CAES Vol. 7, № 2 (May 2021)

Estimating the degree of resemblance of assemblages of stone axes/adzes

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Abstract

To estimate the index of resemblance of two collections of stone axes/adzes, it is necessary to compare the following characteristics: 1) the total numbers of items of the compared collections, 2) the distributions of the material of which the items were made, 3) the percentages of items that can be compared, 4) concrete parameters of items selected for comparison: material, the shape of the working edge, width, cross-section and so on. The last point can contain several points if more than one pair of items is compared. Each of these points gives a certain value laying in the diapason from 0 to 1, and then the degree of resemblance of two collections is the arithmetic mean of indexes of resemblance for each point.

Keywords: stone axes; stone adzes; chopping tools comparison; Neolithic chopping tools

1. Introduction

In this paper I want to give a sketch of a method that would allow estimating the degree of resemblance of collections of stone axes/adzes. I am going to show the method comparing collections of stone axes/adzes from the following Neolithic sites: Tarkhovka, Hepojarvi, and Okhta 1 (see fig. 1).

Fig. 1. Location of sites mentioned in the paper (drawn by the author)

The method deals only with published collections of axes/adzes, i.e.: if in an article/monograph it is said that on a site were found 30 axes, but pictures/photos of only 3 of them are shown, then it means that the collection actually contains only 3 items.

According to the classification elaborated by Semenov (Semenov 1957: 157 – 164), stone axes usually have symmetrical working ends while adzes have an asymmetric end (fig. 2).

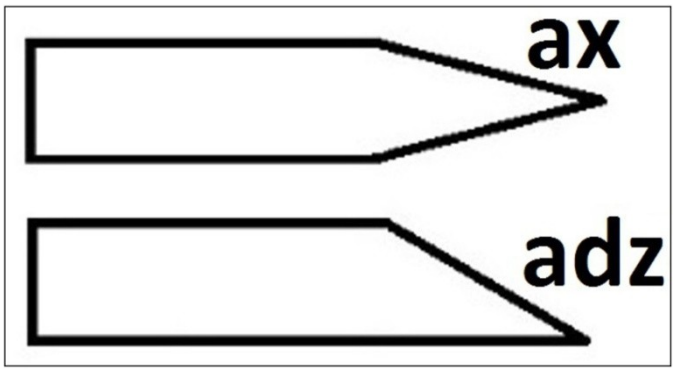

Fig. 2. A scheme representing the difference between axes and adzes (drawn by the author)

In this paper, however, I am not going to consider axes and adzes separately, i.e.: axes and adzes are considered here together as chopping tools.

2. The method of comparison

2.1. Material for comparison

On the site of Tarkhovka were found 5 axes/adzes (fig. 3, fig. 4).

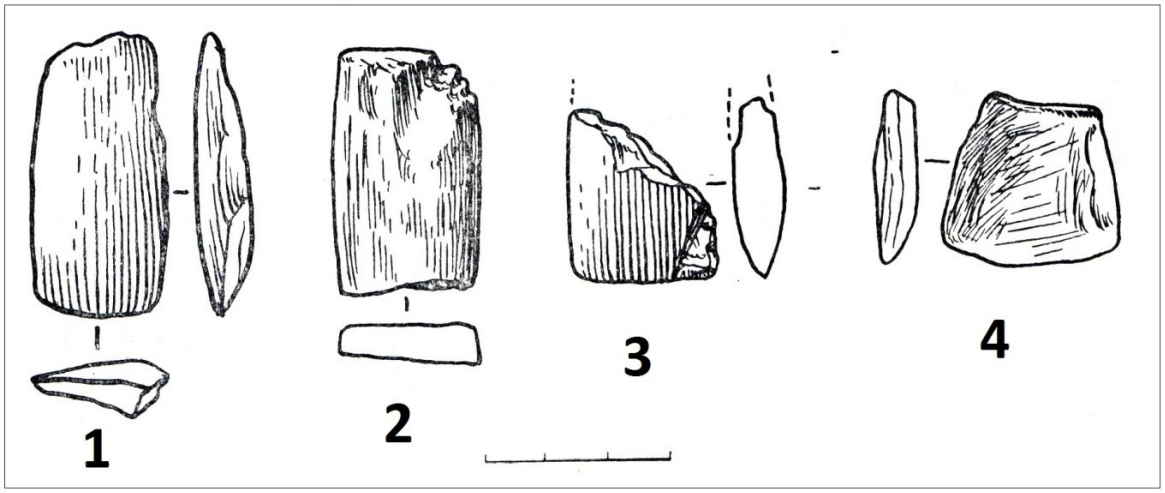

Fig 3. Schist tools from the site of Tarkhovka (image source – Gurina 1961: 425)

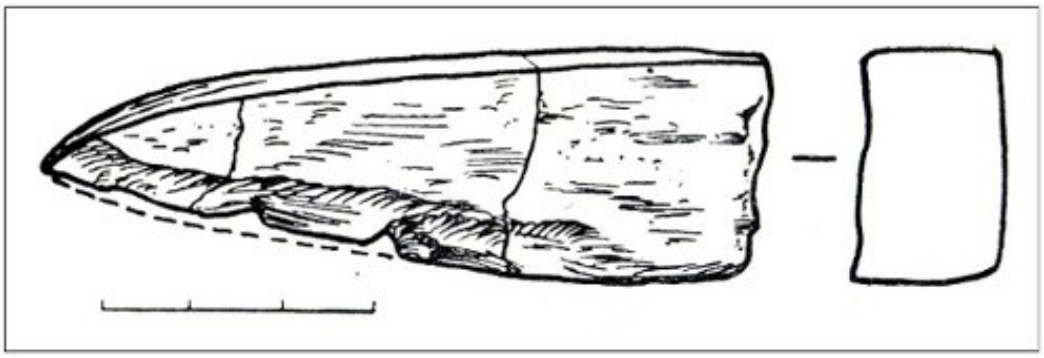

Fig. 4. A chisel-like stone tool from the site of Tarkhovka (image source – Gurina 1961: 425)

On the site of Hepojarvi were found three chopping tools (fig. 5), one of them was made of granite.

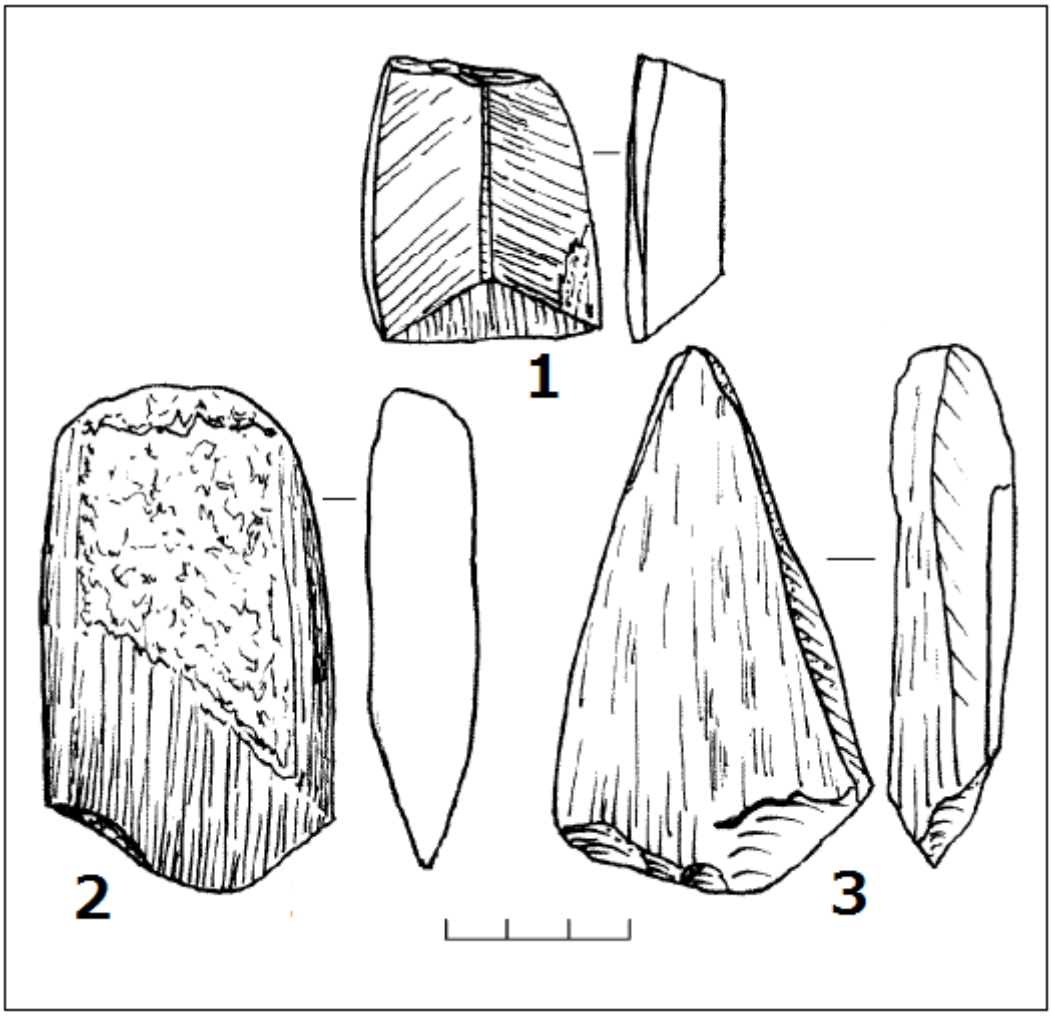

Fig. 5. Chopping tools from the site of Hepojarvi 1st and 3rd made of schist and 2nd made of granite (image source – Vereschagina 2003: 150)

On the site of Okhta 1 were found 2 chopping tools made of schist (fig. 6).

Fig. 6. Schist adzes from the site of Okhta (image source – Gusentsova, Sorokin 2011: 445)

2.2. The procedure of comparison

2.2.1. General outline of the method

To compare two collections, it is necessary to compare the following characteristics: 1) the total numbers of items of the compared collections, 2) the distributions of the material from which the items were made, 3) the percentages of items that can be compared, 4) concrete parameters of items which have been selected for comparison: material, the shape of the working edge, width, cross-section and so on. The last point can contain several points if more than one pair of items is compared. Each of these points gives a certain value laying in the diapason from 0 to 1, and then the degree of resemblance of two collections is the arithmetic mean of indexes of resemblance for each point.

2.2.2. Comparing the collection of Tarkhovka with that of Hepojarvi

The collection of Tarkhovka contains 5 items (fig 3, fig. 4); the collection of Hepojarvi contains 3 items (fig. 5).
Thus, the ratio of the total number of elements in the compared collections is 3/5 or 0.6.

All items of the Tarkhovka collection were made of schist, while in the collection of Hepojarvi 2 items were made of schist and 1 made of granite. The distribution of schist in the collection of Tarkhovka is 1, the distribution of schist in the collection of Hepojarvi is $2/3 \approx 0.66$. And thus, the ratio of two distributions is $0.66/1 = 0.66$.

In the collection of chopping tools from the site of Tarkhovka there are only 3 items that can be used in the comparison (fig. 3 items 1, 3, and 4), items that lost their working end hardly can't be sued in the comparison. And thus, the ratio of items that can be used in the comparison in the case of Tarkhovka collection is 0.6 and in the case of Hepojarvi is 1, and so the ratio of two ratios is the following: 0.6/1 = 0.6.

Now we turn to the comparison of certain axes/adzes.
Items from Tarkhovka collection selected for the comparison are designated as T1, T3, and T4 for shortness and convenience.
Items from Hepojarvi collection are designated as H1, H2, H3.

T1 can be correlated with H1, T3 with H2, and T4 with H3.

To compare these items we have to represent them as a set of standardized utterances.

T1 was made of schist, working end shape |/ (here is used a schematic drawing depicting the shape of working end), rectangular in plan, wedge profile shape; triangle cross-section; width is about 2 cm.

H1 was made of schist, working end shape |/, trapezoidal in plan, front and back sides are parallel, triangle cross-section, width is about 3.5 cm.

To estimate the index of resemblance of two items we have to estimate the degree of resemblance of each utterance and then take the arithmetical mean of all the received values.

T1 and H1 both were made of schist so here the degree of resemblance is 1.
T1 and H1 both have working end of |/ shape, so the degree of resemblance here is 1.
T1 is rectangular in plan, H1 is trapezoidal in plan, so here the degree of resemblance is 0.
T1 has a wedge profile shape, while H1 has parallel front and back sides, so here the degree of resemblance is 0.
T1 and H1 both have triangle cross-sections, so here the degree of resemblance is 1.
The width of T1 is about 2 cm and the width of H1 is about 3.5 cm, so the degree of resemblance here is $2/3.5 \approx 0.57$.

And thus, $T1 \sim H1 = (1 + 1 + 0 + 0 + 1 + 0.57)/6 = 0.595$

The index of resemblance of two axes should also be accompanied (multiplied) by a coefficient showing the ratio of characteristics known about each of compared items. T1 is described by 6 characteristics and H1 is described by 6 characteristics, so in the current case the coefficient is 1.

The list of parameters used in the comparison of concrete items can changes from one case to another depending on what set of parameters is used in the description of a certain item if one item is described in a more detailed way, while the second is described in a less detailed way, then a less detailed scheme of description should be used.

T3 was made of schist; working end shape \/, rectangular in plan, front and back sides are parallel, width is about 2.5 cm.

H2 was made of granite, working end shape \/, rectangular in plan; front and back sides are parallel, width is about 5 cm.

T3 ~ H 2 = (0 + 1 + 1 + 1 + 0.5)/5 = 0.7
The coefficient of correlation of characteristics of T3 and H2 is 1.

T4 was made of schist, working end shape |/, trapezoidal/triangle in plan[1], front and back sides are parallel, maximum width is about 3 cm.

H3 made of schist, working end shape |/, triangle in plan, front and back side are parallel, maximum width is about 5 cm.

T4 ~ H3 = (1 + 1 + 1 + 1 + 3/5)/5 = 0.92.
The coefficient of correlation of characteristics of T3 and H2 is 1.

The index of resemblance of the collection of Tarkhovka and that of Hepojarvi is the arithmetical mean of the above-received indexes of resemblance:
(0.6 + 0.66 + 0.6 + 0.595 + 0.7 + 0.92)/6 ≈ 0.68.

2.2.3. Comparing the collection of Tarkhovka with that of Okhta

Items of Okhta collections are designated as O1 and O2 (fig. 6).

The collection of Tarkhovka contains 5 items (fig. 3, 4), the collection of Okhta contains 2 items. Thus, the ratio of the total number of elements in the compared collections is 0.4.

All items from the Okhta collection were made of schist, and all items from the collection of Tarkhovka were made of schist. The distribution of schist in the collection of Okhta is 1, the distribution of schist in the collection of Tarkhovka is 1. And thus, the ratio of two distributions is 1.

In the collection of Tarkhovka there are 3 items that can be used in the comparison, but in the Okhta collection there are only 2 items, so one item from Tarkhovka collection should be excluded[2]. O1 and O2 look like adzes so it is possible to exclude T2 that looks unlike an adz.
Thus, the ratio of items of Tarkhovka that can be used in the current comparison is 0.4, the ratio of items of Okhta that can be used in the comparison is 1, and so the ratio of two ratios is 0.4.

T1 correlates with O2, and T4 with O1.

[1] It is possible to conclude that the original form of the item was a triangle.
[2] The same number of items should be selected from each collection, and a certain item of a collection should be compared with only one item of another collection.

O1 made of schist, working end shape is unclear, trapezoidal in plan, whether front and back sides are parallel is unclear, the cross-section is unclear, and the largest width is about 4 cm.
T4 ~ O1 = (1 + 1 + 3/4)/3 ≈ 0.92.
The coefficient of correlation of T4 and O1 characteristics is 3/5 = 0.6.
And the final index of correlation of T4 and O1 is 0.6*0.92 = 0.552.

O2 made of schist, rectangular in plan, width is about 3.5 cm.

O2 ~ T1 = (1 + 1 + 2/3.5)/3 ≈ 0.56
The coefficient of correlation of characteristics of O2 and T1 is 3/6 = 0.5.
And thus, the final index of correlation of O2 and T1 is 0.56*0.5 = 0.28.

The index of resemblance of the collection of Tarkhovka and that of Okhta is the arithmetical mean of the above-received indexes of resemblance:
(0.4 + 1 + 0.4 + 0.552 + 0.28)/5 ≈ 0.52.

3. Conclusion

The higher is the index the closer are the compared collections.

This method can be used along with the methods of comparison of collections of potsherds in order to clarify the degree of resemblance of different sites.

References

Gurina N. N. 1961. *Drevnyaya istoria Severo-Zapada evropeiskoi chasti SSSR* (Ancient history of European part of USSR). Materialy i issledovaniya po arkheologii SSSR (Materials and researches on the archaeology of USSR), Vol. 87, Izdatel'stvo Akademii Nauk, Moscow – Leningrad

Gusentsova T. M., Sorokin P. Ye. 2011. Okhta 1 – pervyi pamyatnik epokhi neolita i rannego metalla v tsentral'noi chasti Peterburga (Okhta 1 – the first Neolithic – Early Metal Period site in the central part of Saint Petersburg). *Rossijskii arckheologicheskii ezhegodnik* (Russian archeological yearbook), N 1; pp.: 421 – 451

Semenov S.A., 1957. *Pervobytnaya tekhnika* (*The prehistoric technique*). Materialy i issledovaniya po arkheologii SSSR (Materials and researches on the archaeology of USSR), Vol 54. Izdatel'stvo Akademii Nauk, Moscow – Leningrad

Vereschagina I. V. 2003. Poseleniye Khepoyarvi v yuzhnoi chasti Karel'skogo peresheyka (The settlement of Hepojarvi in the southern part of Karelian isthmus), in Timofeev V. I., Sinitsyna G. V. (eds.) *Neolit – eneolit yuga i neolit severa Vostochnoi Evropy* (Neolithic – Eneolithic periods of the South of Eastern Europe and Neolithic period of Northern part of Eastern Europe). Institute of Material Culture History Publishing, Saint Petersburg; pp.: 140 – 151