INTRODUCTION
The study of IVth century B.C. ceramics we have undertaken served a double purpose:
— on the one hand, we intended to make a quite extended regional study, which got us to examine the ceramic material found on 7 sites: Thasos, Abdera, Stryme, Zoni/Messembria, Maroneia, Samothrace and Amphipolis (Fig. 1). This material came from consumption areas, not from workshops;
— on the other hand, we wanted to take into account different categories of ceramics on each of those sites: black glaze (VN); common ware (CC); cooking ware (CW) (Table 1). We decided to discard the amphorae: they had already been the subject of previous researches and the problems of location of their workshops and of the diffusion of their products are for a large part different from those of the other above-mentioned categories of material.
Three main aims had been fixed for this study (see also Blondé and Picon 1999, 237-251; Blondé and Picon 2000b, 161-188):
— to distinguish on each site the local products from the imports;
— to examine on some sites the technical characteristics of the local products;
— to study the diffusion of the products of each site with regard to the others.

IDENTIFICATION OF LOCAL PRODUCTIONS AND IMPORTS
Archaeologically attested workshops being lacking, a particular strategy had to be adopted. This will be illustrated by a first example, the Thasian one, for which 153 samples coming from excavations in Limenas (Thasos) were analyzed with X-ray fluorescence. (The method used has been developed in Blondé and Picon 2000b, 161-188. On the principles of classification adopted see, among others, Laffitte 1972; Picon 1984, 379-399).
As usual, a preliminary step consisted in the classification of these samples based on their chemical compositions. The method used is hierarchical cluster analysis with centroid linkage on the following 17 major and trace elements: K, Rb, Mg, Ca, Sr, Ba, Mn, Ni, Zn, Al, Cr, Fe, Si, Ti, Zr, Ce, V.

<table>
<thead>
<tr>
<th></th>
<th>VN</th>
<th>CC</th>
<th>CW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thasos</td>
<td>46</td>
<td>51</td>
<td>29</td>
</tr>
<tr>
<td>Abdera</td>
<td>35</td>
<td>59</td>
<td>28</td>
</tr>
<tr>
<td>Stryme</td>
<td>18</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Maroneia</td>
<td>36</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Zoni/Messembria</td>
<td>17</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Samothrace</td>
<td>43</td>
<td>59</td>
<td>12</td>
</tr>
<tr>
<td>Amphipolis</td>
<td>20</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 1 Number of samples taken into account for the different categories of ceramics on each site.
The result of this classification is represented on Figure 2. At least 6 composition groups can be distinguished, numbered from 1 to 6, as well as a large number of samples apparently impossible to classify. Careful examination of those sample compositions showed that quite a number among them are altered fragments belonging to the principal composition groups revealed by the classification. In that case, their high percentages of phosphor and baryum, and their lower percentage of silicon, potassium and rubidium are relevant. On such a site as Limenas on Thasos, the knowledge of the local alterations is a must if one wants to effectuate countings for each category of ceramics, because too many individuals are concerned by this phenomenon.

Every point out by the classification was then studied separately. The aim being to sort out the ceramics extraneous to the considered group and which could have slipped into it on account of the too small size of this group, of its heterogeneity, as well as of the perturbing presence of the other groups of the classification. Let us take an example: we had to eliminate in Group 3 the samples THG 26 and 140, 129 and 131. The former two actually occupy an isolated position inside Group 3, the latter two are in a marginal position out of a sub-group; they are displaying specific typological characteristics, being black-glazed, VN. samples, while all the other samples of the group are common ware, CC. and cooking ware, CW. In a similar way, we had to exclude the sample THG 5 of Group 1, and also some other ones...

On each of the sites studied, the composition groups corresponding to imports can generally be distinguished rather easily from the local groups. Most of the imported ceramics do form small minority groups to be found on different sites, while the local groups are largely represented on one specific site, and are in a minority or lacking on the other ones.

So, Groups 3 and 5, to which belong most of the common ware and the cooking ware of the IVth century levels in Thasos, represent respectively 55% and 25% of the common wares, 70% and 15% of the cooking wares, which means in total nearly 80% of the common wares and 85% of the cooking wares. But on the other hand, those groups are very poorly represented, or even lacking, on the other sites we studied, with the exception of two of them, Stryme and Zoni/Messembria, whose local production seems to be quite restricted during the IVth century and their imports comparatively abundant. In any case, Groups 3 and 5 do not present, in spite of these conditions favourable to export, percentages comparable to those mentioned for Thasos. There is even less risk to confuse these imports with local products whereas other exporting sites, Abdera in particular, also take advantage of this situation favourable to exports. We will come back to this point later when we will evocate the diffusion of the ceramic products of the studied sites.

Among the ceramics we find on the sites of the region and which cannot originate from any of them, there are of course the Attic black-glazed wares, well attested on all the sites we studied, but not always easily distinguishable from local products without the help of analyses. In Thasos they constitute the Group 1 of Figure 2, whereas the Group 2 represents another black glaze group, of local origin; we can find a rather large amount of samples belonging to these two groups with altered compositions among the unclassified items of Figure 2.

Among the ceramics which do not originate from any of the studied sites, we can also mention those of the group labelled B, which is composed mostly of black glaze. We know 3 samples of them at Stryme, 4 at Zoni/Messembria, 3 at Amphipolis — sites for which we had got a batch of samples similar in size. But 2 at Thasos, 1 at Samothrace and none at Maroneia and Abdera, although the sampling on these last 4 sites was quantitatively more important. Among the studied sites, no one seems to be a valuable candidate as a centre of manufacture for this group, for lack of any specific concentration pattern.

But it is clear that the identification of the local products becomes very difficult, whenever those are scarce. We have seen, more particularly, that such was the case for the site of Stryme, the classification of which, done under the same conditions as for Thasos, is reported on Figure 3. If we discard the imports assigned to Thasos and Abdera, as well as the Attic ones, Group B just mentioned and Group A to be discussed later, we cannot point out, among the remaining samples, which one (or ones) could be considered as local, not even those of Group C, which are represented by 2 samples only at Stryme and 2 at Zoni/Messembria. Of course, on such kind of sites, the identification of local products is less important than the identification of their imports (an eventual local production of ceramics of Thracian type still has to be studied).

To finish with it, let's just have a look at last case for which the attachment to — or the exclusion of — one or another of the studied sites meets more difficulties. It deals with Group A we just mentioned regarding Stryme. Group A represents there about 30% of the non-Attic black-glazed ceramics. The Attic ones have not been taken into account for this calculation, because a part of them, being easily recognized to the naked eye, has been voluntarily discarded at the sampling stage. But in these conditions the sampling does not represent the real proportions of the non-Attic black-glaze of Stryme and this is also the case for all other studied sites.

We cannot be very surprised by the 30% reached by Group A at Stryme and not even by the 50% at Messembria, if we take into account the apparently small production already mentioned for these two sites in the IVth century. On the other hand, the group does not even represent 5% of the non-Attic black glaze at Maroneia, even less at Thasos (where only sample THG 5 can be linked to it), and has not been pointed out at Amphipolis. It is surprising to find them at Abdera at nearly 30%, and especially at Samothrace, at 55% of the non-Attic black glaze. To crown it all, as the group includes in the latter site a relatively high number of common ware of the same origin — they represent nearly 20% of the common ware sampled on the site — the hypothesis of a local production of group A had to be examined. But the study of the local clays, particularly the study of their

152
compositions and their dispersions, compelled us to exclude this possibility, as will be shown in the paper on Samothrace, p. 60-00.

Anyhow, we must emphasize here the fact that distinguishing local products from imports on each site would have been incomparably longer and more difficult, if we had chosen to work and argue on sites more distant from one another, and not on those of a same regional context.

TECHNICAL FEATURES OF THE LOCAL PRODUCTIONS

In order to specify the technical characteristics of IVth century Thasian products, those belonging to Groups 2, 3 and 5 on Figure 2, we proceeded at an estimation by the naked eye of their firing degree. This estimation has been tested on a small batch of samples by measuring the temperature corresponding to the maximum of their thermal expansion curve (for temperature measurements, see Tite 1969, 131-143; Cuomo di Caprio, Picon 1999, 86-109). It concerns the apparent temperature, generally near to the effective firing temperature. The results of these measurements are given — by composition groups (2, 3 and 5) and by ceramic category (VN, CC, CW) — on Figure 4 (together with some comparative measurements made on the Attic black-glazed ceramics of Group 1 (VN 1)).

The temperature measurements and the clay compositions point out the existence of two patterns of potters' craftsmanship on IVth century Thasos. The first one — Group 2 — has a calcareous production, fired on high temperature. It gathers essentially black-glazed ceramics, but also some common ware manufactured with the same clay and fired at the same temperature as the black glaze, probably in the same kilns. The second one — Groups 3 and 5 — has a non-calcareous production, fired at a lower temperature. It is composed mainly of common ware and, in a lesser degree, of cooking ware, which no obvious technical features distinguish from the common ware.

One can point out that such a situation, quite banal indeed, often occurs, the production of common ware, calcareous and fired at a high temperature (Group 2) developing to the detriment of the common ware fired at a lower temperature (Groups 3 and 5). That kind of evolution reveals progress in the common ware's standard. It is often accompanied by another improvement, with more important effects: the process of firing cooking ware products at a higher temperature, but only where the clays allow it [see among others Blondé, Picon 2000a, p. 13-26]. The improvement of the cooking ware standard often involves a significant specialization of the producing workshops, with a neat tendency of regroupment within the regional context. It is not impossible that the important variations of firing temperature as observed on Figure 4, may be connected with the start of such a process. But such a development can be validly studied only over a long period, within another specific research program (Cf. Picon 1995, 141-158; Peacock 1982; see also Blondé and Picon 2000a, 13-26).

On the remaining sites we studied, the same partition in two patterns of potters' craftsmanship seems to be existing during the IVth century, at least when an important batch of samples was available for the local products, i.e. in half of the cases. But, depending on the geological context of each site, this partition can be more or less apparent. For instance, among the local products of Abdera, we only could only distinguish one composition group, gathering black glaze, common ware and cooking ware. But an attentive study of the compositions shows that, even when the potters used a same geological formation for all the ceramic categories, the extracting areas of the workshops manufacturing black glaze cannot have been the same as those for the other categories. These variations in composition and differences in firing temperature between black-glaze and common or cooking wares clearly show that the situation in Abdera does not differ from Thasos.

A last remark has to be made concerning the range of workshops producing most of the cooking and common wares. In Thasos, where we studied it most intensively, it is not restricted to those categories only. Under the convenient but also simplifying acronyms CC, different products are in fact included in Group 3, secondary ones, issued from the same pool of workshops. We find among them a production of terracotta figurines (THG 155 to 158, THG 157 having been rejected to the right end of the diagram of Figure 2 due to pollution reasons), and a production of burnished ceramics, getting their inspiration, with another, more simple, technique, on the black-glazed ceramics (THG 9, 23, 29, 59, 60, 100, 144, 145)...This shows the complexity of this craftsmanship pool.

THE DIFFUSION OF THE PRODUCTIONS

Before presenting the state of our knowledge concerning the problems of diffusion of local products on the above-mentioned sites, and also those of the ceramics produced elsewhere and exported to these same sites, let us briefly mention the methods used for their identification.

We first must say that, considering the small number of samples within most of the groups, the Mahalanobis distance could not be used to connect isolated individuals to the local products put into evidence on the different sites, with the exception of the uniform group of Abdera. As to the Thasian Group 3, the second most important one, its size of about 50 individuals could have at the most permitted to preserve the totality of the measured chemical components, but with no safety margin at all. We could of course have substituted the euclidian distance to the Mahalanobis ones, but we preferred to use cluster analysis, in order to avoid the effects due to the reduction of the data when dealing with the average. We focused on finding the most favourable conditions, having in mind that the presence of what could be foreign items within the studied group and which could be included in the classification, could artificially mask differences in compositions, but never take away the meaning of those
which we observe. This lead us to adopt a strategy of progressive elimination of the foreign items during the successive classifications. One of the benefits of this procedure is that it applies itself also to imports, even represented in small numbers, originating from unknown centres. The most important shortcoming being the long work due to the multiplication of operations which have to be done.

The commercialisation of the ceramic products in the different sites concerned by this research was one of the major aims of this study. But we had very soon to admit that, within the regional context we studied, the distribution of local products was particularly poor. So, in Abdera we only found 4 Thasian fragments on more than 120 non-Attic ones, and in Thasos one single specimen from Abdera among an equivalent number of non-Attic fragments. But these two sites were apparently important production centres and we have mentioned that the imports are to be found, as it is normal, rather on sites on which the local production seems to be particularly weak in the IVth century, even non-existent. That should be the case at Smyrne were 8 Thasians ceramics and 6 Abderian ones have been identified among less than 40 non-Attic ones and also at Zoni/Messembria where 5 Thasan and 8 Abderian samples have been recognized among some more than 40 non-Attic ones. And such could be the case, but on a smaller scale, at Samothrace, where we did not find any ceramics from Thasos nor from Abdera, but imports from Maroncia. 9 out of some 110 non-Attic specimens.

These regional data must not at all lead us to deduce that the diffusion of the major production centres is neglectable or nearly so. One could for instance imagine that the Thasian products have been commercialized on longer distances, maybe together with the Thasian wine export. So, we should make further inquiries, for example to the areas surrounding the Black Sea, before generalizing the observations made within the regional limits.

In the meanwhile, one observation has still to be made on the nature of the exported ceramics in our regional context. Indeed, we find an unusually high proportion of cooking ware. Their number is nearly as high as that of the common wares, while the countings made on the Thasos material show that they are clearly less numerous. It looks as if a preference has been given to the export of Thasian cooking ware, their quality having been recognized and appreciated.

The same unusually high proportion of cooking ware has been found among the Abderian export, but in this case no countings are available on the production centre. Should these observations be confirmed in the future — they are still only based on some 30 samples — they could provide evidence of a demand for first-rate cooking ware, at the origin of the above-mentioned specialization and handicraft pooling. Let us add that the less well represented ceramic category among the exports is the black glaze and this could be explained by the omnipresence of Attic products; the situation could be different on more remote sites as those of the Black Sea.

We will finish by evoking the import of ceramics of more remote origin to the sites considered. The case of the Attic ceramics is the best known; they represent in the IVth century at Thasos nearly twice the amount of Thasian black-glazed ware, and the Attic pottery is restricted to black-glazed series (plus some rare red-figure). We find the same predominance of black glaze in Group B of unknown origin already mentioned, and in Group A, more important but also still of unknown origin, which will be given a more detailed account of in the paper about Samothrace (Karadima et al. this volume). This predominance of black glaze seems to be in contradiction with the prevalence of cooking wares observed among the rare regional exports. It is possible that the creation of the important export centres of cooking ware is far from being achieved in the IVth century, and may even not have started. This could be confirmed by the fact that there are very few cooking wares between the unattributed samples of the different sites.

REFERENCES
Blondé, F. and Picon, M., 2000b, Autour de la céramique du IVe siècle dans le Nord-Est de l'Égée ; quelques approches différentes, BCH., 124, 1, 161-188.
Picon, M., 1995, Pour une relecture de la céramique marocaine: caractéristiques des argiles et des produits, techniques de fabrication, facteurs économiques et sociaux, Ethno-archéologie méditerranéenne, coll. de la Casa de J'Elasques, 54, 141-158.
Tite, M.S., 1969, Determination of the firing temperature of ancient ceramics by measurement of thermal expansion: a reassessment, Archaeometry, 11, 131-143.
Production and diffusion of IVth c. B.C. ceramics in Thasos and several sites in Northern Greece

Figure 1 Localization of the studied sites.

Figure 2 General classification of the IVth c. B.C. ceramics from Thasos.
Figure 3 Classification of Wth c. B.C. ceramics studied at Stryme, with indication of the principal groups and proposed attributions.

Thasos (Greece)
Histograms of the apparent firing temperatures

Figure 4 Some temperature measurements of ceramics from Thasos.