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AMPHORAE OF NORTHERN PONTIC REGION OF THE 8th-10TH CENTURIES: STATISTICAL ANALYSIS BASED MORPHOLOGY AND CHRONOLOGY ASPECTS

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ABSTRACT

The article deals with study of medieval amphorae that are spread over sites of the 8th — 10th centuries AD in the Northern part of the Black Sea region. Such vessels were manufactured in pottery centers of Byzantine Taurica. The general aims of this study are the analysis of northern-pontic amphorae shapes and the reconstruction of chronological changes of morphology of these vessels. The sources of study here consist of 197 whole and restored amphorae from 49 sites of the 8th — 10th centuries from the territory of Eastern Europe (Crimea, Taman, Caucasus, the Don, the Volga, the Dnieper basins). Appropriate analytical techniques were used: Chi square tests were applied in biplots of geometric parameters on their shapes; analysis of the functional parts conditions and comparison of these data with the general proportions of amphorae, statistical analysis (canonical analysis for geometrical morphometry) of the data using MorphoJ making possible to use a variety of methods of multivariate statistics. The results of the study show that potters of Crimean workshops of the 8th — 10th centuries who made northern-pontic amphorae followed two different Early Byzantine tradition of ceramic container production. These two traditions initially had fundamental differences in the shape of vessels and the decor of the external surface. Chronological changes of northern-pontic amphorae shapes can be described as a process of gradual erosion and mixing of these two pottery traditions. The results helped to discover the main trends and patterns in the chronological evolution of northern-pontic amphorae morphology.

KEYWORDS: northern-pontic amphorae, Black sea region.

1. INTRODUCTION

Amphorae are the widespread group of finds on the sites of the 8th-10th centuries in the Black sea region. These ceramic containers are called as «northern-pontic amphorae» on the basis of distribution territory and production region (Figure 1). Similar vessels were found on the other sites of the Eastern Mediterranean. But it is not clear whether these amphorae can be identified with northern-pontic amphorae (Arthur, 1989, fig. 5, 7; Hayes, 1992, fig. 25. 1-9, 12-15, 23. 2-6, 8-12; Sagui et al, 1997, fig. 6, 2-3; Vroom, 2005, p. 60-61). Northern-pontic amphorae have not stamps. Centers of northern-pontic amphorae production as well as wineries, which exported its goods in these amphorae, are known in Taurica, that is the south-west, south and south-east Crimea. Unfortunately, there are no stamps on northern-pontic amphorae. Therefore their provenance are evaluated based on shapes and clay.

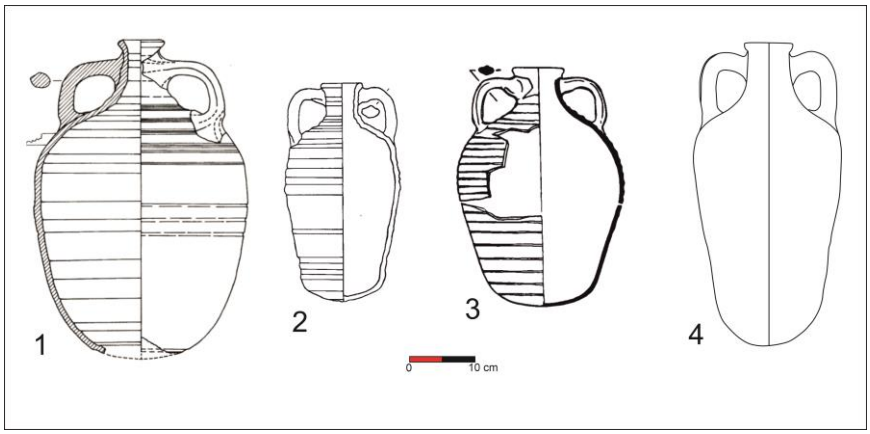

Figure 1. Northern-pontic amphorae (examples). 1 – Martynovo (after Nidzelnitskaya, 2009), 2 – Tyrytake (after Zin'ko, Ponomarev, 2009), 3 – Mangup (after Myts, 1990), 4 – Gora Chirkova (after Sviridov et al., 2018).

The general aims of this study are the analysis of northern-pontic amphorae shapes and the reconstruction of chronological changes of morphology of these vessels. Why are these tasks relevant?

After the Arab conquest in the Mediterranean, the former system of trade and economic relations developed in the Early Byzantine period was destroyed. Many wine-producing centers, which previously exported their products to vast territory, ceased their activity. In the 8th – early 9th centuries several amphorae production centers in the Mediterranean continued to operate (Arthur, 1993). However, their quantity is disproportionately lower than in the 4th-7th centuries.

On the chronology, these events correspond to the appearance and expansion of amphorae production in Crimea. 19 points related to the production of amphorae of the 8th – 10th centuries are found in Crimea (Parshina et al., 2001). According to modern data, the goods in northern-pontic amphorae were in demand throughout the whole Black sea basin.

In the light of these facts, the question arises: is there any historical connection between the termination of wide amphorae production in the Mediterranean and its expansion in the north-east periphery of Mediterranean world, in Crimea? An important detail is that in the Early Byzantine period, in the 4th-7th centuries, there was no local amphorae production in Crimea. In this regard, there is a point of view among many scholars that Crimean potters copied the two major examples of Early Byzantine amphorae – Late Roman amphorae 1 and Late Roman amphorae 2 (LRA), and based on them has «developed» two new types of medieval amphorae produced in Crimean pottery centers.

This «universally» conception has no significant scientific arguments. In my opinion, it has at least two disadvantages. First, it seems strange that the start of Crimean copy-types of Early Byzantine amphorae corresponds on chronology with the time of mass discontinuation of the Mediterranean amphorae production centers. In addition, the medieval Crimean wineries arise at the same time. Secondly, it is strange that the local Crimean potters has developed its own forms of amphorae containers using only two types of Early Byzantine amphorae – LRA 1 and LRA 2. But we know that other popular types of Early Byzantine amphorae (LRA 3, 4, 5 and others) also were well known for Crimean dwellers.

It is possible that this point of view should not even have been made the subject of special discussion, if not for one «but». Such a view of this source does not allow, firstly, to offer an exhaustive classification of northern-pontic amphorae, and secondly, to find out the main trends and directions of chronological changes in the shapes of these vessels. Since chronology is a kind of «core» of any historical and archaeological studies, the undeveloped periodiza-

tion of northern-pontic amphorae prevents their use as a full-fledged source for the study of trade relations in the final centuries of the 1st millennium AD in Eastern Europe.

The hypothesis of the author of this article interprets the reasons and mechanisms of occurrence of amphorae production in Crimea in the 8th century in a different way. In my opinion, in the amphorae production of Taurica in the end I Millennium BC continued different (apparently, mostly two) Early Byzantine traditions of ceramic containers production. Probably these pottery traditions appeared in Crimea together with the direct bearers of these traditions. The chronological changes in the shapes of northern-pontic amphorae were associated with the process of mixing and destruction of the integrity of these traditions.

In this article I will try to prove the hypothesis on the basis of analysis of archaeological sources.

2. MATERIALS AND METHODS

The technique used in this study was developed by the famous Soviet and Russian ceramic researcher A.A. Bobrinsky (1986, 1988). He is a founder of historical-and-cultural approach to the ceramic studies in Russian archaeology (Tsetlin, 2017). The technique has not yet stated in the English-language scientific literature, and therefore it continues to be unknown. The article undertakes the first such experience.

The technique is aimed to the identification of different cultural traditions of potters at the stage of shaping of vessels. For this purpose, vessel shapes are considered at three levels of analysis. 1st level (the most general) - a variety of shapes on the general proportions; 2nd level - a variety of shapes on their «natural structures»; 3rd level (the most detailed) - a variety of shapes on the degree of the vessels' parts functional maturity.

The analysis of general proportions is the study of the ratio of the height of the vessel to its maximum diameter. This information shows the most common differences in the views of potters and consumers of vessels on the dimensional parameters of clay products.

The study of the «natural structures» is a deeper level of analysis. The aim of this level is the grouping vessels by the number and composition of their functional parts. According to historical-and-cultural approach, any vessel can consists of 7 functional parts (Figure 2. 1): «lip» (top edge of vessel capacity), «cheek» (part for pour out), «neck» (dispenser of pour out), «shoulder» (limiter of filling), «brachium» (additional storage capacity), «body» (main filler) and «base» (bottom edge of vessel capacity). Names of functional parts was borrowed from the vocabulary of real potters by A.A. Bobrinsky (Bobrinsky, 1988, p.6).

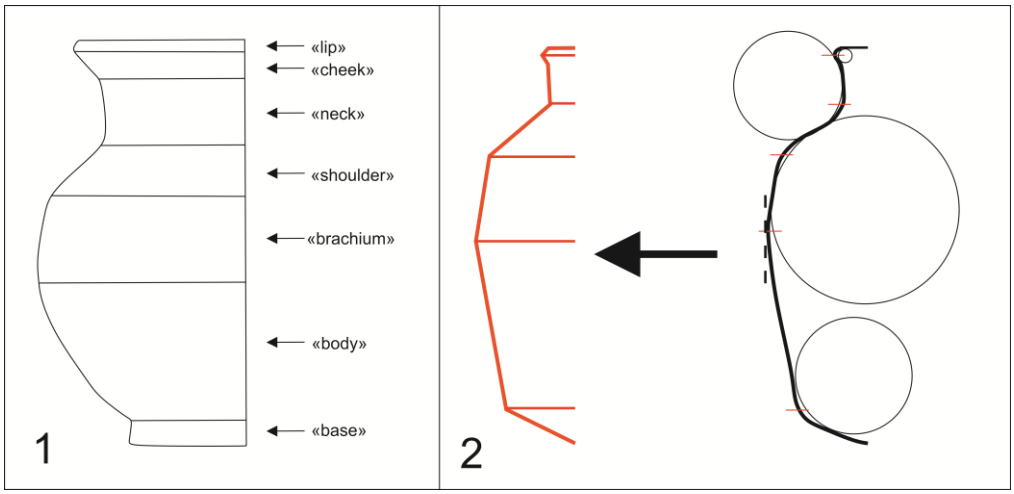

Figure 2. Functional parts in the vessel structure. 1 – Location of different parts, 2 - Technique of allocation of different functional parts (on the example of an amphora)

According to historical-and-cultural approach, physiology of potter's work is a basis for functional parts definition and division. Each act of the shape creation involved two types of accented physical effort of potter – point and spatial. Potter's point physical efforts are targeted to the separation of one part of the vessel from another. Points of application of such efforts can be identified using, for example, circular patterns (Figure 2. 2). Potter's spatial physical efforts are targeted to the shape and size creation of parts. This phenomenon is universal for all potters and all vessels, except those made using «moulds» (Tsetlin, 2012, p.153).

Now about the analysis of the degree of the vessels' parts functional maturity. Each of the functional part can has one of the three degrees of condition: un-formed, partly-formed and fully-formed. Fully-formed is condition when a functional part performs

its function and has the necessary shape for this. For example, it can be high cylindrical «neck» as well low «shoulder» with a high angle of inclination (Figure 3). Partly-formed is condition when a functional part performs its function, but has untypical shape for it. For example, it can be a low «shoulder» with a weak angle close to vertical. Un-formed condition A. A. Bobrinsky defined as the performance of a particular part of the «unusual» features while maintaining its own shape (e.g., the appearance of the high «shoulder», which in addition to the limiter function capacity also performs the function of additional volume).

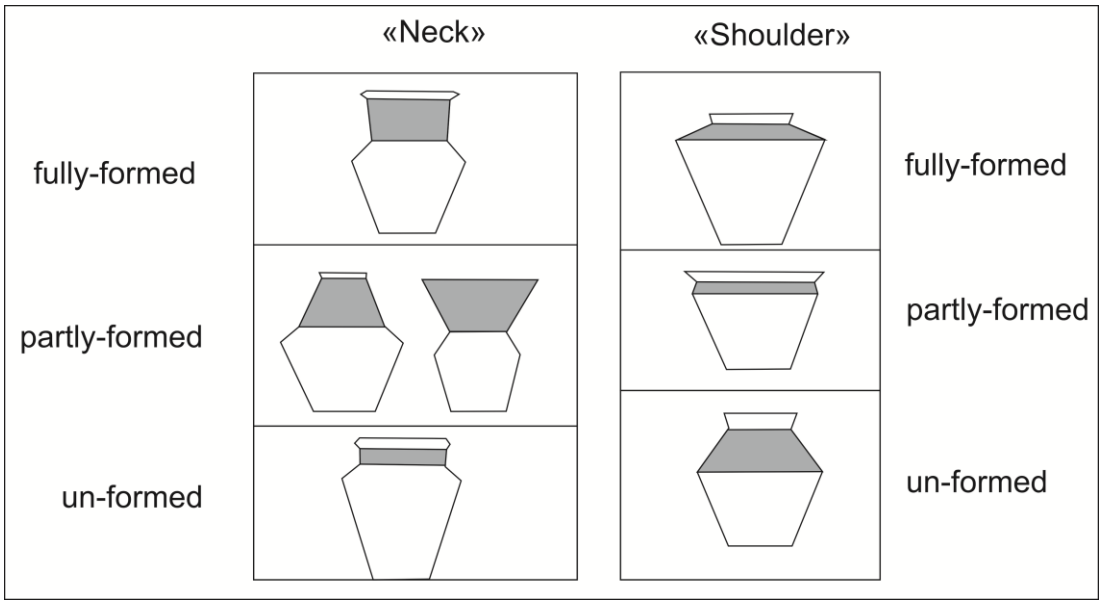

Figure 3. Different degrees of «neck» and «shoulder» condition (an example).

The degree of condition of functional parts is determined on the basis of the height of the part (relative to other parts) as well as the angle of inclination (Bobrinsky, 1988).

Looking ahead, it should be noted, that only two functional parts of northern-pontic amphorae have different degrees of conditions – «neck» and «shoulder». Therefore, it should be said about the criteria for determining of different conditions of these parts. When the height of «shoulder» is less than 15 % relative to other parts of the vessel, it is defined as the fully-formed condition. When the height of «shoulder» is more than 15 % relative to other parts of the vessel, it is defined as the un-formed condition. A similar criterion is used for «neck». The difference is that the fully-formed condition is determined when a height is more than 10 %, and unformed when a height is less than 10 %.

What justifies the use of this analysis technique? The fact is that the traditional methods of grouping the material used earlier in the study of northern-pontic amphorae have not shown their effectiveness in the analysis of periodization and relative chronology of these vessels. A. A. Bobrinsky's technique has qualitative differences. First, it allows abstracting from other striking external differences of amphorae. Here the object of consideration is the shape of the vessel itself. Secondly, this technique allows us to consider and compare the shape of vessels at different levels of detail analysis. Third, the comparison of information obtained at different levels of analysis, allows to identify the «pure» traditions of potters, which are manifested in the presence of strict relationships between the values of the parameters of vessels at different levels of analysis. Also, it allows us to identify cases when these traditions have a «mixed» conditions, when these strict relationships are broken. This idea is the «core» of the following study.

At the finish of current part of the article I would like take a short describe of another technique used in this study. This is geometrical morphometry.

Geometrical morphometry is a complex of techniques for quantitative analysis of the shape of objects (Bookstein, 1991). Geometrical morphometry is widely used in the biological sciences, paleoanthropology and recent years in archaeological studies (Wilczek et al., 2014). This method operates with the coordinates of landmarks, placed on the contour of the object, and its mathematical apparatus allows to analyze the shape of the studied objects as such, abstracting from their linear dimensions. Coordinates of landmarks are analyzed by computer statistical methods. The canonical analysis is used in this study. All procedures for the study of amphorae

shapes by geometric morphometry were performed in computer programs tpsDig and MorphoJ.

In this paper geometric morphometry is used to compare the shapes of the northern-pontic and Late Roman / Early Byzantine amphorae.

The sources of study here is 197 whole and restored amphorae from 49 sites of VIII-X centuries from the territory of Eastern Europe (Crimea, Taman, Caucasus, the Don, the Volga, the Dnieper basins).

3. RESULTS

Analysis of the amphorae shapes

The first step in the analysis procedure is to study the general proportions of amphorae, i.e. the ratio of their height and maximum diameter. The histogram of the values of this parameter shows the absence of normal distribution (Figure 4. 1). The results of $\chi 2$ statistical test confirm it. The normal distribution hypothesis cannot be accepted because the coefficient p = 0.0239 is lower than 0.05.

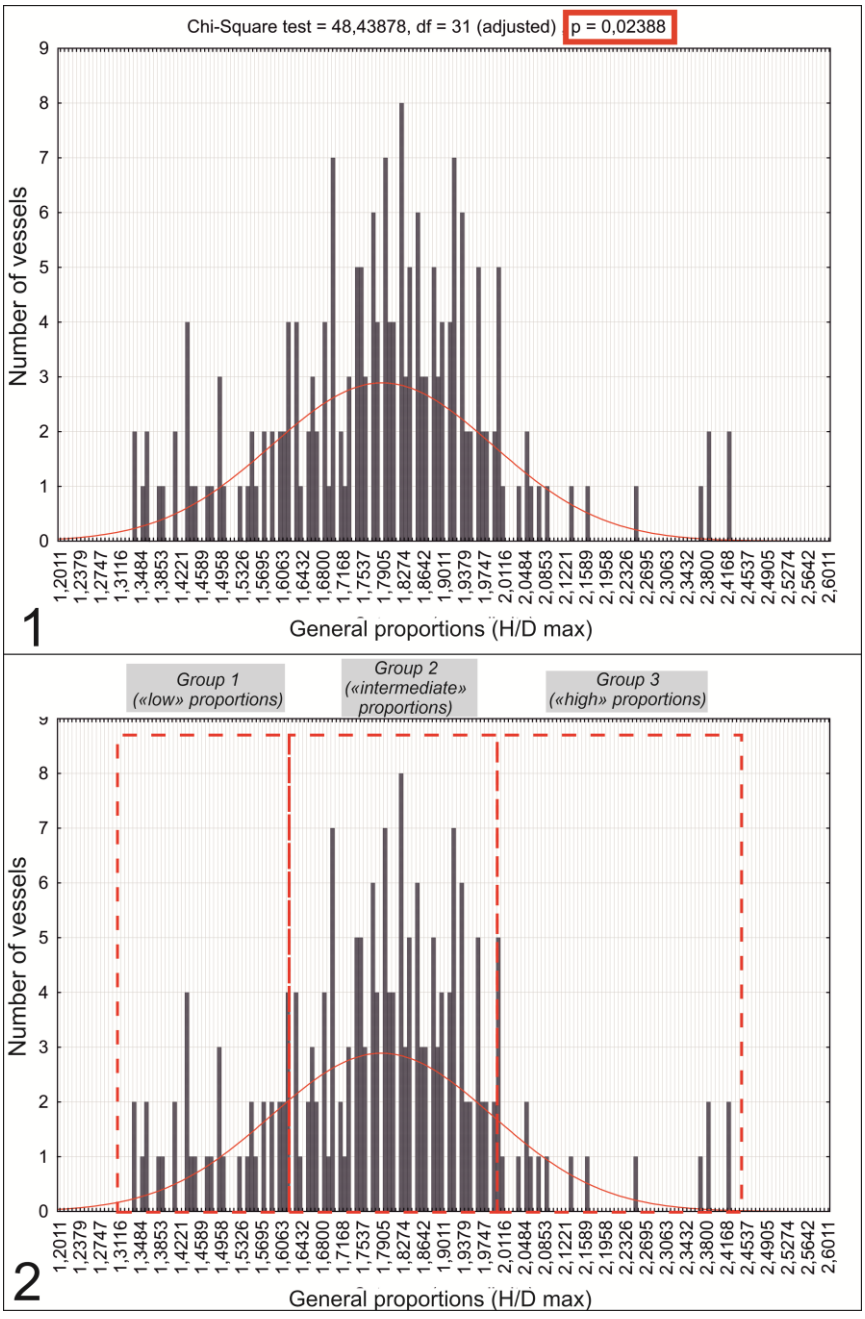

Figure 4. General proportions of northern-pontic amphorae.

Based on the data we can preliminary distinguish three groups of vessels which has a differences in ratio of their height and maximum diameter. Group 1 (Figure 4. 2) includes vessels with a «low» general proportions of about 1.3-1.6. It includes 31 vessels. Group 2 includes vessels from the central part of the

histogram with an «intermediate» proportions, 1.6-2. It includes 142 vessels. Group 3 includes 24 amphorae of the «high» proportions, the coefficient of general proportions is 2 or more.

The appropriateness of the selection of these groups is checked by experimental and ethnographic data. Russian ceramic researcher Y.B. Tsetlin discovered maximum range of random fluctuations in the total proportion of clay vessels due to, on the one hand, the physiology of potter's work, and on the other by their use of different types of pottery wheels (Tsetlin, 2016). According to the data, the series of vessels made by professional potters by hand modeling and partially a pottery wheel, the random fluctuations in the general proportions can be up to ±10 %. We can use this data because northern-pontic amphorae were made in exactly the same way.

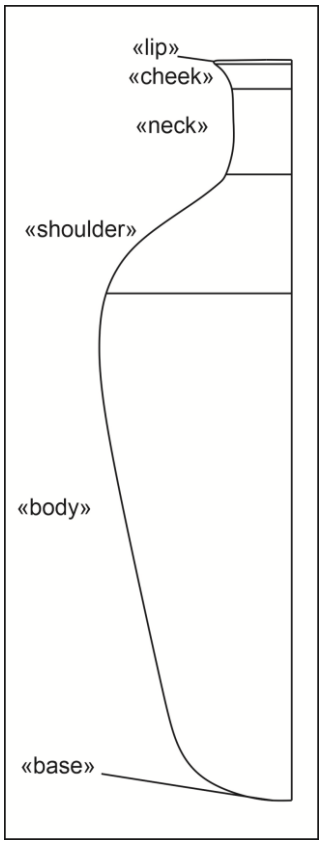

Figure 5. The most numerous structure of northern-pontic amphorae.

The total interval of the fluctuations of the general proportions in the sample under consideration is about ± 22.5%. It exceeds the permissible value of random fluctuations twice. This indicates the non-random nature of the three groups selected on the basis of general proportions.

The second step of analysis is vessels compare on general proportions and «natural structures». This procedure did not yield great results. In all three groups, the dominance is shown by the most numerous structure № 1, including such functional parts as «lip», «cheek», «neck», «shoulder», «body», «base» (Figure 5).

Therefore, we moved on to the next stage of analysis – the study of the functional parts conditions and comparison of these data with the general proportions of amphorae. It was found that only two functional parts show a variety of variants of conditions.

First, it's a «neck». Approximately 79 % of amphorae have fully-formed neck, another 21% of amphorae have un-formed neck. Second, it's a «shoulder». 59% of vessels have fully-formed condition of «shoulder» (Figure 6. 1-2). Un-formed condition is fixed in 41% of amphorae (Figure 6. 3-4).

Now let investigate, how these conditions of the functional parts are represented in each of the three groups selected on the basis of general proportions.

Amphorae of «low» and «intermediate» proportions (groups 1 and 2) have both variants of «neck» condition (Figure 7. 1). The ratio of these two conditions is approximately identical. A different situation is observed for amphorae of «high» proportions (group 3). Here un-formed «neck» is not fixed, all vessels marked fully-formed «neck».

If we compare three groups of amphorae on the «shoulder» conditions, the differences between some of them are more distinct (Figure 7. 2). In the group of «low» proportions there is the prevalence of un-formed «shoulder» (about 70 % of cases). In the group of «high» proportions there is prevalence of fully-formed «shoulder» (about 85 % of cases). Finally, in the group of «intermediate» proportions we fix approximately equal ratio of un-formed and fully-formed «shoulder»: 56 against 44 %.

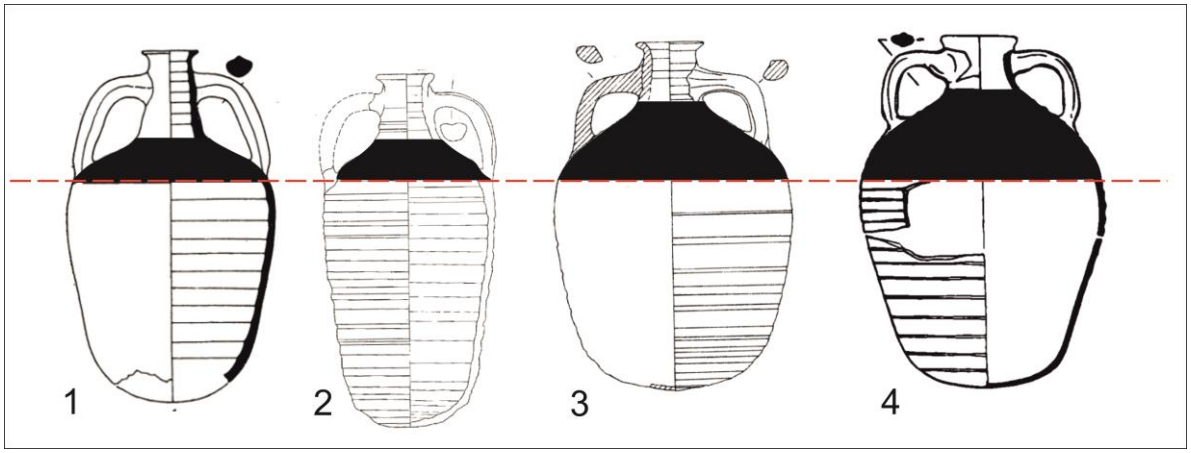

Figure 6. Examples of different condition kinds of «shoulder». 1, 2 – fully-formed, 3, 4 – un-formed.

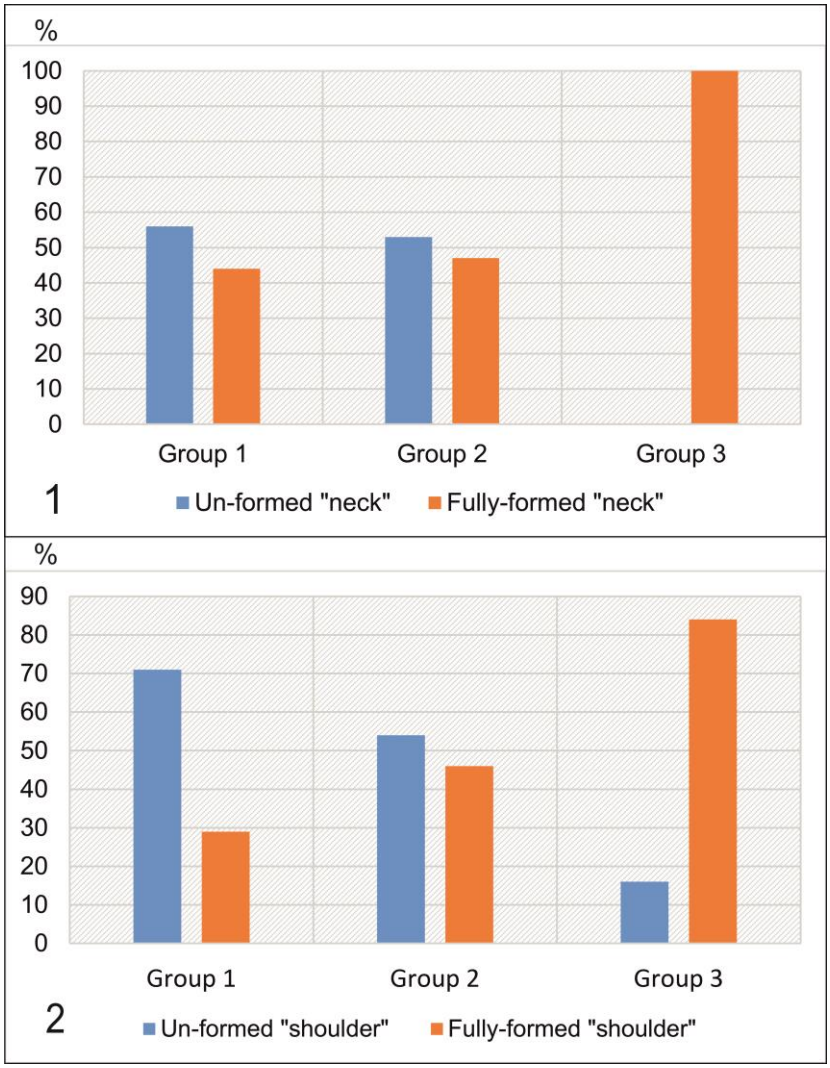

Figure 7. The ratio of condition kinds of different functional parts in the study groups. 1 – «neck», 2 - «shoulder».

The considered results give the basis for some preliminary conclusions:

1) Validity of amphorae division into three groups on the general proportions was confirmed. The two most dissimilar groups of amphorae («low» proportions and «high» proportions) have different kinds of conditions of «shoulder»;

2) We have established that un-formed «shoulder» is most characteristic for the «low» proportions amphorae and fully-formed «shoulder» is most characteristic for the «high» proportions amphorae (Figure 8)

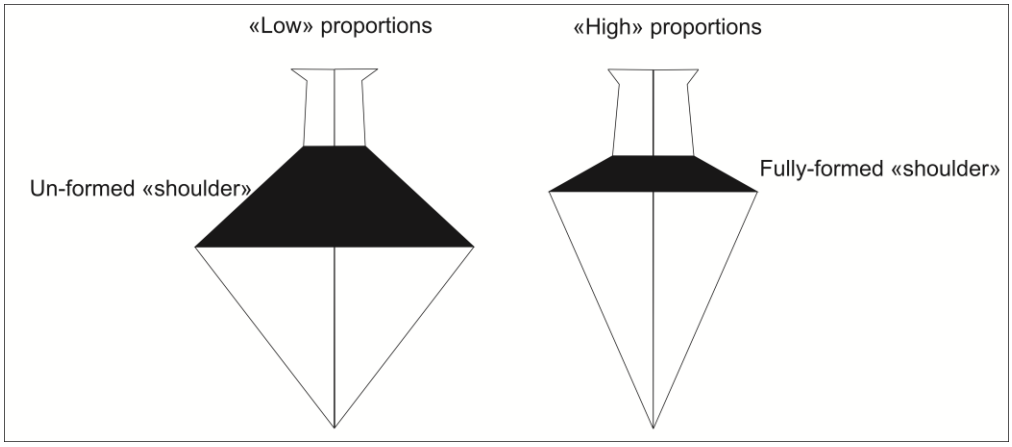

Figure 8. Scheme showing the ratio of general proportions of amphorae and the shape of their «shoulder».

Apparently, it is acceptable to interpret these two combinations of general proportion with special kinds of condition of «shoulder» as two different "pure", i.e. unmixed traditions of northern-pontic amphorae shaping. It is very remarkable that amphorae of «intermediate» proportions, i.e. group 2, do not show connection with any particular kinds of «shoulder» condition.

However, this conclusion needs to be confirmed. For this purpose it is necessary to compare shapes of all considered northern-pontic amphorae with earlier types of Early Byzantine amphorae, which may be associated with the origins of these traditions. If the assumption is true, among the three amphorae groups under consideration the greatest similarity with the earlier amphorae types will show exactly two groups of vessels – amphorae «low» proportions and amphorae of «high» proportions.

What specific types of Early Byzantine amphorae should be compared?

According to modern data the prototypes for northern-pontic amphorae were two different types of Mediterranean amphorae – Late Roman (LR) 1 and LR 2. It is important to emphasize that these two types have different regions of production. LR1 associated primarily with the centers of the southern coast of Asia Minor (Cyprus, Cilicia). LR 2 workshops was located in the Aegean basin (Scopran, 1977, p. 275-276; Dark, 2001. p. 38-39).

To verify this assumption we can use the method of geometrical morphometry. Possibilities and limits of application of this method, so far, are a subject of discussion. My personal experience of using geometrical morphometry allows me to conclude that this method is quite suitable for comparing vessels at the most general level (Sukhanov, Volkova, 2018). That is the ratio of height and maximum diameter of vessels as well as the most obvious differences in the design of their profile parts. This fully corresponds to the task that arose at the current stage of the study.

Previously I have compiled a selection of whole amphorae types LR 1 and LR 2 on the basis of published data. It includes 123 vessels from different sites of the Mediterranean and the Black sea regions.

The procedure for comparing the shapes of vessels using geometrical morphometry consists of two stages:

1) Uniform description of the shape of the vessels using a landmarks placed on the contours of the amphorae (in the computer program tpsDig). Since we are interested not only the proportions of the compared groups of vessels, but also the shape of their upper part, the shapes were described using 40 labels placed along the contour of the vessel at an equal distance from each other (Figure 9);

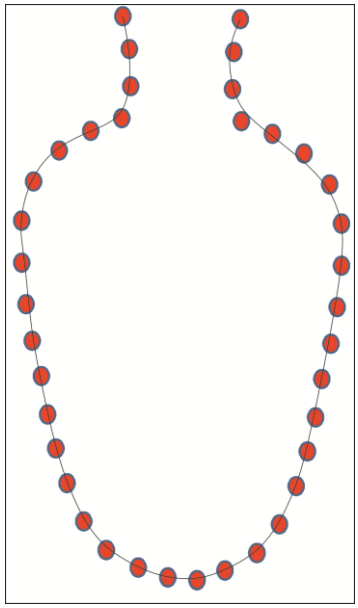

Figure 9. Scheme of landmarks on the contour of amphorae.

2) Statistical analysis of the data in the computer program MorphoJ. This computer program makes it possible to use a variety of methods of multivariate statistics. Since in this case we are interested in the

degree of similarities and differences of the compared groups of vessels, we will focus on the use of the discriminant analysis.

Graph with the results of the analysis gives a certain view of the degree of similarities/differences of the compared groups of vessels (Figure 10). The first principal component, which determines about 59 % of the diversity in the studied series, is responsible for the change of vessels in the ratio of height and maximum diameter, i.e., in general proportions. Accordingly, in the left part of the graph are the vessels of the lowest proportions, in the right – the highest. The second principal component affects 23 % of variability, it determines the differences in the shape of the neck. At the bottom of the graph are vessels with a short expanding neck, at the top of the graph are amphorae with a high conical neck.

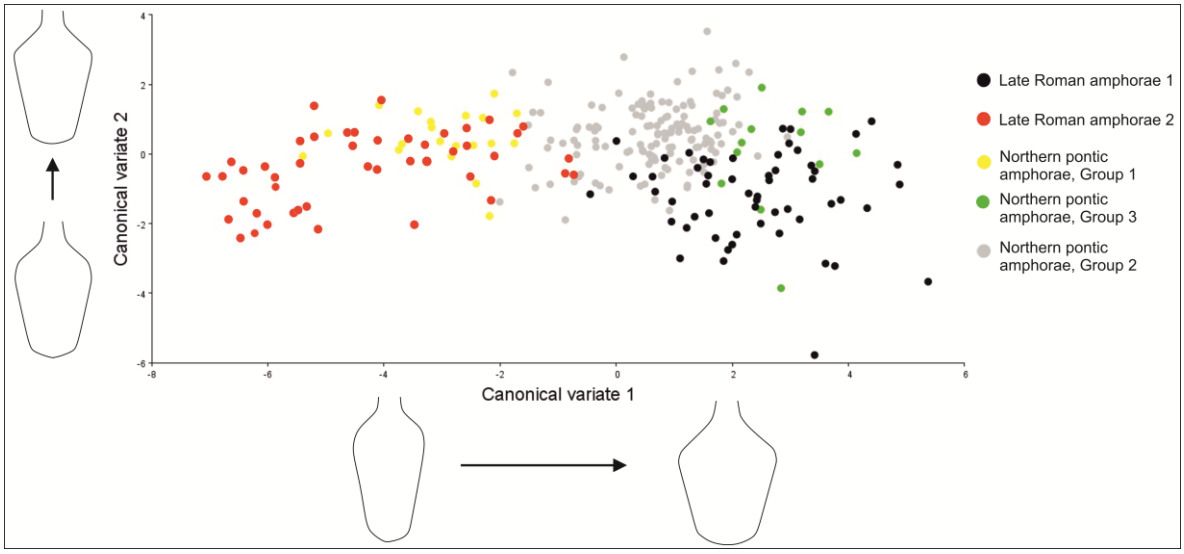

Figure 10. Results of canonical analysis (geometrical morphometry).

Now about the location on the graph of vessels of all compared groups. In the left part of the graph amphorae LR 2 are located (red markers). Amphorae LR 1 are located in the right part of the graph (black markers). This result is quite predictable, because these two groups of amphorae are initially very different from each other.

Location on the graph of the three groups of northern-pontic amphorae has a special interest. First, amphorae of «low» proportions (group 1) are almost indistinguishable from LR 2 amphorae in shapes. Therefore, the graph areas of these vessels completely correspond to each other. Similar situation is observed in the right part of picture, if to compare amphorae LR 1 and northern-pontic of «high» proportions (group 3). The areas of these two groups of objects on the graph are very close. The third and most important observation now is that large part of northern-pontic amphorae of «intermediate» proportions (group 2, gray markers) almost do not «intersect» with earlier types of amphorae. They occupy the area between the areas of earlier types of amphorae on the graph. They are represent something average (first of all, on the first principal component).

The results of the visual analysis of the distribution are confirmed by strict quantitative data. According to the results of a pairwise comparison of all the analyzed groups of amphorae with each other with Mahalanobis distances it turns out that most close pairs are (Table 1):

1) LR 1 and northern-pontic of «high» proportions;

2) LR 2 and northern-pontic of «low» proportions.

Table 1. Mahalanobis distances between different amphorae groups.

	LR 1	LR 2	Northern-pontic 1	Northern-pontic 2	Northern-pontic 3
LR 1					
LR 2	8,5				
Northern-pontic 1	5,7	2,2			
Northern-pontic 2	3,45	7,07	4,1		
Northern-pontic 3	2,03	8,83	5,9	2,9	

The results confirm the assumption that among three groups of northern-pontic amphorae only groups 1 and 3 can be associated with different Early Byzantine traditions of shaping these vessels. Group 2, which turned out to be «intermediate» both in general proportions and in the ratio of different kinds of shoulder condition, did not show a high degree of similarity with earlier prototypes. This is an argument for the idea that vessels of group 2 are the result of a mixing of two different traditions.

There is another serious argument in for this idea.

If we analyze the different kinds of the decorating of external surface of northern-pontic amphorae, we get the following result. In the group of «low» proportions amphorae (group 1), 25 of 31 vessels have a smooth body (sometimes with zonal linear pattern on the top part of body), which is characteristic for the earlier LR 2 amphorae (Figure 11. 1-4). In the group of «high» proportions amphorae (group 1), 20 of 24 vessels have grooved surface, which is characteristic for earlier LR 1 amphorae. (Figure 11. 5-8). Finally, amphorae of «intermediate» proportions do not show a stable connection with one of the two kinds of decorating of external surface. Here there is approximately equal to their ratio – 56 against 44 %.

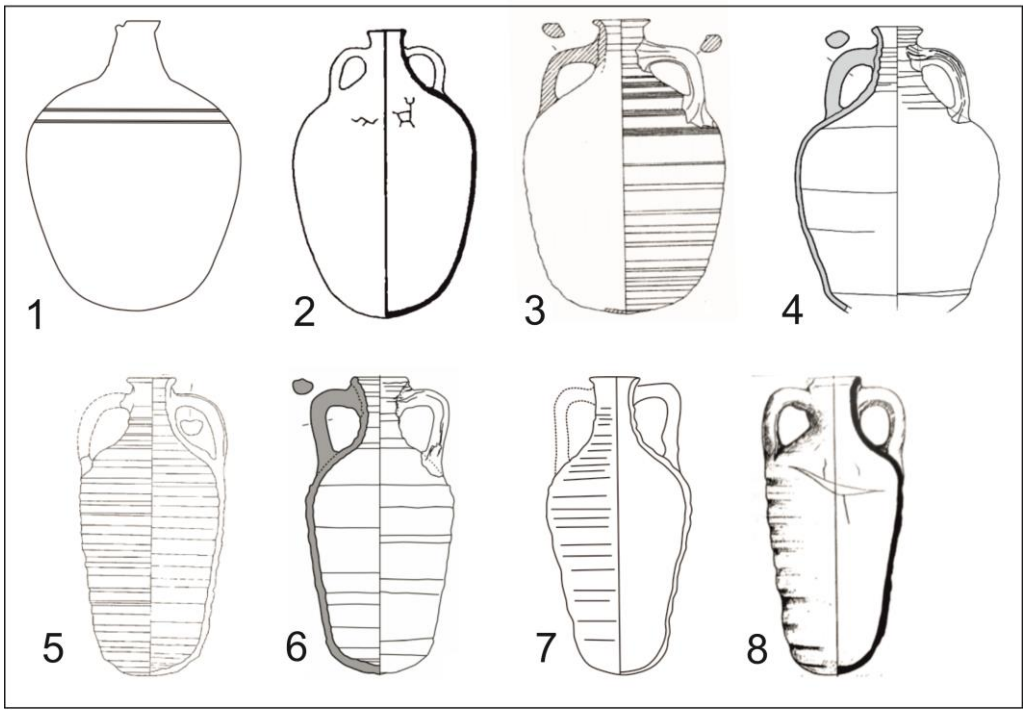

Figure 11. The most typical kinds of surface décor in the groups of «low» proportions and «high» proportions. 1-4 – «Low proportions, smooth body, 5-8 – «high» proportions, grooved body.

Thus, the analysis of northern-pontic amphorae shapes and comparison of its results with the data of surface decoration as well as with shapes of earlier types of Early Byzantine amphorae allows to substantiate the idea expressed. Northern-pontic amphorae of the «low» and «high» proportions are associated with two different pottery traditions in the manufacture of ceramic containers, and amphorae of the «intermediate» proportions, probably, are the result of mixing of these traditions.

Reliable way to confirm this hypothesis finally is analysis of studied vessels distribution by dated contexts.

Before checking the above assumption, we conducted a more fractional grouping of all considered northern-pontic amphorae on the basis of three attributes:

1) General proportions;
2) Condition of «shoulder»;
3) Kind of external surface decor.

What is the reason for this procedure? Above I have already said that despite the presence of some dominant variants of «shoulder» conditions and kinds of surface decoration in the groups of «low» and «high» proportions, however, there are some deviations from these patterns. Therefore, this procedure aims to obtain more «pure» taxons for their imposition on the dated contexts.

The systematic presented below covers all possible variants of combinations of the three abovementioned attributes (Table 2).

Table 2. Characteristic of amphorae subgroups.

«Low» proportions amphorae (the first tradition)	
Subgroup 1-1	Smooth body, un-formed «shoulder»
Subgroup 1-2	Smooth body, fully-formed «shoulder»
Subgroup 1-3	Grooved body, un-formed «shoulder»
«Intermediate» proportions amphorae	
Subgroup 2-1	Smooth body, un-formed «shoulder»
Subgroup 2-2	Smooth body, fully-formed «shoulder»
Subgroup 2-3	Grooved body, fully-formed «shoulder»
Subgroup 2-4	Grooved body, un-formed «shoulder»
«High» proportions amphorae (the second tradition)	
Subgroup 3-1	Grooved body, fully-formed «shoulder»
Subgroup 3-2	Smooth body, fully-formed «shoulder»

Thus, at a detailed level, 9 subgroups of northern-pontic amphorae were identified taking into account their general proportions, shape of «shoulder» and the kind of decoration of external surface. Now we can to analyze the dates of the contexts where amphorae of different subgroups were found.

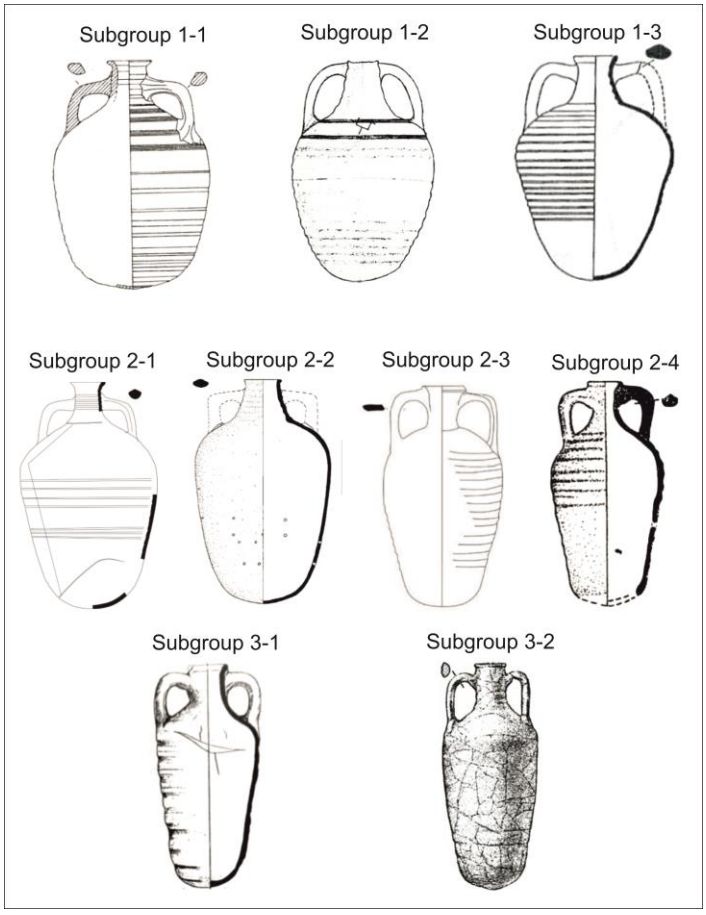

Figure 12. Examples of each subgroup amphorae (without scale).

Subgroup 1-1. Amphora from Nedvigovka settlement (the Don basin) was found in the layer of the 7th - first half of 8th centuries. Base for such date is the ratio of different groups of early medieval ceramics and the find of metal cross from this layer (Nidzelnitskaya, 2009, p. 265-266). Two amphorae from this subgroup were found in Chersonesos, in the filling of a well in the port quarter I. The well was filled up in the late of 8th - early of 9th centuries (Romanchuk et al., 1995, p. 47). One amphora was found on Martynovo settlement, in context of the second half of 7th – 8th centuries (Nidzelnitskaya, 2014, p. 468, 472). Two amphorae were found on Pastyrskoe hillfort. This hillfort stopped the existence in the second half of the 8th century (Prikhodnyuk, 2005, p. 63). One amphora was found on the barrow cemetery Uren II (barrow 4, burial 1). This group of sites date from the second half of the 7th - 8th centuries (Bagautdinov et al., 1998, p. 164).

Thus, subgroup 1-1 that represent the most "pure" version of the tradition of amphorae low of proportions, according to recent data is dated to the 8th century.

Subgroup 1-2. The earliest in this subgroup is amphora from Nedvigovka, 7th - first half of the 8th centuries (Nidzelnitskaya, 2009, p. 265-266). Two amphorae were found in the barrow cemeteries Brusyany 3 and Uren 2 on the Middle Volga. They are dated to the 8th century (Bagautdinov et al., 1998, p. 164). One amphorae was found in Rzhevka cemetery in context of the first half of the 9th century (Sarapulkin, 2006, p. 20). The most late amphora of this subgroup was found in the layer of Sarkel, second half of the 9th - first half of the 10th centuries. Thus, this sub-group of amphorae due to the find from Sarkel has a broad dating. It is the 8th - first half of the 10th centuries.

Subgroup 1-3. One amphora was found in cistern V of quarter B in Chersonesos. The excavation authors attributed the filling of the cistern to the second half of the X century by combining the cycles of coin finds (Ryzhov, 1999, p. 326). One amphora was found in the cross church of Mangup. The date is the beginning of the 10th century (Myts, 1990, p. 241). One amphora was found in Gnezdovo cemetery (the Dnipro basin). It is a context of the first quarter of 10th century (Avdusin, 1952, p. 21).

The considered data show that the earliest amphorae of «low» proportions are vessels from subgroup of the most «pure» version of this tradition, i.e. subgroup 1-1. Vessels of subgroup 1-2 which show the «atypical» form of «shoulder» have a more wide date. The most late dates is characteristic for vessels of the most mixed variants of two traditions, presented by amphorae of low proportions with unformed «shoulder» and grooved body.

The following dates are obtained for amphorae of «high» proportions.

The most «pure» variant of this tradition are vessels of subgroup 3-1. This subgroup includes amphorae from Luchistoe cemetery (Crimea). The vessels were found in context of the second half of the 8th century (Aybabin, Hayredinova, 2008, p. 63, 67).

Subgroup 3-2 is represented by vessels of one of the most mixed variants of traditions. There is the combination of «high» proportions and atypical for such proportions smooth external surface and fully-formed «shoulder». One amphorae was found on Kalos-Limen settlement (Crimea) in the layer of the second half of the 9th – first half of the 10th centuries (Kutaysov, 2004, p. 11). Another amphora was found in the destruction layer of the medieval settlement near Chersonesos dated not earlier than the first half of the 10th century (Yashaeva, 1999, p. 355).

Thus, a similar pattern is observed for amphorae of «high» proportions. The most earlier (second half of the 8th century) is «pure» variant of its tradition. The most later (second half of the 9th – first half of the 10th centuries) are amphorae of mixed tradition.

In conclusion, we consider the dates of contexts with amphorae from the «intermediate» group.

Subgroup 2-1. There are no amphorae found in strictly dated contexts.

Subgroup 2-2. Amphorae shapes of this group are the variant of first tradition, which have higher proportions as well as atypical «shoulder». The earliest here is amphora from Volyntsevo settlement. This vessel belongs to the boundary of the 8th -9th centuries (Smilenko, Yurenko, 1990, p. 305-306; Sukhobokov, 1992, p. 33-34). Amphora from Rzhevka cemetery (the Don basin) was found in the context of the first half of the 9th century (Sarapulkin, 2006, p. 202). Amphora from Dmitrievka settlement (the Don basin) refers to the second half of the 9th century (Sazanov, 2001, p. 242). Another vessel was found in cistern V of quarter B in Chersonesos. Date of the context is the first half of the 10th century (Sazanov, 2001, p. 243, 244).

Thus, such amphorae have a broad date within the boundaries of the 8th/9th – the first half of the 10th centuries.

Subgroup 2-3. Amphorae shapes of this subgroup are a variant of the second tradition, which have a lower proportions. Amphora from Pravoberezhnoe Tsymlyanskoe hillfort (the Don basin) gives the earliest date in this subgroup. The date of the site is the end of 8th – first half of the 9th centuries (Flyorov, 1994, p. 486-487). The second half of the 9th – first half of the 10th centuries is a date for amphorae from Sarkel (1 vessel) and Sidorovo (2 vessels).

Thus, there are no such amphorae in the contexts of the 8th century. All of them belong to the 9th - the beginning of the 10th centuries.

Subgroup 2-4. Amphorae shapes of this subgroup are a variant of the second tradition, which have a lower proportions and «untypical» un-formed «shoulder». Three amphorae from storehouse of Ptashkino church (Crimea) are dated not earlier then the middle of the 9th century (Gadlo, 1980, p. 14). Amphora from Sarkel belongs to the second half of the 9th - first half of the 10th centuries. One of the vessels from this subgroup was found in the destruction layer of the medieval settlement near Chersonesos dated not earlier than the first half of the 10th century (Yashaeva, 1999, p. 355). Finally, the «late» date is characteristic for amphorae from Trepol settlement. The emergence of this site was recorded by written sources in the 11th century (Kuza, 1996, p. 173).

Thus, amphorae of this subgroup are unknown before the second half of the 9th century.

4. DISCUSSION

Analysis of the contexts dates where northern-pontic amphorae of different subgroups were found reveals some trends in the chronological changes in the shapes of these vessels. Exactly subgroups of amphorae represented the «pure» variants of the two traditions of shaping show the earliest dates within the 8th century. These are subgroups 1-1 («low» proportions, smooth external surface, un-formed «shoulder») and 3-1 («high» proportions, grooved body, fully-formed «shoulder»). It seems important that there is not a single amphora of «pure» traditions that was found in the contexts later than the first half of the 9th century.

«Intermediate» versions of mixed traditions represented in the amphorae Group 2 have some other dates. Among three considered subgroups, two belong to the 9th – first half of the 10th centuries, and one to the second half of the 9th - first half of the 10th centuries. The results of the analysis show that such amphorae shapes did not exist in the 8th century.

A very definite chronological picture is shown by amphorae of the most «radical» variants of mixed traditions. These are subgroups 1-3 («low» proportions +grooved body+un-formed «shoulder») and 3-2 («high» proportions+smooth body+fully-formed «shoulder»). In these subgroups there are no vessels found in a context dating back earlier than the second half of the 9th century. Almost all dated amphorae, as shown above, belong to the 10th century.

All this observations are summarized at Figures 13, 14.

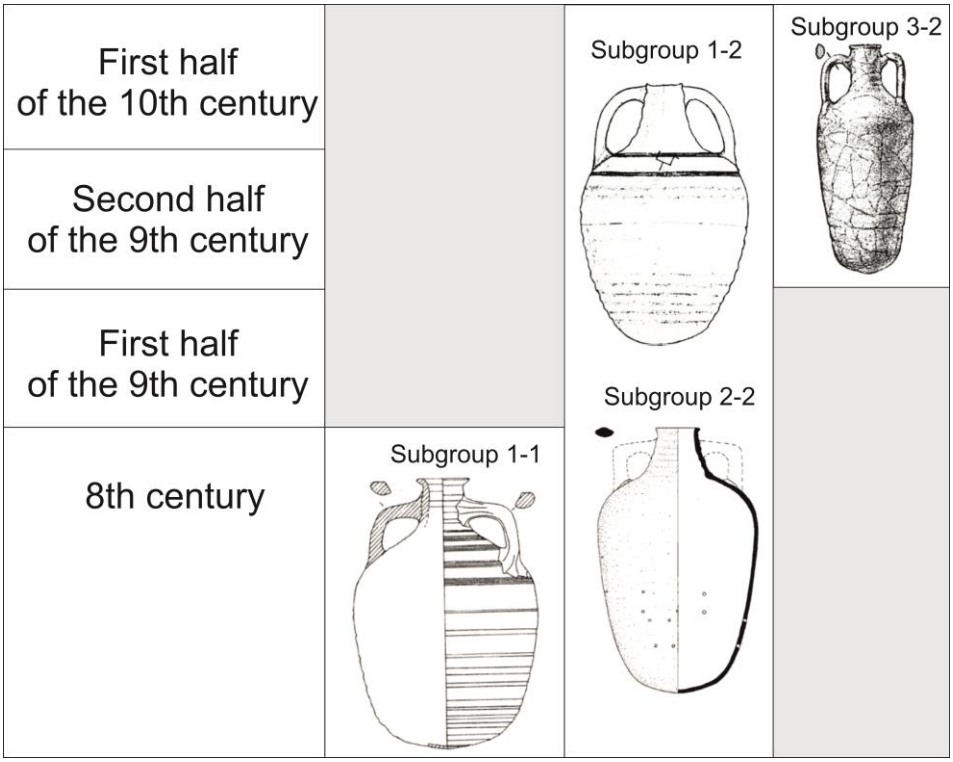

Figure 13. Chronological changes of northern-pontic amphorae (the first tradition).

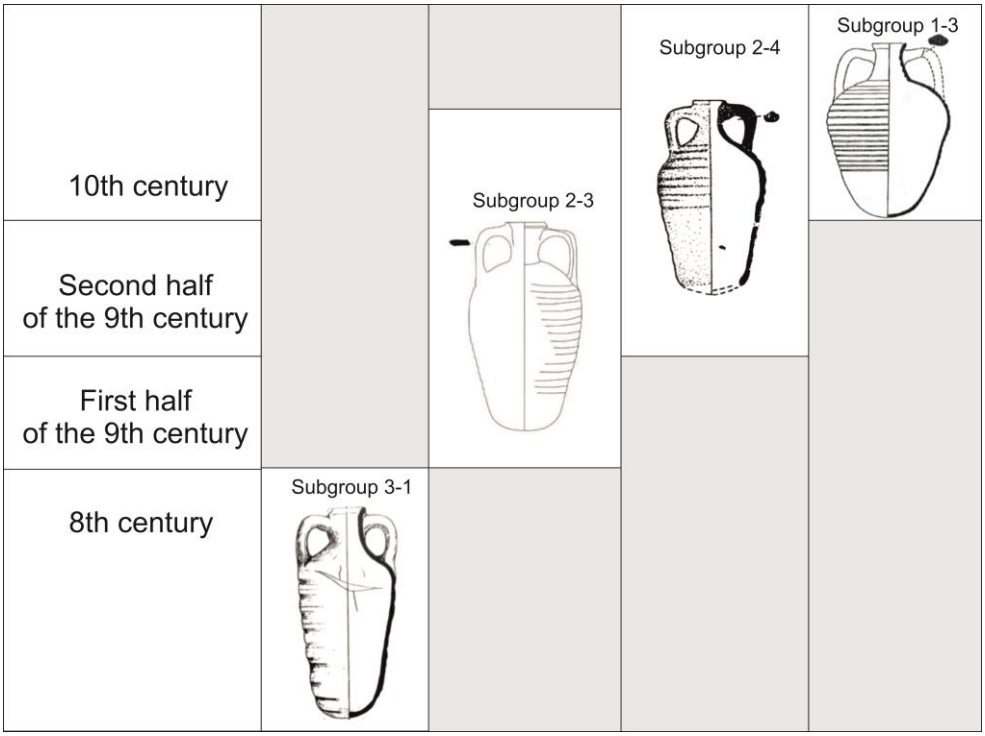

Figure 14. Chronological changes of northern-pontic amphorae (the second tradition).

5. CONCLUSION

Thus, I would like to assume that the data presented are sufficient to make two main conclusions summarizing the results of the study:

1) Potters of Crimean workshops of the 8th – 10th centuries who made northern-pontic amphorae was continuing two different Early Byzantine tradition of ceramic container production. These two traditions initially had fundamental differences in the shape of vessels and the decor of the external surface;

2) Chronological changes of northern-pontic amphorae shapes can be described as a process of gradual erosion and mixing of these two pottery traditions. That is why the earliest vessels relate to unmixed traditions, and the most late vessels do not directly correspond to these two original traditions. I assume that the main reason for this is the coexistence of two different traditions on a small territory of the South Crimean coast. That historical realities created the preconditions for cultural contacts between them and changes in working skills of potters.

Of course, we are aware that a quantity of strictly dated contexts which we can use in this study is not so many. However, these are the archaeological realities of the studied region in the 8th – 10th centuries. Despite this, our research allows to discover of the main trends and patterns in the chronological evolution of northern-pontic amphorae morphology and to confirm this with the independent data.

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