II. PETROGRAPHIC ANALYSIS OF STAMPED AMPHORAE

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1. The Objectives of the Research

The present investigation was carried out as a part of a project entitled 'Optical petrography studies of the pottery produced at Greek centres in the Black Sea area'.[1] The choice of the petrographic method was not accidental. Firstly, optical petrographic studies have been used in archaeology for a long time.[2] Secondly, such studies have been periodically attempted during the investigation of Greek pottery from excavations at the cities in the Black Sea area ever since the 1940s.[3] In those experiments it was proved that petrographic analysis is most certainly applicable to the study of mass ceramic material and especially amphorae.

However, the experiments mentioned above were intended to identify petrographic peculiarities of the pottery of a single local production centre. We set another target in this study: namely, to compare samples of different amphorae whose production centres were reliably established and which were found in a single building dated to a relatively narrow chronological range. We supposed that on the basis of a fairly small set of comparable signs it would be possible to identify more accurately the features of the ceramic paste peculiar to a certain production centre.

We proceeded from the assumption that it was not the natural composition of the pastes – which can show considerable variation even within a single deposit – that should be taken as an indicator but rather the mineral tempers that had been added by the potter to improve the technological qualities of the paste. If groups of tempers specific in terms of their qualitative and quantitative composition could actually be shown to correlate with certain groups of ceramic pastes produced in securely identified centres, then it would be possible to define a reference scale of signs for that class of amphorae. Subsequently this scale could be used both for distinguishing amphorae of unknown provenance and for identifying centres of production of different popular household ware.

Reliably attributed samples were needed for checking this supposition. Such samples are well represented by amphorae with stamps. After identification of the petrographic features specific to each established production centre it would be possible to consider unstamped amphorae as well as different kinds of plain household ware made from paste of similar composition to that of amphorae. Pottery of the latter type along with amphorae, complete or in fragments, constitutes the majority of the archaeological material obtained during excavations.

2. Selection and Description of the Samples

For analysis, 22 chips were chosen, selected from fragments of stamped amphorae produced in four reliably identified Black Sea centres: Herakleia Pontike, Sinope, Chersonesos, and Amastris. The first three centres carried out regular stamping of their amphorae on a large scale and for a long time. Thus Herakleia stamped its amphorae during the 4th- early 3rd centuries B.C.[4] and Sinope during the 4th- the first half of the 2nd century B.C.[5] In Chersonesos

stamping of amphorae began not earlier than the last third or quarter of the 4th century B.C. and ceased not later than the first quarter or half of the 2nd century B.C.[6] By contrast, it seems that Amastris carried out stamping for a short period only, at the very beginning of the 3rd century B.C. (*c.* 300-285).[7]

The fragments of stamped amphorae produced in the centres listed above were not all synchronous, although they were found in a single archaeological context reliably dated to the late 4th or early 3rd century B.C. Thus, for example, the small fragments of stamped Herakleian amphorae, with the exception of sample **9**, were present as filling in the structure of pavements or hearth walls and were dated to an earlier period. To make the selected set more synchronous we also excluded from consideration those fragments of amphorae and tiles bearing Sinopean marks belonging to Grakov's group I because it was evident that they had all been reused in the building. As to the fragments of Chersonesean amphorae and of Sinopean ones with stamps of Grakov's groups II and III or those from Amastris, they seem all to be synchronous. These vessels were actually in use in the building at the time of its sudden destruction.

All samples taken from amphorae fragments with Herakleian stamps show the visual features characteristic of this centre: brown-red colour with shades varying from light to dark, the surface of fractures rough to the touch like an emery grinder, and a considerable quantity of fine mineral inclusions of black, white, or reddish colour.

The series of chips cut from Sinopean stamped amphora handles are visually very homogeneous in their composition and colour. The dense ceramic texture in the fractures has slightly lilac or yellow-lilac shades, against the background of which is distinguishable quite a large quantity of disseminated acute-angled shining black particles; and even with the naked eye the presence of pyroxenes may be guessed at among the latter.

Dense, well-fired clay of various shades of red (from orange to deep red) with different carbonaceous inclusions is characteristic of the series of samples taken from Chersonesean stamped amphorae. The inclusions are homogeneously distributed; their quantity, however, varies considerably, as does the colour of the clay. Moreover, certain correlations may be observed between the visually discernible features of the paste and the magistrates' stamps. Thus the amphora fragments with the marks of the astynomos *Bathyllos* (no. **1**) always include fine white calcareous tempers with grains of regular size, and their very dense and excellently fired clay is coloured deep red. The paste samples taken from amphora handles with stamps of *Apollonios* (nos. **4** and **5**) contain almost no visible admixtures. The clay is soft and 'soapy' to the touch; the paste is light reddish-yellowish in section. The light red and very dense clay of the amphora fragments bearing the marks of the astynomos *Xanthos* (nos. **6** and **7**) contains a considerable admixture of acute-angled black grains along with a small quantity of white calcareous inclusions; this makes these fragments similar to the pottery of Sinope.

The samples taken from Amastrian amphorae (nos. **21** and **22**) have a dense texture containing a great quantity of fine black and white inclusions homogeneously distributed. In section the clay is light pink or red, and therefore resembles in colour the fragments of Sinopean stamped amphorae.

3. THE METHOD OF INVESTIGATION

The samples were studied in transparent thin sections. The percentage ratio of different admixtures in the paste as well as the mineral composition, shape, and dimensions of the grains were determined.

4. RESULTS

It was found that the ceramic material of amphorae from Chersonesos, Sinope, and Herakleia is not uniform in terms of its petrographic composition, and even in specimens from a single centre it can be divided into a number of groups. However, certain groups from different production centres constitute very close petrographic parallels. As will be shown below the Amastrian amphorae, though they are represented by only two samples, are no exception either to these general rules.

The tempers in the samples studied are represented by fragments of quartz, plagioclase, pyroxenes, basaltic hornblende, effusive rocks, quartzite, and limestones. Potsherd is very common too.

The size of the individual granules of temper varies from 0.01 to 1 mm. As a rule they are of acute-angled shape which suggests that most of the grains are those of artificially ground tempers. However the finest of the granules (about 0.05 mm) dispersed throughout the whole fabric were in most cases introduced with the natural clay.

Andesite porphyrites prevail among the fragments of effusives. Felsites and dacites are also found. In a number of cases effusives may, with a fair degree of probability, be considered to be present in the form of larger fragments as the source of grains of plagioclase and pyroxenes in the mineral tempers. As a result of the crushing of the coarse grains of effusive rocks, zonal plagioclases similar to those disseminated in porphyrite, as well as pyroxenes similar to the phenocrystals of pyroxene in porphyrites, were separated out.

Ground quartzite, which is sometimes found in larger particles in the same samples, often serves as a source of quartz grains. However, such a connection between monomineral fractions of the temper with some larger fraction (*i.e.* rock fragments) has not been revealed in all the samples studied. Thus it seems that the source of tempers in the ceramic pastes of amphorae from Sinope was coarse-grained pyroxenite; this is apparent from the fact that the largest grains are the fragments of yet larger crystals.

In a number of groups calcite in the form of finely smoothed fragments is found, along with secondary minerals which fill the hollows or (less frequently) produce pseudomorphes on some prismatic minerals or sometimes on organic inclusions (?). This component probably does not belong to an artificial temper but was introduced with the original clay.

5. DISCUSSION OF THE RESULTS

The most important finding was the discovery of analogies between the petrographically identified groups from different production centres. As mentioned above, the mineral composition of the inclusions was assumed as the main criterion because it is precisely this feature that reflects the technological composition of the tempers. The grain size was considered as a minor indication and was of importance only when it differed considerably from the norm.

Characteristics of the paste of stamped amphorae from each production centre are listed below:

Herakleia Pontike (Pl. 187, *1*). Three petrographic groups were identified.[8] The pastes of amphorae belonging to groups *Herakleia I* (Pl. 187, *1*) and *Herakleia II* (Pl. 187, *2*, *4*) are petrographically fairly homogeneous in terms of their mineral additives, for which a multi-componential composition is characteristic. Fragments of pyroxenes, quartz, feldspars, effusive rocks, hornblende, and limestone are present in these additives. The differences are limited

to variations in the quantitative ratio of the added components (nonplastics). The total absence of quartz fragments and the prevalence of fragments of plagioclase (up to 14%) are peculiar to group *Herakleia III* (Pl. 187, *3*).[9]

The data obtained are listed in Table 1.

Sinope (Pl. 188). Homogeneity of the composition of mineral additives, the closeness to each other of the two groups identified, and almost monomineral admixtures of which above two-thirds are composed of pyroxene fragments are peculiar to the paste of amphorae from this centre. The data are listed in Table 2.[10]

Amastris. The two samples from U6 show a great similarity to those of Sinopean amphorae. They contain 10-15% mineral additives, with the prevailing fragments being 0.3 mm (min. 0.05, max. 0.7) mostly angular; a few individual grains have traces of rounding. Of the additives 5-13% are composed of pyroxenes of rhombic enstatite-bronzite series (*cf. Sinope II*). The rest of the minerals are represented by quartz (3%), plagioclase (1%), and ore minerals (2%). Of rock fragments up to 3% limestones, 1% tuffites, and single dispersed grains of quartzites, endisites, and acid effusives were discovered. In addition, a secondary carbonate (about 1%) was identified. This group was later designated as *Amastris V.*[11]

Chersonesos (Pl. 189). Petrographically the paste of Chersonesean amphorae is fairly inhomogeneous. Four groups were distinguished each differing markedly from the other. Their characteristics are as follow (see also Table 3).

The common feature of the pastes used in Chersonesean amphorae production is the high concentration of secondary calcite it contains. Probably this feature is a result of the natural clay composition. One other peculiarity has been identified: a direct correlation between the petrographic groups recognized and the names of the astynomoi on the corresponding magistrate's stamps. Thus group *Chersonesos I* (astynomos *Bathyllos*) is distinguished in general by its very low content of tempers, which are composed almost solely of quartz. In that it is close to group *Chersonesos III* (astynomos *Apollonios*) also tempered practically solely with quartz; the latter, however, in contrast to group *Chersonesos I*, is extremely finely ground. In its general features group *Chersonesos II* (astynomos *Dioskouridas*) most nearly resembles group *Amastris IV* identified later. Group *Chersonesos IV* (astynomos *Xanthos*) differs from the other Chersonesean samples in having a considerable content of non-ferrous metals in the temper. In the diversity of its composition and texture the latter group is most similar to groups *Herakleia I* and *Amastris IV*.

Table 1.

Petrographic group *Herakleia*		**I**	**II**	**III**
Sample Nos.		**8, 9**	**10, 11**	**12, 13**
Temper content (%)		25	up to 30	12-18
Size of granules (millimetres):				
Prevailing		0.3	0.4	0.4
Min.		0.1	0.01	0.01
Max.		0.9	0.5	0.7
Rounding:				
Angular		+	+	+
Traces of rounding		single coarse grains	acute-angled –	acute-angled –
Rounded		–	–	–
Fragments of minerals				
***Pyroxenes*:**				
a. Monoclinic of the diopside-goethenbergite series	biaxial positive $2V < 60°$ Ng – Np=0.023-0.028	–	3-4%	–
	biaxial positive $2V = ?$ Ng – Np=0.017-0.020	1%	–	single grains
b. rhombic en-statite-bronzite series	biaxial positive $2V > 70°$ Ng – Np=0.011-0.012	2%	–	2%
Basaltic hornblende		2%	–	2%
Quartz		8%	7%	single grains
Plagioclase		3%	7%	14%
Ore minerals		–	–	–
Rock fragments:				
Quartzite		Single grains	2%	single grains
Vulcanites:				
Andesites		Single grains	–	5%
Effusives of acid composition		2-3%	2-3%	–
Tuffites		Single grains	–	–
Potsherd		1-2%	1%	–
Secondary carbonate		+	–	1%

Table 2.

Petrographic group *Sinope*		**I**	**II**
Sample Nos.		**14, 15, 16, 18, 20**	**17, 19**
Temper content (%)		15	12
Size of granules (millimetres):			
Prevailing		0.3-0.4	0.5-0.7
Min.		0.1	0.1
Max.		0.6	0.8
Rounding:			
Angular		+ acute-angled	+ acute-angled
Traces of rounding		–	–
Rounded		–	–
Fragments of minerals			
***Pyroxenes*:**			
a. Monoclinic of the diopside-goethenbergite series	biaxial positive $2V < 60°$ Ng – Np=0.023-0.028	–	11%
	biaxial positive $2V = ?$ Ng – Np=0.017-0.020	–	–
b. rhombic enstatite-bronzite series	biaxial positive $2V > 70°$ Ng – Np=0.011-0.012	–	9%
Basaltic hornblende		–	–
Quartz		single grains	–
Plagioclase		1%	2%
Ore minerals		single grains	1%
Rock fragments:			
Quartzite		Single grains	–
Vulcanites:			
Andesites		1%	–
Effusives of acid composition		1%	–
Tuffites		–	–
Potsherd		3%	3%
Secondary carbonate		–	–

Table 3.

Petrographic group *Chersonesos*	**I**	**II**	**III**	**IV**
Sample Nos.	**1**	**2, 3**	**4, 5**	**6, 7**
Temper content (%)	5	15-18	10	20
Size of granules (millimetres):				
Prevailing	0.3	0.1	0.1	0.4
Min.	0.01	0.01	0.01	0.05
Max.	0.7	1.5	0.3	1.0
Rounding:				
Angular	+ acute-angled single grains	+ acute-angled single grains	+ acute-angled frequent	angular single grains
Traces of rounding				
Rounded	–	single grains (quartz 0.8 mm)	–	–
Fragments of minerals				
***Pyroxenes*:**				
a. Monoclinic of the diopside-goethenbergite series	biaxial positive 2V < 60° Ng – Np=0.023-0.028	–	–	–	–
	biaxial positive 2V = ? Ng – Np=0.017-0.020	single grains	–	–	single grains
b. rhombic en-statite-bronzite series	biaxial positive 2V > 70° Ng – Np=0.011-0.012	single grains	–	–	2%
Basaltic hornblende		–	single grains	–	single grains
Quartz		3%	8%	10%	3%
Plagioclase		single grains	7%	–	7%
Ore minerals		single grains	–	–	–
Rock fragments:					
Quartzite		single grains	single grains	–	–
Vulcanites:					
Andesites		1%	–	–	5%
Effusives of acid composition		single grains	–	single grains	–
Tuffites		–	–	–	single grains
Potsherd		1%	3%	1%	single grains
Secondary carbonate		5%	single grains	1-2%	2-4%

6. PETROGRAPHIC SUMMARY

The paste used for the production of Sinopean amphorae seems fairly homogeneous in terms of the composition of its tempers. To a lesser extent this is also true of the amphorae production of Herakleia Pontike, but we are dealing with quite another situation when considering the pastes of amphorae from Amastris and Chersonesos. The Amastrian samples from U6 are nearest to the Sinopean pastes in terms of their temper composition – though, in general, a marked diversity of composition is characteristic of amphorae from Chersonesos and Amastris. On the other hand, certain groups from Chersonesos and Amastris do find parallels in the pastes of Sinope and Herakleia.

A comparative description of the petrographic groups considered is given below (Table 4).

Table 4.

Petrographic groups, sample nos.	**Peculiar features**
Sinope I. Nos. 14, 15, 16, 18, 20	The additives consist mostly of monoclinic pyroxene of diopside goetherbergite series with strong birefringence, and a small amount of potsherd. Group *Sinope I* is close to groups *Amastris II* and *III* in terms of the content and composition of pyroxenes.
Sinope I. Nos. 17, 19; *Amastris V*. Nos. 21, 22	The mineral additives in the paste consist almost entirely of rhombic roxene of the hystatite - bronzite series with low birefringence. *Amastris* is identical to *Sinope* in the quantity and composition of pyroxenes but differs sharply in the multicomponential composition of nonplastics.
Herakleia I. Nos. 8, 9; *Chersonesos V* . Nos. 6, 7	The mineral nonplastic material is multicomponential: viz. pyroxene (small amount, low birefringence), quartz, zonal plagioclase, ore minerals, limestone, effusives. In addition, *Herakleia* contains basaltic hornblende. Close to the groups described is that of *Amastris*
Chersonesos II . Nos. 2, 3	Quartz and plagioclase prevail. The mineral tempers are not homogeneous in grain size: among fine fragments of quartz and plagioclase are coarse fragments of effusives and quartzite. These groups are close to that of *Amastris VI*. However, in the latter are present the finest grains of polymorphic carbonate that were a constituent of local clays.

7. THE ARCHAEOLOGICAL INTERPRETATION

In what way can the results of the 'optical petrography study' be explained in terms of archaeological science?

First, we will consider the stamped amphorae of Herakleia Pontike.[12] The petrographic group *Herakleia III* includes amphora fragments bearing stamps of the first group (sample **12**) and the late phase of group 2 (sample **13**) according to the typological classification of I.B. Brašinskij. That author assigned the first typological group to the first period (A) of amphora stamping (the first-beginning of the second quarter of the 4th century B.C.). The late phase of group 2 of stamps was dated by him to the third quarter of the same century. To the latter typological group belong also both the samples comprising petrographical group *Herakleia II* (nos. **10** and **11**).

The two samples that make up petrographical group *Herakleia I* demand special consideration. The anepigraphic stamp (sample **8**) belongs to Brašinskij's seventh typological group and to the first (A) or second (B) period of stamping, *i.e.* to the period from the early 4th century B.C. to the beginning of the last quarter of that century. Sample **9**, another neck fragment from a small amphora, bears an engraved stamp from the late sub-group of Brašinskij's fifth group. The latter assigned this group to the third and final period (C) of amphora stamping in Herakleia (late 4th – first quarter of the 3rd century B.C.).

Thus we may suppose that certain differences between the petrographic groups most probably reflect not a chronological series but a compositional one. In this connection a question arises as to whether different workshops had their own particular sources of the raw materials used for tempering the pastes, or adhered to their own traditional compositions of the tempers. This question may be solved only after analysing a sufficiently representative sampling of fragments from stamped amphorae.

The ceramic body of Sinopean amphorae, as has already been said, is remarkable for constancy of composition of its mineral tempers both in qualitative and quantitative terms, and the fact that this constancy continued over a long period that began with the practice of stamping vessels. The same constancy has been recorded in the stamped amphorae of Grakov's chronological groups I to III (the groups later than these could not have been included in the experiment). We should probably connect the fine mineralogical differences revealed between the petrographical groups *Sinope III* and *Sinope I*, on the one hand, and *Sinope II*, on the other hand, with different sources of raw materials and, moreover, with those used simultaneously in different workshops. Such a supposition is suggested by the fact that during the time when the astynomos *Mnesikles* was in office a 'manufacturer' named *Apollonios* (sample **15**) used pyroxenes with high birefringence as tempers while another 'manufacturer' called *Philokrates* (sample **16**) used those with low birefringence. Both workshops were operating simultaneously.

Only two examples of stamped amphorae from Amastris come from building U6. It was in fact at this very site that such amphorae were identified for the first time. Both items belonged to vessels close to Sinopean amphorae with stamps of Grakov's chronological group III and, as it subsequently emerged, were also petrographically close to them (*cf.* Table 4). Later we compiled a corpus of stamps and rims of Amastrian amphorae and conducted a special typological, chronological, and petrographical analysis of stamped Amastrian amphorae found at various sites in the northern Black Sea area.[13] This analysis showed that the two types of amphorae from Amastris were related to amphorae from both Herakleia and Sinope. Moreover, the petrographical parallels between the pastes of Amastris and Herakleia, on the one hand, and Amastris and Sinope, on the other, were clearly revealed.

It is known that the city of Amastris, which lay between Herakleia and Sinope, was

founded by Amastris – the female ruler of Herakleia – in about 300 B.C. According to Strabo (XII. 3. 10), the city was composed of four settlements – Sesamos, Kytoros, Kromna, and Tios. Of those, Kytoros was originally the *emporion* of Sinope. Hence it is probable that the early population of Amastris included both Dorian Greeks – 'Herakleiotes' – and Ionian Greeks – 'Sinopeans'. This is further suggested no only by the morphology of the two types of vessels (imitating the Herakleian and Sinopean wine amphorae) but also by the presence of engraved stamps (typical of Herakleia) and the relief ones (typical of Sinope). It is therefore justifiable to suppose that natives of both Herakleia and Sinope were among the Amastrian potters. They must have brought their technical secrets with them along with the two standard types of wine amphorae, and this fact is evidently reflected in the composition of the mineral tempers.[14]

As mentioned above, mass production of stamped Chersonesean amphorae with pointed bottoms (for wine) began in the last quarter of the 4th century B.C. [15] From that time on were produced vessels of two basic types (and associated varieties) which evidently imitated the standard shapes of Sinopean and Herakleian amphorae.[16] This imitation could have been deliberate but we cannot rule out the possibility that there were potters in Chersonesos who originated both from the metropolis and from Sinope. However, in the series studied the most closely paralleled petrographically were the Herakleian and especially the Amastrian amphorae (*cf.* Table 4). This fact is hardly a mere coincidence. The following observations are also to be noted.

1. The mineral composition of tempers in the fabric of Chersonesean amphorae is clearly not of local (or even wider Crimean) origin.[17] Moreover, a great variety of temper compositions can be observed (which is not typical for *e.g.* Sinope). Hence we may suppose that the raw materials for the tempers probably came from other regions, including possibly the southern Black Sea area. This would account for the special petrographical similarity in the fabric of contemporaneous amphorae from Chersonesos and Amastris. It is from within the *chora* of Chersonesos that the most numerous finds of Amastrian amphorae or their fragments and stamps have been reported in the northern Black Sea area (Kimmerian Bosporos, Chersonesos, Olbia).[18] This fact indicates intensive importation of certain goods carried in amphorae from Amastris to Chersonesos and its territory during the period covering about 300-285 B.C.

At Chersonesos as well as in other Greek cities and rural settlements in the northern Black Sea area there are constant finds of 'exotic' rock species that come from deposits of Northern Anatolia or the islands of the Aegean. These finds are not limited to stone artefacts, and indeed the majority of these imported rock species are represented by unworked blocks mostly rounded by sea – in other words, natural cobbles and pebbles. Possibly this material was used as ships' ballast.[19] Such stones are fairly common in excavations of the walls of buildings and in the pavements of courtyards and streets, and it is possible that they could also have served as the source of raw minerals for Chersonesean potters. On the other hand, however, if we take into account the technological traditions of the potters, we cannot rule out the possibility of organized importation of the necessary raw materials.

2. Each of the four petrographical groups identified in the Chersonesean amphorae is rigidly connected to the name of only one particular astynomos. Firstly, this provides additional evidence that the goods contained in the Chersonesean transport amphorae came to the settlement of Panskoye I as a number of homogeneous lots. Secondly, it suggests that the amphorae from a single lot stamped with the name of one particular astynomos were manufactured in a single workshop.

3. If the samples are arranged in order of increasing content of tempers (taking into account the diversity of the mineralogical composition of the latter) the following sequence of astynomoi emerges: *Bathyllos* (5%) – *Apollonios* (10%) – *Dioskouridas* (15-18%) –*Xanthos* (20%). The pastes of amphorae stamped with the name of *Bathyllos* (*Chersonesos I*) and *Apollonios* (*Chersonesos III*) are extremely close to each other in the character of their almost monomineral quartz temper. According to the typological classification developed by V.I. Kac the stamps of the four above-mentioned astynomoi should all be assigned to different sub-groups of the first chronological group, and he dates the boundaries of this group to 325-285 B.C. Thus he assigns *Bathyllos* (*Chersonesos I*) to sub-group IA (325-315 B.C.), *Apollonios* (*Chersonesos III*) and *Xanthos* (*Chersonesos IV*) to sub-group IБ (315-300 B.C.), and *Dioskouridas* (*Chersonesos II*) to sub-group IB (300-285 B.C.). As we can see here the sequence suggested by using petrographic data differ somewhat from this. Hence the question arises as to whether it is reasonable to use petrographic data obtained on a representative sampling for a further improvement of the chronological classification of Chersonesean amphora stamps?

8. Conclusion

All conclusions reached in the present study are based on a rather limited amount of material, as was also the case with the earlier petrographical studies of pottery from Black Sea centres mentioned at the beginning of this appendix. Therefore these conclusions are simply of a preliminary character and demand further examination on the basis of a sufficiently large volume of representative sampling.

Nevertheless these results are encouraging, even though they are not exactly what was expected. The situation is fairly complex. One is justified in supposing that the two independent centres producing stamped transport amphorae – Sinope and Herakleia – gave birth to two further centres – Chersonesos and Amastris, – whither perhaps were transported not only the standards and shapes of the wine amphorae together with the bearers of the technological traditions and some other factors unknown to us, but also the peculiarities of stamping as well as the technological formulae.

Catalogue

Chersonesos

1 (2). U6 courtyard, DE-6. Find list 17/26. 1972.

Sample from an amphora fragment (**Ad 2**). On the shoulder of the amphora there is graffito **H 13**. On the handle a relief stamp (**Ae 32**):

Βαθύλλου
ἀστυνόμου

Ceramic paste very dense; brick-red; contains regularly dispersed fine white (seemingly carbonaceous) inclusions. High-quality of firing.

Achmerov 1959, group I; Michlin 1979, group I; Kac 1994, group IA.

2 (9). U6 room 3. Find list 6/8. 1969. Pl. 56.

Sample from an amphora handle with a stamp (**Ae 35**):

Διοσκουρίδ[α
ἀστυνόμ[ου

Ceramic paste very dense; greyish-greenish and reddish in section; slightly resembles some specimens of stamped Sinope handles in colour.

Achmerov 1959, group II; Michlin 1979, group II; Kac, 1994, group IB.

3 (10). U6 room 3. Find list 6/9. 1969. Pl. 56.

Sample from an amphora handle with a stamp (**Ae 36**):

Διοσκουρίδα
ἀστυνόμου

Achmerov 1959, group II; Michlin 1979, group II; Kac, 1994, group IB.

4 (11). U6 courtyard, V-4. 1973.

Sample from an amphora handle with a stamp (**Ae 13**):

Ἀπολλωνίου
ἀστυνόμου

Achmerov 1959, group III; Michlin 1979, group II; Kac, 1994, group IБ.

5 (**12**). U6 courtyard, VG-4. 1967. Pl. 55.
Sample from an amphora handle with a stamp (**Ae 15**).
ʼΑπολλωνίου
ἀστυνόμου
Achmerov 1959, group III; Michlin 1979, group II; Kac, 1994, group IБ.

6 (**13**). U6 courtyard, D-6. 1972.
Sample from an amphora handle with a stamp (**Ae 66**).
Ξά[νθου
ἀστ[υνόμου
Achmerov 1959, group I; Michlin 1979, group II; Kac, 1994, group IБ.

7 (**14**). U6 courtyard, D-2. 1973.
Sample from an amphora handle with a stamp (**Ae 64**).
Ξάνθο[υ
ἀστυνόμ[ου
Achmerov 1959, group I; Michlin 1979, group I; Kac, 1994, group IБ.

Herakleia Pontike

8 (**7**). U6 courtyard, V-2. Find list 11/14. 1971. Pl. 61.
Sample from a fragment of amphora neck with an anepigraphic engraved stamp in the form of a cross with equal arms (**Ae 132**).
Brašinskij 1980, group 6.

9 (**8**). U6 courtyard, D-6. Find list 17/45. 1972. Pl. 60.
Sample from a fragment of amphora neck with an engraved stamp (**Ae 121**):
KEP
Retrograde, enclosed inside an ivy leaf.
Brašinskij 1980, group 2-3.

10 (**21**). U6 courtyard, E-6. 1973. Pl. 60.
Sample from a fragment of amphora neck with an engraved stamp (**Ae 120**):
ʽΗρακ[λείδα
Retrograde.
Grakov 1926, group I; Brašinskij 1980, group 2 late.

11 (**22**). U6 courtyard, G-5. 1973. Pl. 60.
Sample from a fragment of amphora neck with an engraved stamp (**Ae 119**):
ʽΗρ[α( )
Grakov 1926, group I; Brašinskij 1980, group 2 late.

12 (**23**). U6 courtyard, Zh-7. 1972. Pl. 60.
Sample from a fragment of amphora neck with an engraved stamp (**Ae 124**):
Διο]ν-
υσί]ο ʽΗρ( )
Grakov 1926, group I; Brašinskij 1980, group 2 late.

13 (**24**). U6 courtyard, G-6. Find list 3/20. 1972. Pl. 60.
Sample from a fragment of a neck with an engraved stamp (**Ae 123**):
Θε]οξέν-
ο ʼΑριστ[ο-
κλέο[ς
Grakov 1926, group I; Brašinskij 1980, group 1.

Sinope

14 (**5**). U6 room 13. Find list 8/11. 1971. Pl. 59.
Sample from an amphora handle with a relief stamp (**Ae 105**):
Μικρίου ἀστυνο-
μοῦντος
Θυός Horse
Grakov 1929, group III.

15 (**6**). U6 room 13. Find list 8/12. 1971. Pl. 59.
Sample from an amphora handle (traces of an illegible relief stamp are visible).

16 (**15**). U6 courtyard, V-4. 1973. Pl. 59.
Sample from an amphora handle with a relief stamp (**Ae 106**):
ἀστυνόμου
Μνησικλέου[ς
ʼΑπολλωνίο leaf
Grakov 1929, group III.

17 (**16**). U6 square Z-7. 1973. Pl. 59.
Sample from an amphora handle with a relief stamp (**Ae 110**):
ἀστυνόμου
Μνησικλέου<ο>ς
Φιλοκράτους Grape
Grakov 1929, group III.

18 (**17**). U6 courtyard, E-3. 1973. Pl. 59.
Sample from an amphora handle with a relief stamp (**Ae 103**):
Θευπε]ίθου
ἀστυν]όμου Wreath
[– – – –]
Grakov 1929, group II.

19 (**18**). U6 courtyard, D-6. Find list 17/42. 1972. Pl. 59.
Sample from an amphora handle with a relief stamp (**Ae 112**):
[Πυθ]ο[κλέους]
ἀστυνόμο
Π]οσειδωνίου Satyr head
Grakov 1929, group III.

20 (**19**). U6 courtyard, V-4. 1973.
Sample from an amphora handle with a relief stamp (broken off, illegible).
According to stamp type: Grakov 1929, group II or III.

Amastris

21 (3). U6 gate. Find list 3/25. 1972. Pl. 60.
Sample from an amphora wall with an engraved stamp on the neck (**Ae 115**).
᾽Αμάστ-
ριος Ivy leaf
Pridik 1917, no. 170; Ščeglov 1986; Kac, Pavlenkov and Ščeglov 1989, stamp 1.

22 (4). U6 gate. Find list 3/73. 1973. Pl. 60.
Sample from an amphora wall with an engraved stamp on the neck (**Ae 116**):
᾽Αμάστ-
ριος Ivy leaf
Pridik 1917, no. 170; Ščeglov 1986; Kac, Pavlenkov and Ščeglov 1989, stamp 1.

NOTES

1. The study was carried out in the Department of Classical Archaeology and the Laboratory of Archaeological Technology of the LOIA, AS USSR (now IIMK RAS). The results are published in: Ščeglov and Selivanova 1992, 32-67.
2. *Cf.*, *e.g.*, Peacock 1970, 375-389; Whitbread 1986, 95-101. Of the recent general works, note in particular the following handbooks: Caprio 1985; Rice 1987; and especially the important study presented by Whitbread 1995.
3. In particular, for the purpose of identifying ware produced in local North-Black-Sea Greek centres, and for studying certain technological peculiarities of pottery manufacture. Kul'skaja 1940, 171-185; Kul'skaja, 1958; Krug 1960, 128-132; Krug and Četverikov 1961, 34-44; Bogdanova-Berezovskaja, Naumov and Kovnurko 1964, 314-319; Kadeev and Šumenko 1967, 271-276. Of the recent studies see Vnukov 1992, 68-89.
4. The typological and chronological classification of Herakleian stamps was developed by B.N. Grakov in 1926 (Grakov 1926). Later this chronology was defined more precisely, see I.B. Brašinskij 1965; Brašinskij 1984, 82-89; Brašinskij 1984a; Vasilenko 1970. The material known to us suggests that in Herakleia Pontike stamping of amphorae ceased about 280-270 B.C.
5. B.N. Grakov precisely identified the location of Sinopean amphorae production and developed the typology of the stamps (Grakov 1929). Grakov's typology has not been subjected to any changes, but the chronology (in absolute dates) has been extensively corrected. See Brašinskij 1963; Cechmistrenko 1963; Vasilenko 1971; Šelov 1975, 134-139.
6. The first classification was developed by R.B. Achmerov (1949). Later it was improved: Borisova 1974; Michlin 1979; Kac 1985; 1994. The latter work encountered sharp criticism. See Gilevič and Ščeglov 1996; Tochtas'jev 1997. It is impossible to use V.I. Kac's handbook in a practical study because of inaccuracy of the tables, and thus the author's brilliant idea – in itself – has been spoilt by the technical production of the tables as well as by other faults pointed out in S.R. Tochtas'ev's article. Nevertheless, it seems that the earliest and latest dates of stamping amphorae in Chersonesos proposed by Kac are fairly reliable.
7. Ščeglov 1986; Kac, Pavlenkov and Ščeglov 1989. On another dating of the stamps, see Saprykin and Kruglikova 1991, 92.
8. Later one further group was added – *Herakleia IV*. See Ščeglov and Selivanova 1992, 34, table 3.
9. For a typical example of the group *Herakleia III*, see Ščeglov and Selivanova 1992, 60, fig. 4.
10. Compare these with the results of the independent analysis: Whitbread 1995, 236 ff. We detail three petrographical groups. See Ščeglov and Selivanova 1992, 39 f.
11. For the other petrographical groups of Amastrian amphorae and their interpretation, see especially Kac, Pavlenkov and Ščeglov 1989; Ščeglov and Selivanova 1992, 44-46, tabs. 1 and 3.

12. Here we accept the typology and chronology of Herakleian stamps according to Brašinskij 1984.
13. Kac, Pavlenkov and Ščeglov 1989.
14. See Ščeglov 1986.
15. Borisova 1974, 100; Kac (1994, 100) dates the beginning of stamping to about 325 B.C. on the strength of his more precise chronology.
16. Borisova 1974, 101.
17. See Petrun' 1967, 149 ff.
18. See Kac, Pavlenkov and Ščeglov 1989, the catalogue and fig. 5.
19. Petrun' 1967, 144-150.