Cooking pottery in Priene*

Imports and local/regional production from late Classical to late Hellenistic times

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It has become increasingly apparent over the last decades that cooking pottery played a considerable role as a trade commodity in ancient times, yet relatively little research has yet been done on this topic for its own sake. By taking a closer look at the cooking pottery found in Priene, a small city in southern Ionia re-founded in the middle of the 4th century BCE, we want to trace some of the broader developments within the cooking wares that were used over a period of roughly 300 years. The aim is not only to outline the general shapes that were in use over this period of time, but also to register if and how these shapes correlate with the different fabrics observed in Priene so far.

The typological studies that form the backbone of this article are comprised of two important chronological horizons: the bulk of some of the earliest closed deposits so far found in the city spanning c. 350 to 250 BCE (L. Heinze) and a vast deposit found in the terrace filling under the eastern end of the Athena sanctuary's southern stoa, closed c. 50 BCE (N. Fenn). Selected vessels from these deposits are studied via a broad analytical approach, including wavelength-dispersive X-ray fluorescence analysis (G. Schneider),energy-dispersive X-ray fluorescence analysis (N. Fenn) and a petrographic study (S. Amicone). Thereby we hope to gain new insights into the local production of cooking pots, the dependency on imported pots from other production centres, as well as preferences for shapes and fabrics that might provide insight into how and when certain pots where chosen in Prienian kitchens. As a preliminary study, this analysis is limited to cooking pots.[1] For now it excludes the complicated (although of itself very interesting) case of cooking devices such as braziers, grills and cooking stands.

Cooking wares of late Classical and early Hellenistic times

The earliest closed deposits derive from public areas (the Agora) as well as from two excavated houses in the western (Insula D2) and the eastern quarters (Insula F15) of the re-founded city[2]. Since cooking vessels ought to have a shorter life span than the probably more precious, and thus more carefully handled fine wares, we can assume that the pots found in these deposits are not likely to be much older than the re-

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1 The catalogue texts at the end of the article only provide minimal information, since all specimens are discussed at length in the forthcoming publications by N. Fenn and L. Heinze. – Abbreviations (followed by trench and feature) are as follows: Bu (Bouleuterion); F15 (Insula F15); D2 (Insula D2); AH (Sanctuary of Athena Polias).

2 These contexts will be discussed and studied in depth in the ongoing PhD *Untersuchungen zur spätklassischen und frühhellenistischen Keramik von Priene* (L. Heinze, Frankfurt am Main).

foundation of the city in c. 360–340 BCE[3], thus giving a good terminus post quem for the pots and therefore the chronological framework of this study. The various deposits that were taken into account, although not strictly contemporary, are here treated as one simplified group, spanning the time from the foundation of the city, to the first decades of the 3rd century BCE. A detailed discussion of the developments within these contexts and of the c. 80–100 year period that they represent will be given in the final publication of these contexts.

The spectrum of cooking vessels used in Priene in the first decades after the city's relocation includes the usual suspects of late Classical and early Hellenistic cooking devices: deep (chytrai) and shallow cooking pots (lopades), and pans, as well as cooking stands (lasana) are frequently present; on the other hand, braziers and shallow grills (escharai), are rather scarce.

The chytrai, lopades and pans are of special interest here, since all of them are attested as just two different subtypes. For the chytrai, the most common version is the typical baggy shaped type with out-turned rim and one or two strap handles (**Fig. 1.1**). Another type frequently present in early Priene is the so-called 'necked chytra' (**Fig. 1.2**). While the baggy type of chytra is common throughout the Hellenised Mediterranean world, and is still in use in the late Hellenistic period (**Fig. 2.3**), the necked chytra seems to be rather limited in its life span[4] and, given our current knowledge about cooking pots in Asia Minor, is also far more restricted in terms of regional distribution. Until now, the necked chytra appeared to be attested only in southwestern Asia Minor where it was usually present in association with the baggy type. Besides its more or less pronounced neck, it often showed an almost square profile at the uppermost end of the rim, within which a lid may have rested[5].

The common Classical and Hellenistic casserole, widely attested in mainland Greece, but also at almost all other sites where Greeks were present, has an inner flange to sustain the lid, and developed out of the classical lidded chytra during the 5th century BCE[6]. While few examples of this type are present in early Priene (**Fig. 1.3**), the vast majority of lopades from the 4th/3rd century BCE contexts show a regional variant as substitute for the shallow cooking pot: the upper wall of the lentoid body is clearly incurved or bent towards a narrow rim (**Fig. 1.4**). The flange itself is replaced by the upturned rim, above which the lid must project so that the pot can be closed properly. This type of lopas is obviously related to 'lebes-type' storage vessels from which the shape most likely derived, presumably via some cauldron-like metal shapes. Nevertheless, due to the, as yet insufficient deposits from 5th- and 4th-century Asia Minor, we are not yet able to trace precisely the origin and the timing of transition into the shallow ceramic cooking pot that is found so frequently in Priene. It seems to have been most popular in southwestern Asia Minor (e.g. Ephesus, Priene, Miletus, Didyma, Halicarnassus), although there are some noticeable exceptions to this distribution pattern[7]. It is still abundant in late Hellenistic contexts, thereby proving

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3 A refoundation of the older Ionian city of Priene on a site that was previously unoccupied was suggested by the first excavators (WIEGAND – SCHRADER 1904, 35), and has been strongly confirmed through the recent excavations conducted after 1998 (RAECK 2003). Unfortunately the historical and epigraphic evidence does not give an exact date for this event. Therefore, the date of the foundation varies according to the historical framework in which different authors place it (for a brief overview, see RUMSCHEID 1998, 15).

4 The shape is missing in Prienian contexts after the 3rd century BCE.

5 The lid **27**, stemming from the same deposit as the necked chytra **26** (**Fig. 1.2**), seem to match so closely in size and fabric that the two must be considered as a set.

6 SPARKES – TALCOTT 1970, 227.

7 For a general discussion of the shape and its distribution, see HEINZE FORTHCOMING.

the popularity of the shape in Priene over the centuries discussed here.

As attested in the earliest contexts, the pans do not form comparable homogeneous sub-types, nor are the few preserved examples very consistent in their appearance in general. Despite being rather shallow, the main differences are that one group has a completely flat bottom with a more or less angular upturned rim (**Fig. 2.1**), while the other type shows a more evenly upturned rim section (**Fig. 2.2**). For smaller rim fragments it is not always possible to decide if the whole bottom or just the rim was flexed in this way. The fact that the angular profiled 'pans' are wider and shallower than the other type indicates that they served a special function in the kitchen, presumably as some kind of baking tray. The deeper and rounded type is perhaps more versatile and thereby better deserves to be called a pan, although even this description could limit our conception of the various ancient usages of these artefacts.

Cooking wares of late Hellenistic times

An exceptionally good context to illustrate the latest stage in the development of Hellenistic cooking pottery in Priene derives from the southern stoa of the sanctuary of Athena Polias. The eastern end of the terrace functions as a foundation for the stoa, and excavations conducted during the 2000 campaign confirmed that the eastern part of the terrace (and also the whole eastern part of the sanctuary), were the product of an expansion that occurred during the middle of the 1st century BCE[8]. The small trench within the southern end of the stoa terrace's fill was densely packed with pottery, unveiling a vast amount of pottery that mostly dates to the later 2nd century and the first half of the 1st century BCE[9].

The late Hellenistic cooking pottery from this trench shows some interesting continuities, as well as significant changes, and new developments within different types of cooking pots and cooking devices. Chytrai, lopades and pans still form the main body of the cooking ware assemblage, but we now see a considerably larger number of braziers in the form of the well-known and often richly decorated Hellenistic type[10], whereas the old fashioned cooking stands and eschara are no longer apparent.

While the baggy chytra, which hardly changed over a period of c. 150 to 200 years, is still a frequently attested shape (**Fig. 2.3**), we now see a well-established alternative to this old fashioned deep cooking pot: a hard fired, fairly thin walled chytra with a vertical offset rim (**Fig. 2.4**)[11]. In terms of fabric and shape, this latter group of pots forms a relatively homogeneous class, which for a few years now is suggested as being Phocaean in origin[12]. This assumption was supported by the original X-ray fluorescence analysis conducted by N. Fenn on a selection of these chytrai from the late Hellenistic and early Roman Imperial deposits[13].

It is noteworthy that we find the same pattern in the lopades from the Athena sanctuary deposit, as was found in the chytrai. The lebes-type of lopas with high swung vertical handles is still present (**Fig. 3.9**), although here at least we are able to

8 HENNEMEYER 2013, 190 f.

9 This deposit forms one of the two main contexts that were thoroughly analysed by N. Fenn in her PhD thesis (FENN 2009; FENN 2010; FENN FORTHCOMING).

10 ROTROFF 2006, 199-219.

11 ROTROFF 2006, 172 f. (chytra, Form 4).

12 Sauer unpublished; ZABEHLICKY-SCHEFFENEGGER – SCHNEIDER 2005.

13 FENN FORTHCOMING; for the type of analysis that was conducted, see footnote 18.

detect signs of typological development through time. Most significant amongst these is the angular shoulder, a feature that already occurs on some of the presumably early Hellenistic lopades; however henceforth, the shoulder becomes narrower and the wall at this particular part of the vessel becomes much heavier. Again we find a second type of lopas in the deposit. Parallel to those qualities observed amongst the chytrai, it exhibits a thin and hard fired fabric and is limited to a series of distinct metal-like shapes (**Fig. 3.10**)[14]. As suggested by their chemical fingerprint, they should also be considered Phocaean in origin, therefore encouraging us to label this group 'Phocaean'-type lopades.

With the exception of one baking tray, all the pans in the deposit follow one highly standardised shape (**Fig. 3.11**)[15]. The hard and dense fabric closely resembles that found amongst the Phocaean chytrai and lopades. Not surprisingly, they too are believed to have originated from Phocaea, as suggested by X-ray fluorescence analysis carried out on all of the four inventoried pans from this assemblage.

The overall number of imported cooking wares in this late Hellenistic deposit is striking: 39% derive from Phocaea, 7% (namely the braziers) are of unknown origin, and the rest seems to be locally produced. The imports from the Phocaean region are comprised largely of the chytra with vertical offset rim and the sharply accentuated type of lopas that are so common also in later Imperial contexts. Other than these two shapes, which still seem to compete with locally produced cooking pots, Phocaean pans seem to have almost completely outrivaled any of the local competitors on the Prienian market. The archaeological record therefore strongly underlines large-scale imports of Phocaean cooking wares for Priene already by the late Hellenistic period, a trend that continues well into the early Roman Imperial period.

Petrographic and X-ray fluorescence analyses

After a macroscopic examination of the Prienian cooking wares from the late Classical / early Hellenistic and late Hellenistic assemblages, they were divided into several preliminary fabric groups. A representative cross-section of the deposits previously discussed was then selected for further study through petrographic and X-ray fluorescence analyses.

Thirty-two thin sections (18 from the late Classical / early Hellenistic period and 14 from the late Hellenistic period[16]) have so far been studied through petrographic analysis[17]. The results revealed that the broader variety of fabric groups observed in the hand-specimen could be divided into two main petrographic groups, supplemented by four subgroups for the latter group[18]:

Group A (Fig. 4.1 + 4.2): characterised by abundant quartz, muscovite and the presence of fragments of metamorphic rocks, especially mica schist. The group

[14] ROTROFF 2006, 183-186 (lopas, Form 4 with two handles and Form 5 without handles).
[15] ROTROFF 2006, 188-191 (pan, Form 1–3 depending on handle type).
[16] This comprises of c. 20% of the inventoried pots from late Classical / early Hellenistic period and more than 30% of those from the late Hellenistic context.
[17] Ceramic thin sections were studied with a polarizing light microscope, both in plane polarised light (PPL) and crossed polars (XP) at magnifications of 25x, 50x and 100x with a Leica DM in the Wolfson Archaeological Science Laboratories at the University College London.
[18] For an overview of the samples that belong to each of the following groups, see **Fig. 8**; to compare the shapes see also the catalogue, that is arranged according to the petrographic groups.

comprises vessels from the late Classical and the late Hellenistic contexts, mostly chytrai with out-turned rim and the lebes-type lopades, but also a variety of earlier pans, a lopas with inside flange and 'imitations' of the necked chytrai and the Phocaean-type chytrai. The late Classical baking tray (cat. no. **8**) is added to this group, although it shows some differences due to the presence of iron rich inclusions.

Group B: dominated by fragments of volcanic rocks but further divisible into the following subgroups:

> **B1 (Fig. 4.3)**: coarse fabric, fragments of intermediate-acidic volcanic rocks, quartz and abundant k-feldspars as well as plagioclase. This sub-group contains only the Phocaean-type pans from the late Hellenistic deposit.
> **B2 (Fig. 5.1)**: medium coarse fabric, fragments of intermediate-acidic volcanic rocks, quartz, muscovite, biotite, and rarely plagioclase. This sub-group is comprised of the late Hellenistic cooking pots, namely the Phocaean-type chytrai and lopades.
> **B3 (Fig. 5.2)**: medium coarse fabric, fragments of intermediate-acidic volcanic rocks, quartz, muscovite, biotite; rarely plagioclase and abundant presence of pumice. This sub-group consists of the late Classical/early Hellenistic cooking vessels, namely necked chytrai and pans.
> **B4 (Fig. 5.3)**: coarse fabric, fragments of basic-intermediate volcanic rocks, chert, few fragments of sedimentary rocks (sandstone and quartzite) and very few fragments of metamorphic rocks. It includes the late Classical / early Hellenistic necked chytrai, lebes-type lopades and a pan.

The petrographic study was then integrated with the results obtained from the X-ray fluorescence analysis. So far, a total of 24 samples (4 from the late Classical / early Hellenistic period and 19 from the late Hellenistic period[19]) have been analysed, in part by wavelength dispersive X-Ray Fluorescence Spectrometry (WD-XRF) by ARCHEA (Warsaw) and Free University of Berlin and by energy dispersive X-Ray Fluorescence Spectrometry (ED-XRF) in the Institute of Geological Sciences (Department of Mineralogy) at the Goethe-University in Frankfurt[20].

These results (**Fig. 7**) were compared with reference samples that are securely attributed to Phocaea and Ephesus, the first city presumably being the most important centre for the production of cooking wares in Asia Minor in later Hellenistic and earlier Roman Imperial times, and the latter was of general importance as a pottery production centre for Priene, as attested by the frequent presence of Ephesian fine wares in Hellenistic assemblages throughout the city[21].

The TiO_2 (titanium dioxide) *versus* K_2O (potassium oxide) variation diagram (**Fig. 6**) illustrates that the late Hellenistic cooking wares from Priene, Phocaea and even nearby Ephesus can be clearly distinguished in terms of their concentrations of

[19] So far, we were only able to analyse about 7% of pots from late Classical / early Hellenistic contexts could with this method. Opposed to this, almost 60% of inventoried pots from the late Hellenistic context have been analysed.

[20] WD-XRF analysis was carried out on samples fused using Lithium borate by M. Daszkiewizc, G. Schneider and R. Naumann in Warsaw and Berlin (see e.g. SCHNEIDER – JAPP 2009). ED-XRF analyses were conducted by N. Fenn and G. Brey in Frankfurt by analysis of small samples fused into pellets at 1200°C (FENN FORTHCOMING). Analyses are valid for ignited samples and oxides of major elements were normalised to a constant sum of 100%.

[21] For the various dependencies regarding the late Hellenistic wares in Priene, see FENN FORTHCOMING.

these compounds. In the first instance it is interesting to note that the composition of one group of cooking pots from Priene (indicated as a rhomboid shape in **Fig. 6**) corresponds well with local reference material, as defined by stamped tiles and medicine vessels[22]. Samples from this group have also been petrographically analysed and all of them belong to petrographic **Group A**, the group that best displays the mineralogical composition attested by the geology of the vicinity of Priene. Therefore, **Group A** can be considered local, or at least representing a production group that is situated in the closer vicinity of Priene. It is also worth noting that this Prienian group separates well from the Imperial Roman cooking ware from Ephesus[23], which, although scattered in the diagram, clearly represents a distinct group. This is a particularly interesting observation considering the similar geology of the urban hinterlands of these sites.

We subsequently observed that a group of cooking pots of the later Hellenistic period (indicated in **Fig. 6** as pale and dark red squares) scatters in the same array as the Phocaean reference samples (grey squares in **Fig. 6**). Reference material for the well-known Hellenistic and Roman period cooking wares from Phocaea is represented by seven samples from Phocaea[24], and by reference material from Ephesus[25], Aquileia and Emona[26], Pergamon[27], as well as unpublished data from Aguntum and Gadara, for which a Phocaean origin has been proven. It is interesting to observe that from a chemical point of view the Phocaean samples found in Priene can be divided into two sub-groups: one with higher potassium and lower titanium, which corresponds to the pans, the other with lower potassium and higher titanium, which corresponds to the group of chytrai and lopades. This matches well with the two petrographic groups (**B1** and **B2**) into which the later Hellenistic samples can be divided based on the analysis of the thin sections.

So far only four samples from the late Classical / early Hellenistic deposits have been analysed. Two of these vessels (cat. no. **4** and **7**) belong to petrographic **Group A** and are therefore compatible with local production. However, the content of titanium of **4** and **7** is notably higher in comparison with the local group of the late Hellenistic period.

One necked chytra (cat. no. **26**) belongs to petrographic **Group B3**. While the thin section analysis seems to indicate that the sample (as well as the rest of this group) is compatible with the geology of the area of Phocaea, it displays a significant elemental difference in relation to the secure Phocaean petrographic groups (**B1** and **B2**), a phenomenon that will be addressed in more depth at the end of this paper.

Additionally, a lebes-type lopas with a very fine clay matrix (cat no. **32**) is as yet of an uncertain, possibly volcanic, petrographic group. Geochemically this sample corresponds to the local composition in relation to proportions of magnesium, chromium and nickel, but it differs significantly e.g. in titanium, sodium, vanadium and in the ratio of rubidium to potassium. Also from petrographic analysis a local production seems unlikely. This lopas is therefore representative of a small group of cooking vessels with fine clay that needs to be further investigated.

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22 FENN 2009, 102 f.; FENN FORTHCOMING.

23 For XRF-analyses of cooking vessels from an Augustan context, see ZABEHLICKY-SCHEFFENEGGER – SCHNEIDER 2005. For thin section analyses, see Sauer unpublished.

24 Permission to use these Phocaean reference samples was kindly granted by Zeynep Yilmaz.

25 ZABEHLICKY-SCHEFFENEGGER – SCHNEIDER 2005.

26 ISTENIČ – SCHNEIDER 2000.

27 SCHNEIDER – JAPP 2009.

Shape and fabric developments of Hellenistic cooking wares in Priene

Chytrai

From a typological point of view we witness the presence of the baggy-type of chytra over the whole period of time observed here, a chronological range that is likewise attested for this type of cooking pot at other places as well[28]. So far the shape seems to be predominantly produced in the local fabric and is attested in a broad variety of dimensions, thus showing not only the close link between the production of this shape and the local market, but also its utility as a cooking device in general.

Additionally we see the presence of two quite different subtypes of deep cooking pot: first the necked chytra with its globular body and the pronounced offset neck, later the Phocaean-type of chytra with its metal-like appearance and the inside flange.

We are as yet unable to determine with any certainty when the presence of the necked chytra ends. Even though the few sparse contexts from the advanced 3rd century BCE do not show this shape any longer, this can only be a weak indication for the hypothesis that the shape might have run out of use during the first half of the 3rd century. Most of the necked chytrai clearly show a distinctive fabric when studied macroscopically, but there are a few exceptions, some of which have been analysed during the course of this study (for example cat no. **5**). Since, in this case, the clay composition is rather fine, the petrographic study was not able to place it securely in any of the established groups, and we currently lack the spectrographic analyses of these vessels to confirm if they are of local production or not. Nevertheless, it can be stated with some security that this shape was to a large extent imported during the 4th and 3rd centuries BC.

The Phocaean type of chytra is attested in Athenian contexts in the later second half of the 2nd century BCE[29], and the vast number of vessels in the late Hellenistic contexts in Priene confirms its popularity well into the 1st century BCE. Again we see the shape dominated by a distinctive fine and gritty fabric. But there are also a few specimens that vary in their fabric, which, when analysed spectrographically and petrographically (cat no. **13**), show all the signs of being of local manufacture and thereby might best be labelled as Prienian imitations of the Phocaean chytrai.

Lopades

Many of the developments shown with the chytrai are reflected in the lopades: one version, the lebes-type, spans the whole chronological range covered here and, with few exceptions (cat no. **30**), is mostly attested in the local mica schist fabric. As stated above, little can be said about the beginning of this shape or its likely place of origin. The fact that it is so dominant in Priene over such a long time at least seems to point towards an origin somewhere in Ionia or its neighbouring regions.

An early version of the lopas with inside flange (cat. no. **6**) is petrographically compatible with the local or regional mica schist fabric and therefore is most likely not an import from far away, as might have been suggested by the foreign character of the shape in early Priene. The situation is different in later Hellenistic times, when we see the rise of the Phocaean-type of lopas that now seems to be exclusively imported,

[28] ROTROFF 2006, 167-169 (Type 1, earlier versions of this type of cooking pot are referred to as 'common type', see SPARKES – TALCOTT 1970, 224-225).

[29] ROTROFF 2006, 172-173.

as revealed by X-ray fluorescence analysis of the fabric, which is Phocaean in origin. Altogether this seems to have resulted in a clear distinction in terms of the types of lopades available in Priene at that time: one could choose the locally produced lebes-type or an imported Phocaean-type. Both seem to have been used widely and it would be interesting to see if usage in a Prienian household in the first half of the 1st century BCE was exclusive to one of the types or if both were used for different purposes.

Pans

The development of the pans and other baking utilities, as investigated so far, seems to go from relative obscurity with varying shapes and versatile fabrics to an absolute clarity symbolised by the reign of the Phocaean pan. Uncertainties to this rather clear impression derive mainly from the small number of pans available in the earlier contexts. However, data scarcity is also a problem in the later periods, where pans are not very numerous. Hence we might need to apply some changes to this contrasting picture following further analysis of more context material.

General conclusions and hypotheses

As discussed, starting in the middle Hellenistic period, Phocaea became one of the most renowned production centres for cooking pots and pans in Asia Minor, and its products were exported to many parts of the eastern Mediterranean. It is not surprising then, that this Phocaean cooking ware was also quite dominant in Priene for most of the Hellenistic period. A contrasting result of note was the discovery of cooking ware fabrics containing fragments of volcanic rocks (**B3**, **B4**), which were amongst the earliest deposits. At first we thought this could be proof of an earlier Phocaean production that until now seems not to have been recognised at other places. However, corrections to this first hypothesis came from the few X-ray fluorescence analyses that were conducted on the earlier fabrics characterised by fragments of volcanic rocks (cat no. **26** and **32**). In the bivariate plot (**Fig. 6**) these samples clearly do not belong to the same group as the later Hellenistic Phocaean cooking pots and pans that separates so clearly from the rest of the samples through their low titanium and potassium contents. Nevertheless, the petrography clearly shows that they do not belong to the local / regional group that might originate from Priene or the Maeander valley. Based on current knowledge this leaves us with at least two general solutions: first, these early volcanic groups might represent one or more as yet unknown production centres that have access to raw sources compatible with the volcanic outcrops described for Phocaea and its surrounding; second, these pots, although not matching the chemical fingerprint of the standard late Hellenistic Phocaean production, do nevertheless originate from Phocaea, but were made using a different recipe or different clay outcrops that show a different chemical composition to the ones that were used in later times.

As yet, it is too early to decide for certain which one of these two scenarios is more realistic. Arguments for, and against, these alternatives can be considered. One would be the distribution of the distinctive shapes of the necked chytrai and the lebes-type lopades. The first is predominantly imported in Priene and the distribution pattern we are able to reproduce so far has shown that it is mainly attested in southwestern Asia Minor. The latter shape is only partially attested in the volcanic fabric; still, the fact that it was also imported demonstrates that the production centre for the volcanic group of these lopades was accustomed to this shape, a shape that was limited primarily to the region of southwestern Asia Minor. Thereby it should be

assumed that the production centre, if not producing special types of pots for distant markets, was probably close to or within southwestern Asia Minor and its offshore islands. A closer look at the geological map could narrow down the possible production sites, with Phocaea being one of them.

Some emphasis could be put on Phocaea as this possible Classical production centre, because of the diversity within its geological environment[30]. Looking more closely at the geology of Phocaea and its surroundings, it is evident that even though the region is entirely characterised by outcrops of volcanic rocks, there is considerable geological variability ranging from pyroclastic deposits in the north, and areas dominated by the presence of acidic and intermediate volcanic rocks in the south and east. Therefore, chemical variability may be explained in terms of different clay deposits exploited by workshops in the different periods investigated here[31].

The idea that the well-known later Hellenistic production of cooking wares at Phocaea was preceded by a minor yet persistent production phase in Classical times is a tempting one. However, this hypothesis needs to be firmly tested by further spectrographic and petrographic analyses and, if possible, by comparison with a secure reference group of late Classical and early Hellenistic cooking pots from Phocaea itself[32]. Moreover, a detailed survey of the clay sources available in the area of Phocaea would be useful for assessing the geochemical variability of the raw material present around the city. Until these data become available for comparison, we cannot exclude that these groups of cooking pots with volcanic inclusions derive from another production area. Based on its geology[33], another good match to the petrography attested in these cooking pots would for example be the Bodrum or the Datça peninsula. The argument for the first is strengthened by the fact that Halicarnassus, situated on the southern coast of the Bodrum peninsula, is one of the few places where the necked chytra is also attested in larger quantities within the material record of late Classical times[34].

Another very interesting result concerns the differing fabric of the imported Hellenistic cooking pots (chytrai and lopades) and the pans. Although certainly from Phocaea, both show clear differences when it comes to their elemental composition, as well as their mineral inclusions. Both of these observations are definitely linked to each other. One conclusion would be that slightly different recipes, adjusted to the specific needs of their usage, were utilised for pans and cooking vessels, thereby producing the different chemical signatures; alternatively it could be that we are dealing with separate specialised workshops located in different areas in the vicinity of Phocaea, or at least using different clay outcrops for their production. Both scenarios would result in the same observable outcome. A solution to this problem

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30 For geological maps of the area in 1:500.000, see <http://www.mta.gov.tr/v2.0/eng/maps/images/1-500/IZMIR.jpg> (01.05.2014).

31 This variability of clay can also be seen in the varying composition of Late Roman C pottery produced in Phocaea in later times (see e.g. SCHNEIDER – JAPP 2009, pl. 4).

32 A workshop dump that could function as a reference point, at least for the earlier Hellenistic period, was presented by Ö. Özyiğit at the 6th Scientific Meeting on Hellenistic Pottery at Volos (ÖZYIĞIT 2004). Mr. Özyiğit kindly showed us this pottery in 2012. Whether further samples can be taken in the future has yet to be clarified.

33 <http://www.mta.gov.tr/v2.0/eng/maps/images/1-500/DENIZLI.jpg> (01.05.2014).

34 VAAG ET AL. 2002, 51 f. – The shape is, amongst others, attested in the so called "red burnished ware" (VAAG ET AL. 2002, 45-47), that closely resembles the fabric description of the Prienian specimens. The fact that a variety of other vessels in Halicarnassus is also documented in this "red burnished ware" might yet be another indication that could point towards this region as the place of origin for our late Classical volcanic cooking ware group.

could be found in the Phocaean workshop dumps if they show that pans and cooking pots are to be found in the same kiln wasters. Nevertheless, the petrographic study of the specimens already shows that the first scenario is more likely and fits much better with the obviously high degree of connoisseurship shown by the Phocaean potters: the coarser fabric of the pans would have been better for the handling of the vessels directly on the fireplace itself, while the chytrai and lopades were mainly used on braziers or with other devices, and therefore would not come into direct contact with the heating material.

Perspectives

So far the number of samples analysed with both XRF and petrography is quite limited. In particular, some of the rather uncommon fabrics require further sampling and analysis to determine if they are mere variations of the larger petrographic groups that are already known, or if they represent completely different local or imported groups. Currently we are also looking to incorporate cooking pots from the 2nd century BCE to narrow down the chronological gap between the two assemblage groups presented here. This will be achieved by including material from the excavation of a 2nd century BCE destruction layer in the western part of the city (Insula D2)[35], studied by S. Neumann. By expanding the study in this way we will be able to add a variety of extraordinarily well-preserved cooking pots to the study. Furthermore, this context will enable us to determine if, and how, local and imported cooking devices were combined in one single household. This will provide further evidence to inform our interpretation of the other contexts, which mainly consist of random waste fillings. We also intend to broaden the chronological frame of the study by including Roman Imperial contexts from Priene, at least up to the 1st century CE[36].

By widening the study in this way, we hope to be able to trace developments regarding the cooking pots found in Priene over a period of at least 400 years. A very important aspect of this investigation will be to outline the ratio of regionally produced and imported cooking pots and to see how these compare to the most common shapes. While it has already been confirmed that the volcani fabrics of later Hellenistic and Roman Imperial times found in Priene derive, as it seems, almost exclusively from the dominant production centre of Phocaea, we have yet to prove if this were the case for the earlier volcanic cooking ware fabrics or if there was a shift from one volcanic import group towards another. For this purpose the 2nd century BCE destruction layer again may prove to be very useful, since a preliminary macroscopic check of the fabrics revealed that both volcanic fabric groups might be present in the destruction layers of the house. Therefore, a shift from the earlier volcanic fabric towards the later one may have occurred in this period, making it crucial for our understanding of the diachronic pattern, i.e. whether it represents a change in the mode of production or a shift from one production centre to another.

As a second field of research we would like to include in our models (as soon as more results are available) the interdependencies between material agency and vessel shape. Already we can see that different fabrics sometimes correlate with different and, from a Prienian point of view, 'foreign' shapes. Therefore consumers were obliged to make a decision regarding not only the material qualities that they preferred for food preparation, but also which type of pot they should use for it. It is to

35 RUMSCHEID 2003.

36 A deposit from Insula E5, studied by N. Fenn, dates to the middle Augustean period (FENN FORTHCOMING) and could easily be added to the current research.

be expected that production groups were eager to accent their pots by certain means so that consumers would be able to recognise these lines of production more easily. On the other hand, this might have conflicted with consumer habits. Given the fact that in Priene there was a 'native' type of lopas, it would be interesting to compare not only differences regarding the usage of the sub-types, but also if the varying sub-types and the accompanying fabrics excel in different practical aspects, e.g. durability or thermal shock resistance.

A third aspect that will also need further study is the group of cooking devices not examined here, especially the braziers but also the eschara and lasana. Since there seems to be a correlation between some of the observed fabrics of cooking pots and the well-known monumental Hellenistic braziers[37], we hope to provide a new stimulus to the discussion of the location of the main production centre of these braziers, and if there was any prior manufacture with a similar fabric that might already have had an impact in Asia Minor.

[37] ROTROFF 2006, 200-216.

Catalogue

Petrographic Group A

Late Classical / early Hellenistic deposit

CHYTRAI

1 (PR 01 K038) Bu 6.10 **Fig. 1.1**
Sample No.: *Pri519*
Baggy chytra (rim with handle)
D: 27 cm ; preserved H: 12,9 cm

2 (PR 07 K261) Bu 7.6
Sample No.: *Pri614*
Baggy chytra (rim with part of handle)
D: 11,2 cm ; preserved H: 4,6 cm

3 (PR 07 K160) Bu 7.7 **Fig. 4.1**
Sample No.: *Pri616*
Baggy chytra (rim)
D: 17,5 cm ; preserved H: 6,4 cm

4 (PR 02 K462) D2 / 22.4
Sample No.: *Pri605*
Necked chytra (rim)
D: 7,6 cm ; preserved H: 4,4 cm

5 (PR 02 K500) D2 / 22.4
Sample No.: *Pri604*
Necked chytra (rim with part of handle)
D: 12,2 cm ; preserved H: 5 cm

LOPADES

6 (PR 01 K017) Bu 6.7
Sample No.: *Pri515*
Lopas with inside flange (rim)
D: c. 17 cm ; preserved H: 1,3 cm

7 (PR 05 K056) F15 / 11.16
Sample No.: *Pri608*
Lebes-type lopas (rim)
D: 22 cm ; preserved H: 5,6 cm

PANS AND BAKING TRAYS

8 (PR 05 K097) F15 / 11.17 **Fig. 2.1**
Sample No.: *Pri628*
Baking tray (complete profile)
D: c. 43 cm ; H: 2,2 cm

9 (PR 01 K087) Bu 6.8
Sample No.: *Pri512*
Pan with curved profile (rim)
D: 45–50 cm ; preserved H: 4 cm

10 (PR 07 K044) Bu 7.10
Sample No.: *Pri626*
Pan with bent profile (rim)
D: 30–31 cm ; preserved H: 2,7 cm

11 (PR 07 K042) Bu 7.10
Sample No.: *Pri627*
Pan with bent profile (rim)
D: 33 cm ; preserved H: 2,8 cm

Late Hellenistic deposit

CHYTRAI

12 (PR 00 K379) AH 3.4 **Fig. 4.2**
Sample No.: *Pri148*
Baggy chytra (rim with handle)
D: 21 cm ; preserved H: 12,3 cm

13 (PR 00 K511) AH 3.4
Sample No.: *Pri154*
Phocaean-type chytra (rim)
D: 12 cm ; preserved H: 3,1 cm

LOPADES

14 (PR 00 K383) AH 3.4
Sample No.: *Pri152*
Lebes-type lopas (rim with handle)
D: c. 29,5 cm ; preserved H: 6,9 cm

15 (PR 00 K387) AH 3.4
Sample No.: *Pri153*
Lebes-type lopas (rim)
D: 19 cm ; preserved H: 4 cm

Petrographic Group B1

Late Hellenistic deposit

PANS

16 (PR 00 K359) AH 3.4 **Fig. 4.3**
Sample No.: *Pri146*
Phocaean-type pan (rim and beginning of bottom)
D (rim): 29–30 cm ; D (bottom): c. 24 cm ; H: 3,4 cm

17 (PR 00 K514) AH 3.5
Sample No.: *Pri147*
Phocaean-type pan (rim and beginning of bottom)
D (rim): 30,5 cm ; D (bottom): c. 24 cm ; H: 3,8 cm

18 (PR 00 K361) AH 3.4
Sample No.: *Pri169*
Phocaean-type pan (rim and large part of bottom)
D (rim): 32–33 cm ; D (bottom): c. 28 cm ; H: 3,9 cm

19 (PR 00 K360) AH 3.4 **Fig. 3.3**
Sample No.: *Pri145*
Phocaean-type pan (rim and beginning of bottom)
D (rim): 38 cm ; D (bottom): 33 cm ; H: 3,8 cm

Petrographic Group B2

Late Hellenistic deposit

CHYTRAI

20 (PR 00 K362) AH 3.4
Sample No.: *Pri157*
Chytra with plain rim (*exceptional type!*) (rim)
D (rim): 10 cm ; preserved H: 5,2 cm

21 (PR 00 K364) AH 3.4 **Fig. 5.1**
Sample No.: *Pri158*
Phocaean-type chytra (two joining rim fragments)
D (rim): 15 cm ; preserved H: 5,7 cm

22 (PR 00 K366) AH 3.4 **Fig. 2.4**
Sample No.: *Pri160*
Phocaean-type chytra (multiple rim fragments, one with part of handle attached)
D (rim): 18,5 cm ; preserved H: 7,8 cm

23 (PR 00 K367) AH 3.4
Sample No.: *Pri162*
Phocaean-type chytra (multiple joining rim fragments, one with part of handle attached)
D (rim): c. 17,5 cm ; preserved H: 9,3 cm

24 (PR 00 K467) AH 3.6
Sample No.: *Pri159*
Phocaean-type chytra (three joining rim fragments)
D (rim): 21,6 cm ; preserved H: 7,8 cm

LOPAS

25 (PR 00 K513) AH 3.4 **Fig. 3.2**
Sample No.: *Pri156*
Phocaean-type lopas (rim fragments with part of handle attached)
D (rim): c. 17 cm ; preserved H: 3,9 cm

Petrographic Group B3

Late Classical / early Hellenistic deposits

CHYTRAI

26 (PR 02 K145) D2 / 22.4 **Fig. 1.2, 5.2**
Sample No.: *Pri599*
Necked chytra (rim with handle)
D: 14,5 – 15,5 cm ; preserved H: 10 cm

27 (PR 02 K430) D2 / 22.3 + 4
Sample No.: *Pri511*
Lid, very likely belonging to a necked chytra (complete profile, three non-joining fragments)
D: c. 17 cm ; H: 3,8 cm

PANS

28 (PR 02 K373) D2 / 22.3 + 4

Sample No.: *Pri625*

Pan with curved profile (rim with grip)

D: 37 cm ; preserved H: 3,6 cm

Petrographic Group B4

Late Classical / early Hellenistic deposits

CHYTRAI

29 (PR 01 K039) Bu 6.9 **Fig 5.3**

Sample No.: *Pri514*

Necked chytra (rim with handle)

D: 12 cm ; preserved H: 4,8 cm

LOPADES

30 (PR 01 K018) Bu 6.7 **Fig. 1.4**

Sample No.: *Pri513*

Lebes-type lopas (rim with handle)

D: 15 cm ; preserved H: 3,6 cm

PANS

31 (PR 01 K157) Bu 6.6 **Fig. 2.2**

Sample No.: *Pri516*

Pan with curved profile (rim)

D: c. 30 cm ; preserved H: 3,5 cm

Unknown Petrographic Group (possibly volcanic)

Late Classical / early Hellenistic deposits

LOPAS

32 (PR 02 K486) D2 / 22.4

Sample No.: *Pri598*

Lebes-type lopas (rim with handles)

D: 19 cm ; preserved H: 1,9 cm (without handles)

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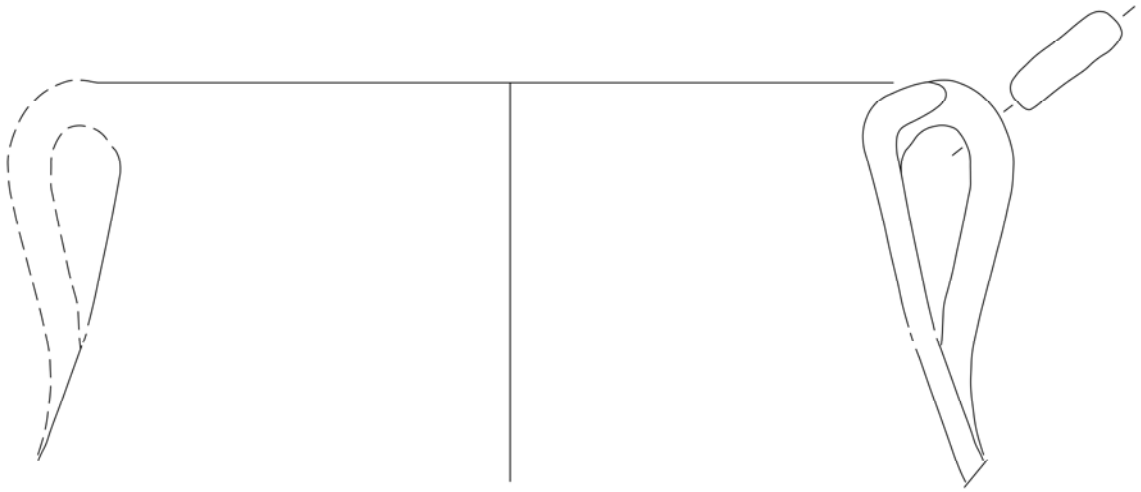

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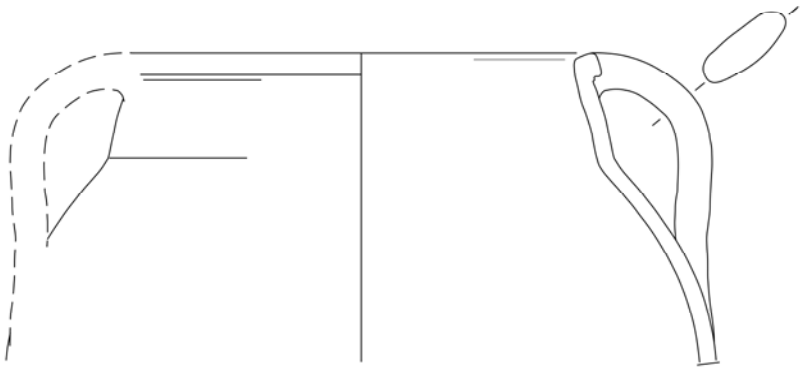


2 (cat. no. 26 ; Pri599)

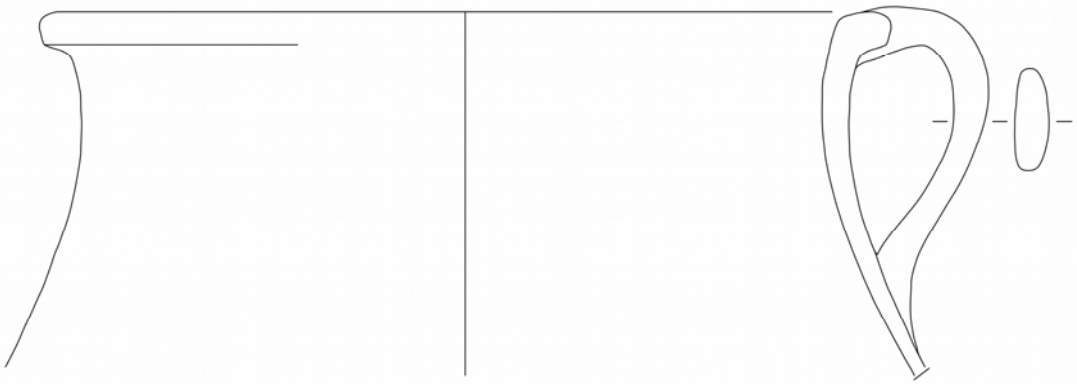
3 (inv. no. PR 07 K011)

4 (cat. no. 30 ; Pri513)

Fig. 1 *Vessels from 4th/3rd century BCE* contexts: *baggy chytra (**1**), necked chytra (**2**), lopas with inside flange (**3**), lebes-type lopas (**4**).* c. 1:2

1 (cat. no. 8 ; Pri628)

2 (cat. no. 31 ; Pri516)



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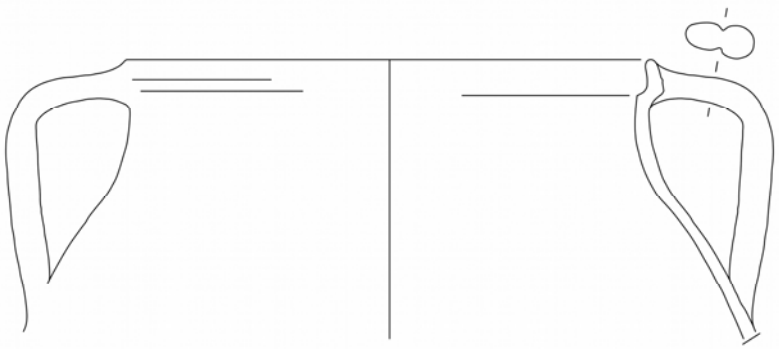
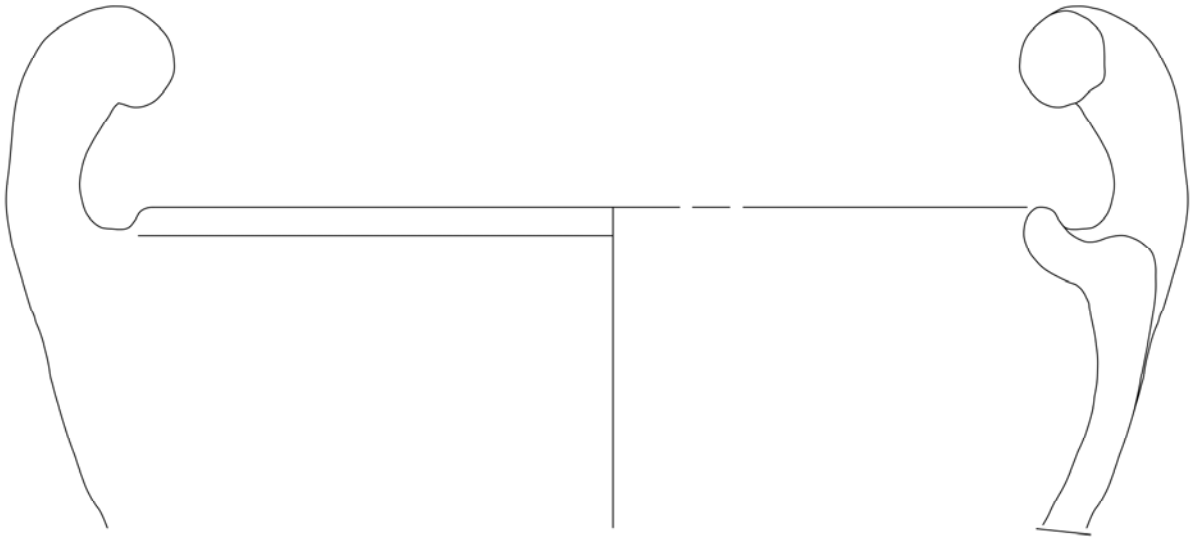


4 (cat. no. 22 ; Pri160)

Fig. 2 *Vessels from 4th/3rd century BCE: 'baking tray' (**1**), pan with curved rim (**2**) ; vessels from 2nd/1st century BCE: baggy chytra (**3**), 'Phocaean'-type chytra (**4**).* c. 1:2

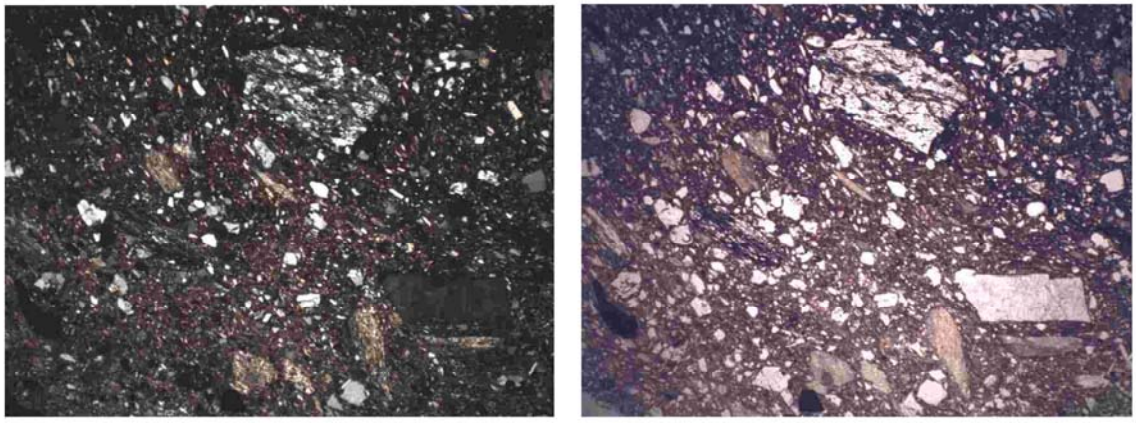


1 (inv. no. PR 00 K438)

2 (cat. no. 25 ; Pri156)

3 (cat. no. 19 ; Pri145)

Fig 3. *Vessels from 2nd/1st century BCE: lebes-type lopas (**1**), 'Phocaean'-type lopas (**2**), 'Phocaean' -type pan (**3**).* c. 1:2



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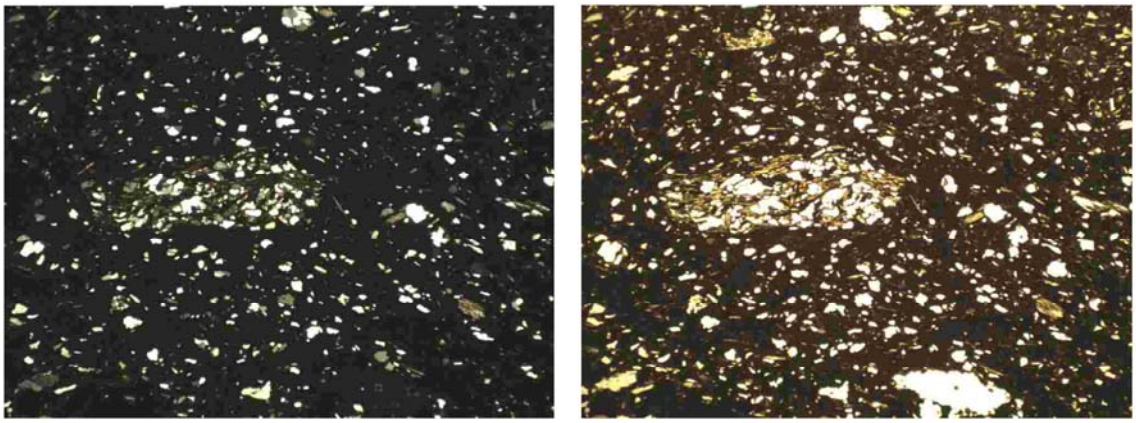

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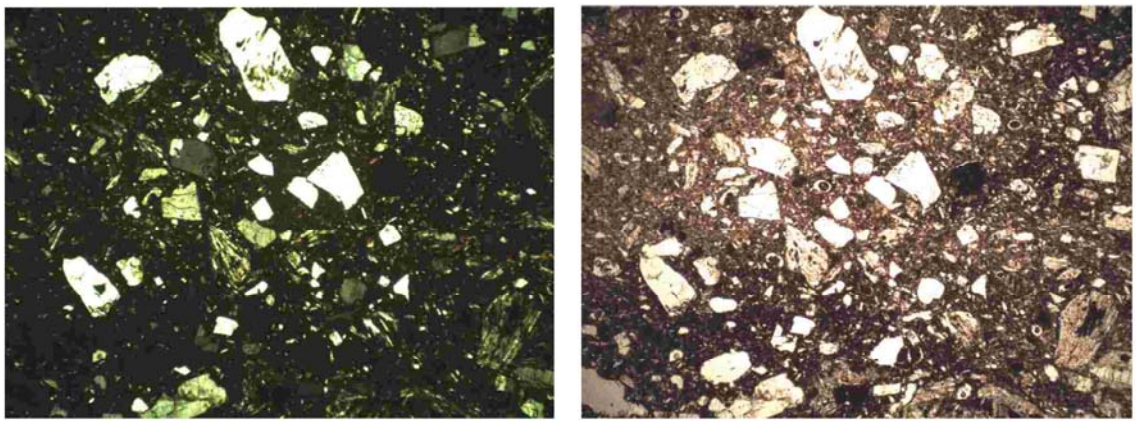
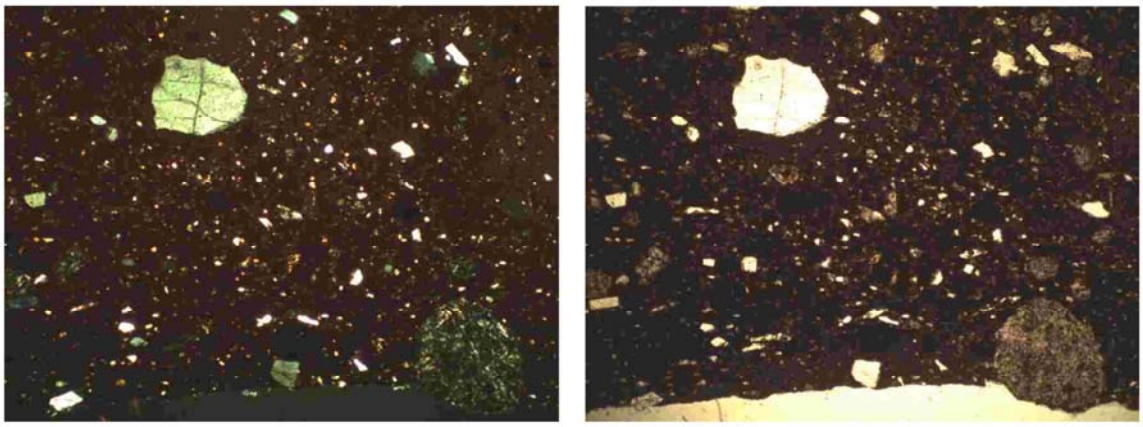


3 (left: XPL, right PPL ; field of view: 7 mm)

Fig 4. *Petrographic group* **A***: baggy chytra, cat. no. 3 (***1***) and baggy chytra, cat. no. 12 (***2***) ; petrographic group* **B1***: 'Phocaean'-type pan, cat no. 16 (***3***).*



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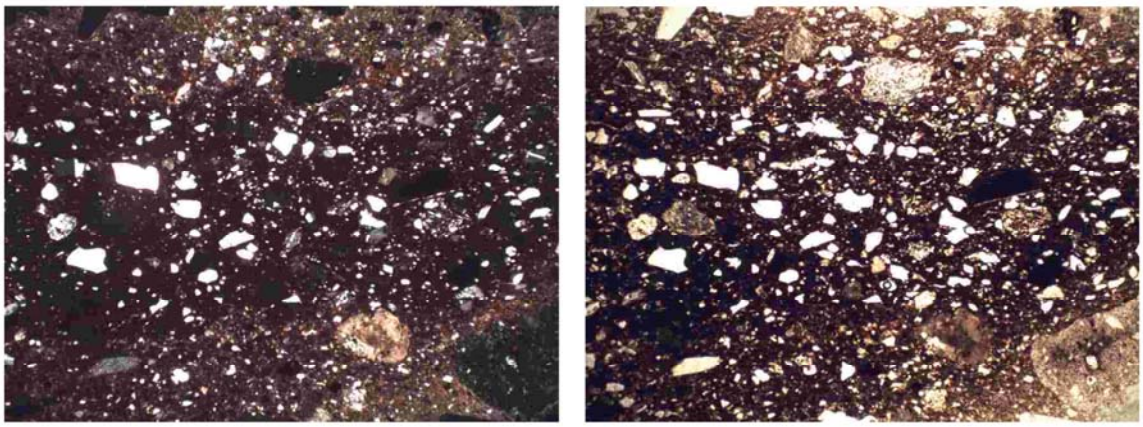

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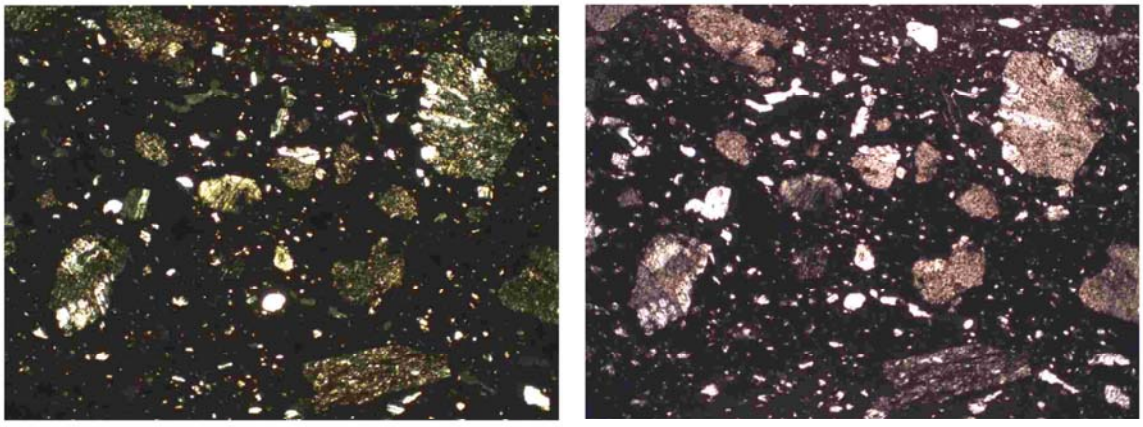

3 (left: XPL, right PPL ; field of view: 7 mm)

Fig 5. *Petrographic group* **B2***: 'Phocaean'-type chytra, cat. no. 21 (***1***) ; petrographic group* **B3***: necked chytra, cat no. 26 (***2***); petrographic group* **B4***: necked chytra, cat. no. 29 (***3***).*

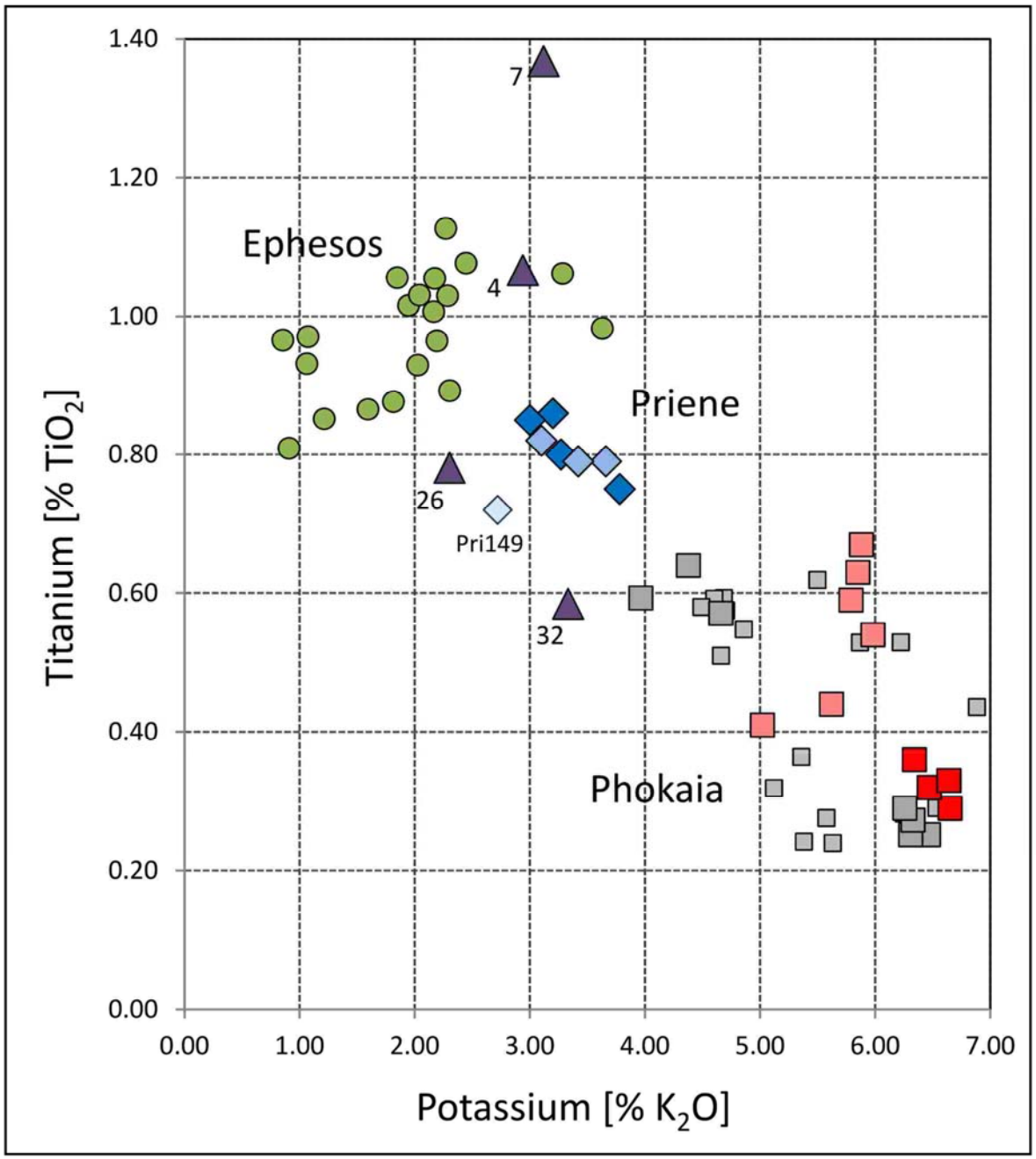

Fig. 6 *Titanium and potassium contents of cooking ware by WD-XRF and ED-XRF: squares = products of Phocaea (red =samples from Priene, grey = reference samples from Phocaea and attributed finds from other sites); rhombs = cooking wares from Priene in composition corresponding to local reference material ; triangles = early Hellenistic cooking wares; circles = cooking wares from Ephesus. The samples from Priene are from the late Hellenistic pottery deposit at the Athena sanctuary, the darker colours detect samples studied by thin sections (cat. nos. indicated).*

Cat.-no.	Lab.-no.	major elements in wt.%										trace elements in ppm												
		SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	V	Cr	Ni	(Cu)	Zn	Rb	Sr	Y	Zr	(Nb)	Ba	(Ce)	(Pb)	(Th)
petr. group A																									
4	**Pri 605**	57.90	1.067	19.89	9.55	0.136	3.78	3.76	0.80	2.94	0.18	125	266	256	36	95	134	217	42	300	23	557	100	28	27
7	**Pri 608**	60.25	1.368	17.79	8.44	0.108	1.67	5.77	1.35	3.12	0.13	133	122	63	35	96	122	276	36	324	27	721	104	23	22
local kitchenwares																									
12	**Pri148**	56.34	0.860	18.26	8.22	0.103	4.25	7.44	1.14	3.20	0.20	120	223	215	42	83	119	257	41	213	19	580	90	42	22
13	**Pri154**	63.10	0.750	18.78	5.72	0.054	3.37	3.90	0.41	3.78	0.14	101	142	84	27	60	121	108	32	256	14	398	63	38	21
14	**Pri152**	57.07	0.800	20.47	8.10	0.084	3.29	6.18	0.57	3.27	0.17	126	219	136	51	84	133	200	34	146	15	552	74	31	22
15	**Pri153**	61.99	0.850	21.02	7.69	0.062	2.49	2.02	0.79	3.00	0.10	133	225	138	49	78	107	104	25	166	15	375	55	63	17
	Pri150	60.13	0.790	18.14	6.24	0.069	3.84	6.41	0.57	3.66	0.15	94	240	142	23	64	122	136	32	237	14	398	60	28	19
	Pri151	62.10	0.820	21.52	8.13	0.064	2.16	1.24	0.78	3.10	0.09	137	198	114	40	77	118	121	29	167	15	443	59	28	19
	Pri155	63.15	0.790	16.98	5.93	0.061	3.14	5.74	0.62	3.42	0.18	95	175	102	24	71	120	128	34	242	14	429	65	30	19
abberant composition in Mg, Cr. Ni																									
	Pri149	54.45	0.720	15.60	8.11	0.112	9.55	8.04	0.45	2.72	0.24	117	682	456	45	84	96	135	29	213	12	397	52	31	18
unknown group																									
32	**Pri 598**	60.72	0.585	15.58	5.23	0.087	4.25	7.71	2.27	3.33	0.23	59	259	272	14	56	162	198	31	272	19	531	76	16	31
petr. group B1 (volcanic): pans																									
16	**Pri146**	61.46	0.290	21.37	5.26	0.126	0.64	0.75	3.40	6.65	0.06	22	28	16	15	99	290	104	40	399	65	136	145	84	48
17	**Pri147**	61.10	0.320	21.32	5.40	0.149	0.66	1.30	3.21	6.47	0.07	28	39	18	12	99	278	147	41	405	53	175	148	68	52
18	**Pri169**	62.12	0.330	21.10	4.99	0.132	0.68	0.71	3.25	6.64	0.07	26	39	16	14	97	294	102	37	430	66	142	145	74	50
19	**Pri145**	61.46	0.360	21.61	5.50	0.138	0.78	0.72	3.06	6.34	0.06	28	36	17	9	95	278	127	40	376	58	179	137	69	47
petr. group B2 (volcanic)																									
20	**Pri157**	60.91	0.670	21.13	6.34	0.139	1.04	1.79	2.03	5.88	0.07	58	110	36	22	82	196	252	32	399	37	431	110	57	38
21	**Pri158**	60.61	0.630	21.73	6.28	0.138	1.10	1.70	1.88	5.85	0.10	62	93	29	12	82	200	250	31	393	38	455	122	76	39
22	**Pri156**	61.40	0.410	21.86	5.61	0.096	0.92	2.28	2.28	5.02	0.14	47	88	29	22	82	210	119	35	496	46	256	138	89	54
23	**Pri160**	60.04	0.440	22.90	6.21	0.128	0.92	1.53	2.17	5.62	0.06	41	63	26	51	91	230	158	36	463	51	214	126	82	50
24	**Pri162**	60.14	0.540	22.28	6.03	0.099	1.18	1.22	2.41	5.98	0.12	51	52	21	17	80	186	290	31	338	36	419	126	58	41
25	**Pri159**	60.23	0.590	23.10	6.65	0.073	0.89	0.83	1.82	5.79	0.04	52	64	29	24	69	199	220	23	406	42	363	115	61	45
petr. group B3 (volcanic)																									
26	**Pri 599**	65.92	0.781	18.78	5.77	0.089	1.18	2.99	2.10	2.30	0.08	84	131	65	17	62	103	257	18	300	19	713	66	26	25

Fig. 7 *Chemical composition (WD-XRF and ED-XRF) of cooking wares from Priene arranged by petrographical groups.*

	Petrographic Group A	Petrographic Group B1	Petrographic Group B2	Petrographic Group B3	Petrographic Group B4
Chytrai					
baggy type	**1** (PR 01 K038), **2** (PR 07 K261), **3** (PR 07 K160), **12** (PR 00 K379)				
necked type	**4** (PR 02 K462), **5** (PR 02 K500)			**26** (PR 02 K145)	**29** (PR 01 K039)
'Phokaian' type	**13** (PR 00 K511)		**21** (PR 00 K364), **22** (PR 00 K366), **23** (PR 00 K367), **24** (PR 00 K467)		
Lopades					
inside flange	**6** (PR 01 K017)				
lebes type	**7** (PR 05 K056), **14** (PR 00 K383), **15** (PR 00 K387)				**30** (PR 01 K018)
'Phokaian' type			**25** (PR 00 K513)		
Pans					
baking tray	**8** (PR 05 K097)				
curved wall	**9** (PR 01 K087), **10** (PR 07 K044), **11** (PR 07 K042)			**28** (PR 02 K373)	**31** (PR 01 K157)
'Phokaian' type		**16** (PR 00 K359), **17** (PR 00 K514), **18** (PR 00 K361), **19** (PR 00 K360)			

Fig. 8 *Overview over the most common Prienian cooking ware shapes and their petrographic groups (late Classical to late Hellenistic contexts).*

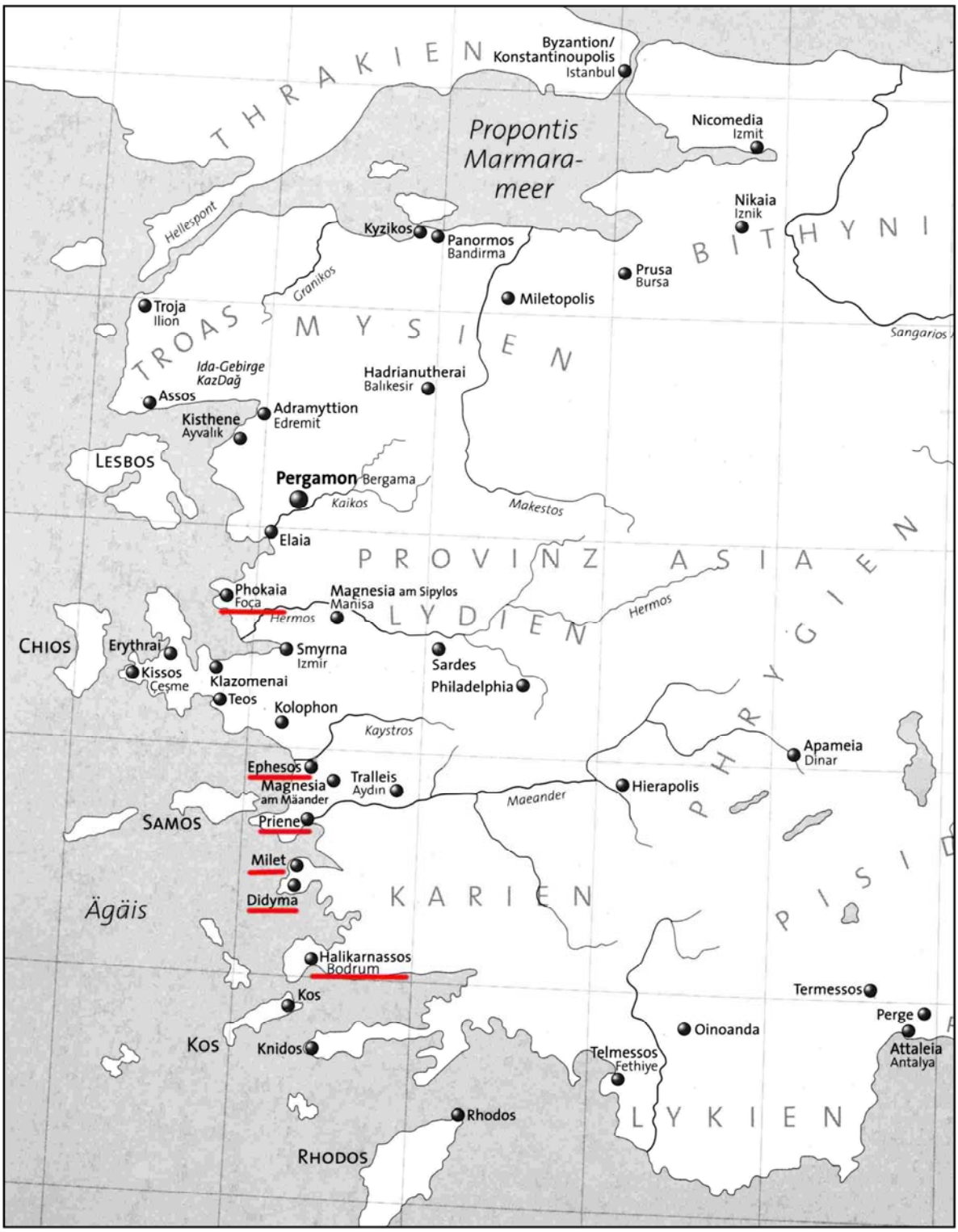

Fig. 9 *Map of the west coast of Asia Minor (cities refered to in the text are underlined red).*

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