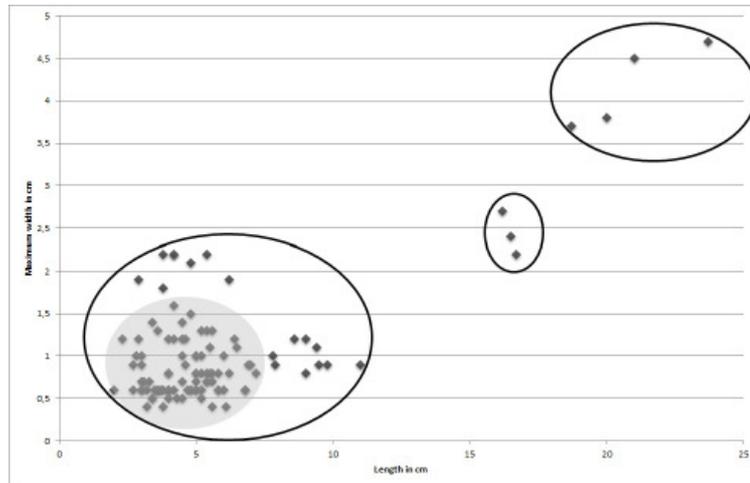


Fig. 4: Metrical analysis of length and width of the projectile points.

Fig. 4 shows the results of the comparison between length (horizontal axis) and width (vertical axis). Clearly three clusters can be distinguished: a large one which includes all smaller projectile points of bone, stone and bronze, a smaller one which includes the smaller spears of the control group<sup>65</sup> and another one with longer and wider spears. The first group forms a big nucleus but has also some outliers made up of points of different types. For example, the small outlier group above the core cluster is formed of projectile points with longer shafts (of types 4B, 5E, 5C, with well delimited shafts and 2A, with not well-delimited shafts). This could indicate a different function, but reflects possibly just different methods of shafting. Interesting is also a second outlier group (right of the core cluster) of projectile points with wider blades (types 3D, 4C, 4G and 4I). Points of these types appear also in the core cluster, which indicates that the same shapes could have had different functions.

This image is cleared up by analysing the TCSA distribution (fig. 5). Five distinct groups can be observed. A first cluster includes for the most part projectile points with TCSA values under  $40 \text{ mm}^2$ , most of them though have up to  $20 \text{ mm}^2$ . They belong to the types 1 and 2 and can be slim or wider but are generally very thin which results in a low TCSA value. The second cluster comprises the types 3, 4 and 5 A and B, which are generally wider and thicker. Most TCSA values of this group are between  $20$  and  $40 \text{ mm}^2$ . A third cluster is represented by narrow points with TCSA values between  $40$  and  $60 \text{ mm}^2$ . A fourth cluster is made up of by spears with TCSA values between  $90$  and  $200 \text{ mm}^2$  and a fifth has values over  $200 \text{ mm}^2$ .

Based on the metric values provided by Thomas<sup>66</sup> and Shott<sup>67</sup>, Bretke et al.<sup>68</sup> have calculated a range of values between  $13$ - $53 \text{ mm}^2$  for arrows and  $40$ - $76 \text{ mm}^2$  for dart points. The analysed African and American specimens are made of stone and have specific forms. Of course, these data sets do not represent good analogies for Bronze Age projectile points, as the geographical and chronological variability is too

<sup>62</sup> see Sisk/Shea 2011, 3, fig. 1.

<sup>63</sup> This is intended in the new project.

<sup>64</sup> This would be possible though through a microscope examination.

<sup>65</sup> designated as "throwing spears" by Dergačev 2002, 132.

<sup>66</sup> Thomas 1978.

<sup>67</sup> Shott 1997.

<sup>68</sup> Bretke et al. 2006.

big and the shapes of the analysed projectile points differ markedly. But with the assumption that the TCSA mainly describes mechanical properties, these values can be nevertheless used for comparison, however with largely hypothetical results. Of course, these values do not indicate categorically that the Bronze Age specimens are darts; some arrow heads can have high values, too. But some other finds attributable to the NSC add some support in favour of the presence of atlatls respectively dart points. The pieces in question are bone hooks, which could represent end pieces of atlatls (fig. 6 with possible reconstructions). Two bone hooks were until now published: one from the settlement of the SC from Novokievka, which has a perpendicular hole for attaching it to a shaft, and another one from the NC settlement of Giurcani. The latter has a groove, maybe for attaching it to a wooden shaft using strings. It is very probable that more hooks were found in NSC sites but have not been recognized and/or published. It is also possible, that most atlatls were made entirely of wood and their recognition is a matter of archaeological visibility. The presence of atlatls in the NSC seems thus possible; the cluster represented in the TCSA could contain arrow heads and darts with similar shapes (types 3, 4 and 5).

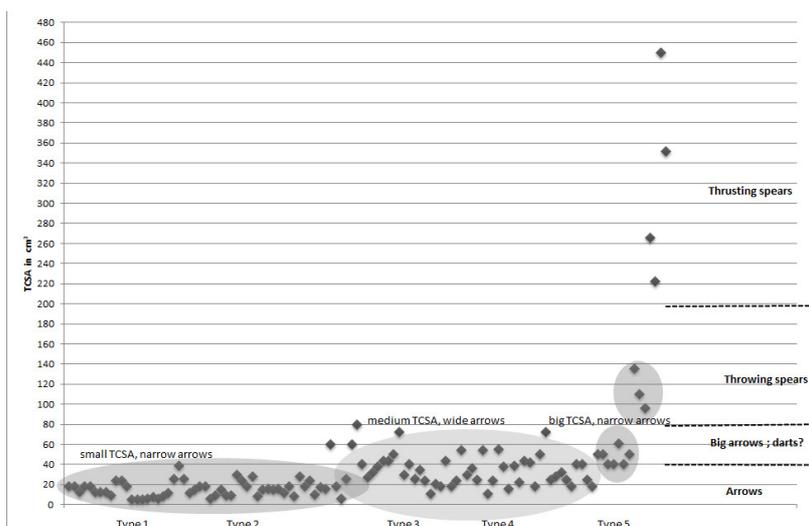


Fig. 5: Metrical analysis of tip cross sectional area (TCSA) of the projectile points.

To sum up, by calculating the TCSA values different clusters of projectile weapons, possibly each with own properties and functions, could be identified. A cluster of small, narrow arrows can be differentiated from a cluster of wider arrows with medium TCSA values and a cluster of narrow arrows with big TCSA values. This could indicate different levels of efficiency and effectiveness, as arrows with different shapes and sizes produce different wounds. The most efficient shape seems to be that of points of type 5 C, D and E, which are aerodynamic and have a bigger entry power, can produce big wounds and due to their barbs cannot be removed easily.

In addition, two more clusters with considerably higher TCSA-values appear. But even if a distinction between the fourth and the fifth cluster is clear, an interpretation in the lines of different functions, like for example throwing and thrusting spears, is not certain. Experiments with penetration depths of Levallois points<sup>69</sup> have shown that potential values for thrusting spears lie between approximately 80 and 250 mm<sup>2</sup> (see also the calculations of Bretke *et al.* 2006). However, these experiments were made with stone points and a transfer of the results to metal points is probably not possible. Anyhow, experiments on the efficiency of metal and stone axes have shown that the thickness of the stone axes decreases their penetration depths in comparison to the bronze axes<sup>70</sup>. This variable would also change the TCSA value range for stone and metal projectile points, the first being thicker. Another essential variable to take into account analysing throwing and thrusting possibilities is weight, which cannot be used here to control the results. Some studies have revealed furthermore that spears can be used for multiple purposes, having similar properties to swords<sup>71</sup>. It is for this reason difficult to say if the fourth and fifth clusters represent different functional categories, even if the specific shapes could indicate

<sup>69</sup> Shea *et al.* 2001, 2005.

<sup>70</sup> Mathieu/Meyer 1997.

<sup>71</sup> Anderson 2011.

differentiated ways of use for the narrow spears of cluster three<sup>72</sup> and four<sup>73</sup>. Also analysing the use-wear would be useful in tracing the function of these two clusters of objects.

### **Contexts and meanings**

Most finds of arrow heads and possible darts come from settlements, an apparent discrepancy to the spears, which come mostly from bronze hoards due to their material. Anyway this distinction is not absolute, as spears are also attested in settlements. Furthermore, differences can be seen between NC and SC finds. Almost all arrow heads and dart points of the NC were found in settlements, while the projectile points of the SC come from settlements and also from graves (although not in big numbers). The proposed atlatl is present only in settlements.

How can these contexts be interpreted and what roles of projectile points can be deduced from them? To get an answer to this question, the finds must be analyzed in their cultural contexts. It has been shown that almost all arrow heads were found in settlements; some of them come- as also other finds of the NSC- from the 'ashmounds', which were preferably excavated, while areas near the 'ashmound' remained unexplored<sup>74</sup>. Based on the discoveries from Rotbav, one can think about the 'ashmounds' as intensely used activity areas in the form of basins deepened into the earth, well-limited from the inhabited area, and slowly filled during use but also intentionally 'closed' at the end of their use-lives, through depositions that were found immediately under their surface<sup>75</sup>. The fact that some finds of pottery, animal bones, tools etc. are concentrated here shows that the 'ashmound' represents somehow a center of communal life. This special mode of deposition<sup>76</sup> related to the 'ashmounds' could be the explanation for the relatively massive appearance of projectile points in the NSC and their apparent scarcity in other earlier settlements and cultural milieus, like for example the Wietenberg, Monteoru or Tei Cultures, where no 'ashmounds' exist and the projectile points not usually constitute grave goods. Indeed, a large percentage of the arrow points could have been integrated in the depositional process in the 'ashmounds', although for most of the analyzed pieces find contexts are missing or were not published. In conclusion, one could argue that even if many more projectile points are known from the NSC, that does not necessarily mean that they were not with the same intensity used in other cultural milieus, being poorly preserved/handed down<sup>77</sup>. But, for example, in Rotbav, where a big surface near the 'ashmound' was excavated, it could be observed that the projectile points came almost exclusively from outside of the 'ashmound'. They were not deposited and represent with high probability discarded items. Of course the situation in Rotbav cannot be transferred on all 'ashmounds', but there is a big probability that at least in some regions the visibility of projectile points is not affected by the depositional processes and they really do appear in larger numbers than in earlier periods. Another aspect of archaeological visibility is the quasi-absence of arrow heads from the hoards, which can lead easily to a false image of the weaponry in the NSC and the importance of projectile points. Not only the big amount, but also their diversity denotes a wide use. A function as a hunting weapon is possible, however the high diversity of projectile types renders an exclusive use in hunting rather improbable. Finds of wild animal bones are attested in NSC settlements usually in small amounts of up to 5%, more rarely up to 20%, thus the usual quantities in a world dominated by animal husbandry. Attested are inter alia deer, wild boar, hare, aurochs, antelope, wild ass, fox, wolf, bear, lynx, badger, nutria and otter; also birds and fish bones are known<sup>78</sup>. Particular weapons could have played a role for hunting on 'special' occasions. They may reflect the importance to point out the traditional identity as a hunter for people living in a society whose world view was deeply entangled with animals<sup>79</sup>, but there are no hints that hunting became more important than in the earlier periods (in which projectile points are less visible), or that it takes a more important role in the cultic sphere. The large amount, the various sizes and shapes of the projectile points lead to the conclusion that they must have played an important role in armed

<sup>72</sup> for definition of the type see Klochko 2001, 204-207; Dergačev 2002, 132 with further literature.

<sup>73</sup> for the definition of these two types see Klochko 2001, 203-204; Dergačev 2002, 132-133.

<sup>74</sup> Dietrich 2011, 2012, 2013.

<sup>75</sup> Dietrich 2009.

<sup>76</sup> Dietrich 2013.

<sup>77</sup> In this sense already Hansen 1994, 82-97 for the Late Bronze Age finds in Central Europe.

<sup>78</sup> Bălășescu, Radu, in preparation; El Susi 2002; Boroffka 2005, 142; Sava 2005, 145-146; Bindea/Kelemen 2011.

<sup>79</sup> Dietrich 2011b.

conflicts. Hints at the social role of projectile points are given by their general aspects. Some types and variants, like for example 3 A-C or 5 C-D require some skill in production, especially for fashioning the barbs (variant 5C-D); some projectile points are extremely well-made and carefully finished. This indicates a high importance of these points and the distance weapons they were used with. The use of separately crafted nocks further emphasizes the special value of the arrows. Through mounting these pieces separately, a better preservation of the arrows can be reached. The work input in crafting the extra-pieces and multipartite arrows was high and resembles that of other Noua Culture implements, like for example the sets of needles and needle holders<sup>80</sup>; it underlines the importance of the bow weapon for this culture. However a specific social group cannot be recognized behind them archaeologically<sup>81</sup>, even if it may have existed. The projectile points are not personalized, only a few graves link them to particular persons, but funerary rules are generally archaeologically discrete in the NSC<sup>82</sup> and do not permit much social interpretation. The few barrows with projectile points of the SC seem to indicate the continuation of older traditions<sup>83</sup>, they represent isolated cases. Maybe in these few graves particular characteristics of the deceased are reflected<sup>84</sup>.

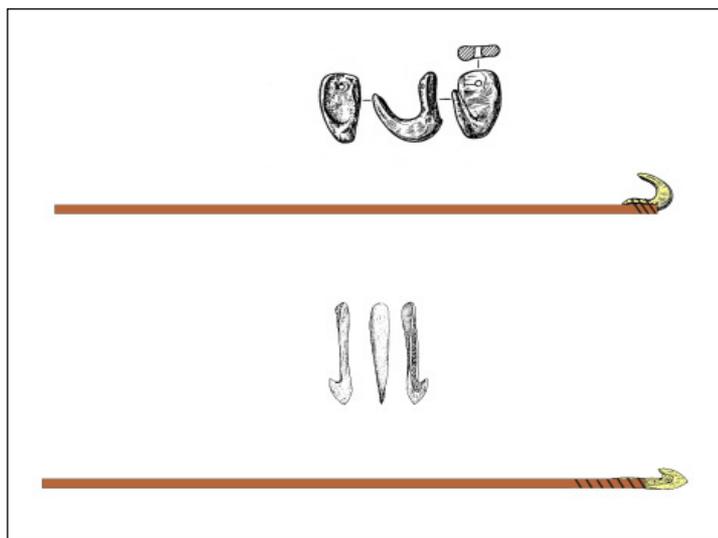


Fig. 6: Reconstruction of possible atlatl weapons of the Noua-Sabatinovka-Coslogeni Complex.

Spears and daggers, on the other hand, have been predominantly hoarded, but finished products as well as casting moulds were also found in settlements<sup>85</sup>. A detailed statistical comparison of find contexts between projectile points and other weapons would be biased by various factors like the fragility of bone projectile points and the bigger possibility of loss/discard versus the increased visibility of deposited bronze spears and daggers, but also e.g. the manufacturing of a greater number of bone projectile points<sup>86</sup> versus recurrent re-melting of bronze weapons. Anyhow the general image seems to indicate projectile points as important weapons of the NSC. For some reason, they are not part of the depositional process like other weapons of bronze and are neither deposited in graves, similar also to other find categories. Most likely projectile points were used in warfare, and a correlation with mobility<sup>87</sup> seems probable; however the finds do not reflect the agents. The proposal of the presence of the atlatl in the NSC may appear surprising, but it could represent, next to the numerous well-made and varied arrow heads, a hint at a 'culture of projectile weapons' in the Late Bronze Age in Eastern Europe and at an 'experimental period' concerning this weapon type. More mobile battle tactics, which may imply also the invention of new forms of lighter bows, seem to become visible behind this find group.

<sup>80</sup> Dietrich 2010b.

<sup>81</sup> see also Hansen 1994, 88 for Middle and southeastern Europe.

<sup>82</sup> Sava 2002.

<sup>83</sup> e.g. Dergačev 1994, 43-50; Sava/Agulnikov 1993.

<sup>84</sup> In this sense also Hansen 1994, 96-97 for Late Bronze Age in Central Europe.

<sup>85</sup> Uşurelu 2006, Gerškovič 1999.

<sup>86</sup> Hansen 1994, 95 gives based on younger finds a number of 10 arrows per quiver; darts for atlatals are usually fewer, because they are longer and bigger.

<sup>87</sup> See bridle finds by Dietz 1998, 150-156.

**Projectile points of NSC-catalogue of finds**

1. **Buiucani, oraș Chișinău, Moldavia.** One bronze projectile point (type 4H). Klochko 2001, 201, pl. 79/18.
2. **Cavadinești, comuna Cavadinești, județ Galați, Romania**  
Settlement of the NC with 'ashmounds'; three bone projectile points; (type 2A and a semi-finished product, probably type 3). Florescu 1991, 44-45, nr. 111. fig. 136/17-18, fig. 144/1.
3. **Cherson, Oblast Cherson, Ukraine.** One casting mould for type 4F. Klochko 2001, 201, fig. 79/15.
4. **Căplani, raion Ștefan Vodă, Moldavia.** Burials; Barrow 9, one bronze projectile point (type 1); NSC after Klochko (2001, 201, fig. 79/12); Middle Bronze Age after Dergačev (2002, 32, nr. 193, pl. 21/C).
5. **Cândești, comuna Coroteni, județ Vrancea, Romania**  
Settlement of the NC with 'ashmounds'; numerous projectile points, numbers and types are not specified. Florescu/Florescu 1990, 69-70, fig. 6/10.
6. **Čikalovka, raion Kremenčug, oblast Poltava, Ukrain**  
Settlement of the SC; bone projectile points (type 2A?). Sava 2002, 180 (with further literature).
7. **Cobâlnea, Raion Șoldănești, Moldavia**  
Settlement of the NC with 'ashmounds'. One flint projectile point (type 3D). Levitsckii/Sava 1993, 133, fig. 11/8.
8. **Corlăteni, comuna Corlăteni, județ Botoșani, Romania**  
Settlement of the NC with 'ashmounds'; one bone projectile point (type 4A). Florescu 1991, 52, nr. 148, fig. 140/1
9. **Coslogeni, comuna Dichiseni, județ Ialomița, Romania**  
Settlement of the NSC with 'ashmounds'; one bone projectile point (type 4D). Florescu 1991, 147-148, nr. 620, fig. 112/2
10. **Crasnaleuca, comuna Coțușca, județ Botoșani, Romania**  
Settlement of the NC with 'ashmounds'; 10 bone projectile points and nocks (projectile points type 4A). Dascălu 2007, 119, pl. 55/94.5, 6.
11. **Fetești, raion Edineț, Moldavia**  
Settlement of the NC with 'ashmounds'; one bone projectile point (unknown type). Darina 1986, 2-11.
12. **Frunze, raion Grigoriopol, Moldavia**  
SC barrows; 30 projectile points? (type 2C). Sava 1998, 276, fig. 5; Sava/Agulnikov 2003, 131, fig. 9/130.
13. **Gârbovăț, comuna Ghidigeni, județ Galați, Romania**  
Settlement with 11 'ashmounds' of the NC; 38 bone projectile points (types 1, 2A, 3A, 3B, 3C, 4G, 5A, and 5C); semi-finished products of types 3A or/and 3B; four flint projectile points (types 3D and E). Florescu 1991, nr. 244, 73, fig. 136/19-21, 140/3, 8, 141/1, 4, 5, 7, 9, 12-18; 142/2-7, 9-13; 143/2-4, 6-7, 9; 144/2-6; 163/3-4, 6, 10.
14. **Ghindești, raion Florești, Moldavia**  
Settlement with 11 'ashmounds' of the NC; 13 bone projectile points (types 2A, 4G and 5C). Meljukova 1961; Sava 1998, fig. 5/4-12.
15. **Giurcani-SSV, comuna Găgești, județ Vaslui or Popeni, comuna Zorleni, județ Vaslui, Romania**  
Settlement with 'ashmounds' of the NC; one bone atlatl hook. Florescu 1991, 68, nr. 240; Coman /Rotaru, 58 (under Popeni), Fig. 5/1 (under Giurcani).
16. **Giurcani, comuna Găgești, județ Vaslui, Romania**  
Settlement with 'ashmounds' of the NC; one bone projectile point (type uncertain, 2A or 5). Florescu, 1991, 68, nr. 240; Rotaru/Gheorghe 2006, fig. 12/2.
17. **Lichișteni, comuna Vultureni, județ Bacău, Romania.**  
Settlement with four 'ashmounds' of the NC; three bone projectile points (types 1 and 2A) and nocks. Florescu 1991, 88, fig. 136/15, 141/7, 142/8.
18. **Mera, comuna Baci, județ Cluj, Romania.**

Settlement of the NC; one bone projectile point (type 5C). Wittenberger 2008, 9, Pl. 2/1.

**19. Lobojkovka, oblast Dnjepetrovsk, Ukraine.**

Hoard of the SC; two bronze arrow heads (type 4I and 5E). Leskov 1981, 11, pl. 3, A 43-44, 49-51.

**20. Mahala, oblast Tscherniwzi, Ukraine**

Settlement with 'ashmounds' of the NC; several bone projectile points (types 1, 5C). Smirnova 1993; Klochko 2001, fig. 79/6, 10.

**21. Miorcani, județ Botoșani**

Settlement of the NC; one flint projectile point. Dascălu 2007, 117.

**22. Mihălășeni, județ Botoșani.**

One bone projectile point (possibly type 4A). Ioniță/Șovan 1995, 257, fig. 1/7.

**23. Nicoliscoe, raion Slobozia, Moldavia.** Barrow cemetery of the SC. Three flint projectile points (type 3E). Sava/Agulnikov 2003, 130, fig. 10/10, 11, 13.

**24. Novoselytsia, oblast Chernivtsi, Ukraine**

Settlement with 'ashmounds', NC?; One bronze projectile point (type 4E). Klochko 2001, 201, fig. 79/13; 1995, 142, fig. 37/17.

**25. Novokievka, oblast Cherson, Ukraine:**

Settlement of the SC; one bone atlatl hook. Gerškovič 1999, 66, pl. 33/20.

**26. Obitočnoe, oblast Saporischschja Ukraine**

Settlement of the SC; four projectile points? (type 2c). Gerškovič 1999, 66, pl. 47/4-7.

**27. Odaia Miciurin, raion Drochia, Moldovia**

Settlement with „ashmounds“ of the NC; 11 bone projectile points (types 2A and 2B); 1 silex projectile point (unknown type). P. Morgenstern 2011, 256, Fig. 73; Sava/Kaiser 2011, 299, Fig. 90/1

**28. Peresadovka, oblast Mykolaiv, Ukraine.**

Settlement of the SC; one projectile point (type 1). Klochko 2001, 201, fig. 79/8.

**29. Petrușeni, raion Rîșcani, Moldavia**

Settlement with 'ashmounds' of the NC. Two bone projectile points (type 2A). Another projectile point is supposed to come from a grave in the 'ashmound', but it is not sure, whether the object published by Sava (1998, fig. 5/13) is the same with that from Sava (2002, 180, fig. 14/2). Thus either one or two projectile points come from here, one is certainly from a grave.

**30. Poșta Elan, comuna Vutcani, județ Vaslui, Romania**

Settlement of the NC; two projectile points (type 4F). Rotaru/Gheorghe 2006, fig. 5/10, 11.

**31. Rotbav „La Pârâuț“, comuna Feldioara, județ Brașov, Romania**

Settlement with 'ashmound' of the NC; 12 bone projectile points (types 2A, 4A, 5A and 5D) and two flint projectile points (type 3E). Unpublished (own excavation).

**32. Sabatinovka, Oblast Kirovohrads'ka, Ukraine.**

Settlement of the SC. One bone projectile point (type 1). Klochko 2001, fig. 79/11.

**33. Săveni, județ Botoșani, Romania**

Settlement with 'ashmounds' of the NC; one bone projectile point (type 4C). Florescu 1991, 115-116, nr. 476, fig. 141/2.

**34. Sebeș, județ Alba, Romania**

Settlement of the NC; one bone projectile point (type 5B). Florescu 1991, 117, nr. 484, fig. 140/6.

**35. Slobodka, Oblast Odessa, Ukraine**

Settlement of the SC; one casting mould for projectile points (type 4F). Klochko 2001, 202, fig. 79/14.

**36. Slobozia-Șireuți, Raion Briceni, Moldavia**

Settlement with 'ashmounds' of the NC; two bone projectile points (type 2A). Dergačev 1969, 121, pl. 3/7, 8.

**37. Stepove, oblast Mykolaiv, Ukraine**

Settlement of the SC; one bone projectile point (type 5C). Klochko 2001, 199, fig. 79/4

**38. Stuhuleț, comuna Berezeni, județ Vaslui, Romania**

Settlement with 'ashmounds' of the NC; one bronze projectile point (type 5E). Florescu 1991, 122, nr. 508, fig. 110/1.

**39. Suvorovo, oblast Odessa, Ukraine**

Settlement of the SC; two bronze projectile points (type 4C and 4F) and one casting mould for type 4H. Klochko 2001, 201-202, fig. 79/18.

**40. Șuletea, comuna Șuletea, județ Vaslui, Romania**

Settlement with 'ashmound' of the NC; one bone projectile point (type 2A). Coman/Rotaru 1981, pl. 1/17.

**41. Șipoteni, comuna George Enescu, județ Botoșani, Romania**

Settlement with 'ashmounds' of the NC; one flint projectile point (type undefined, maybe 3E). Ignat 2009, 162, fig. 6/1.

**42. Tăvădărăști, comuna Dealul Morii, județ Bacău, Romania**

Settlement with 'ashmounds' of the NC; two bone projectile points (types 3A and 3C). Florescu 1991, 127-128, nr. 539, fig. 143/5, 8.

**43. Trușești, comuna Trușești, județ Botoșani, Romania**

Settlement with 'ashmounds' of the NC; two bone and four antler projectile points and nocks (types 2A and 5B). Petrescu-Dîmbovița *et al.* 1953, 36, fig. 23/1; Florescu 1994, 134, nr. 560, fig. 136/16, 140/5, 9; 141/3, 10, 11.

**44. Țigănești, comuna Vultureni, județ Bacău, Romania**

Settlement with 'ashmounds' of the NC; one bone projectile point (type 5C). Florescu 1991, 136, nr. 564, fig. 140/2

**45. Uškalka, raion Verchnerogacik, obl. Cherson, Ukraine**

Settlement of the SC; one bone projectile point, maybe of type 2A. Sava 2002, 180; Gerškovič 1999, 28.

**46. Valea Seacă, comuna Lehliu, județ Ialomița, Romania**

Settlement of the NSC; one bronze projectile point (type 4D). Florescu 1991, 154, Nr. 645, Fig. 112/1

**47. Zoltan, comuna Ghidfalău, județ Covasna, Romania**

Settlement with 'ashmounds' of the NC; 21 bone and antler projectile points (types 2A, 2B, 4B, 5C, 5D), Cavruc 2003, 32-36, 77; Beldiman 2002;

<http://www.mncr.ro/cercetari+arheologie+zoltan+satul%20zoltan%20%20acirc%20%20%20nisiparie%20%20com%20%20ghidfalau%20%20jud%20%20covasna.html>.

**48. Zlatopol, Novomyrhorod, oblast Kirovohrad, Ukraine**

Settlement of the SC; one unfinished bone projectile point. Gerškovič 1999, 65, pl. 10/10.

**Bronze spear heads (selection of bronze spears of NSC; control group):**

**Lozova II**, hoard of the NC; one spear head type Krasnyi Majak (Dergačev 2002, 132, nr. 113, pl. 35/18).

**Museum Bârlad**, one spear head, type Krasnyi Majak (Dergačev 2002, 132, nr. A 431, pl. 70 A 431).

**Hoard Dancu III**, one spear head type Dancu (Dergačev 2002, 133, nr. 177, pl. 50/A).

**Settlement of NC, Șipca, Moldavia**; one casting mould (Dergačev 2002, 133, nr. 166, pl. 46K).

**Sanžejka**, one spear head type Dancu (Dergačev 2002, 133, nr. A 433, pl. 71A 433)

**Hoard of Dobrjanka**; one spear head type Krasnyi Majak (Leskov 1981, 18, pl. 4, D2)

**Hoard of Dremajlovka**; one spear head (Leskov 1981, 16, pl. 4 E1)

**Stuhuleț, hoard in a settlement of the NC**, two spear heads (Florescu 1990, 110/1).

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