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**The Ancient Settlement at Karabournaki:
the Results of the Corinthian and Corinthian Type Pottery Analysis**

Introduction

Karabournaki is located on the edge of a peninsula in the center of the Thermaic Gulf¹ (fig. 1). The site preserves the remains of a settlement placed on the top of a low mound, with its cemeteries extended in the surrounding area and the ancient harbor reaching the lower part of the hill. Karabournaki should be related to ancient Therme mentioned by the literary sources as the most important settlement before the esta-



Fig. 1 - Karabournaki: aerial view of the site.

¹ For the ancient settlement located in Karabournaki and the current excavations carried by the Aristotle University of Thessaloniki see TIVERIOS *ET ALII*, 2003, 327–351; TIVERIOS *ET ALII*, 2008, 263–270; TIVERIOS 2008, 27–28.

establishment of Thessaloniki. Current excavations unearth the residential area that along the houses preserves ceramic and metal workshops, providing important information for life in Macedonia during Late Geometric, Archaic and Early Classical periods (fig. 2). The site preserves a great number of ceramics, local and imported, in a remarkable quantity as well as quality. The material evidence demonstrates that during the Archaic period, Karabournaki was a commercial and distribution point and a meeting place with influences from the East and the West. The University excavations at the site are carried under the directorship of prof. M. Tiverios and his associates the assistant prof. E. Manakidou and the senior researcher Dr. D. Tsiafakis.



Fig. 2 - Karabournaki: view of the excavation site.

Corinthian and Corinthian type pottery

A major category of pottery found in the settlement at Karabournaki is the Corinthian. Based on the up today unearthed examples, however, it can be distinguished into various groups of vase fragments that resemble more or less to the well recognized Corinthian imports. The resemblance is found on both shape and decoration. Through the archaeological observation, and study all this Corinthian and Corinthian type material can be differentiated into three groups that will be described in detail below: A) Corinthian imports, B) Corinthian type pottery of good quality in shape and technique with black-figured decoration, and C) Local imitations of Corinthian pottery with particularly linear decoration.



Fig. 3 - Sherds of imported Corinthian vases, Group A. Some of them are up side down (phot. by E. Manakidou).

Group A: Corinthian Imports

The earliest fragments of the imported Corinthian vessels found in Karabournaki date in the middle Protocorinthian period. The Corinthian presence in Karabournaki though, becomes clear during the last quarter of the 7th c. B.C. (Transitional period) and mostly from the late 7th c. B.C. and throughout the 6th c. B.C.² All the known shapes of the Corinthian production are represented in the findings with a particular emphasis on perfume and symposium vases as well as on less common vessel types (fig. 3). As for the first, they are mostly found round and some ovoid *aryballoi*, *alabastra*, *exaleiptra*, and few plastic vases as in the form of a ram and a Satyr. Among the *symposium* vessels the most characteristic examples come from

² MANAKIDOU 2003, MANAKIDOU forthcoming.

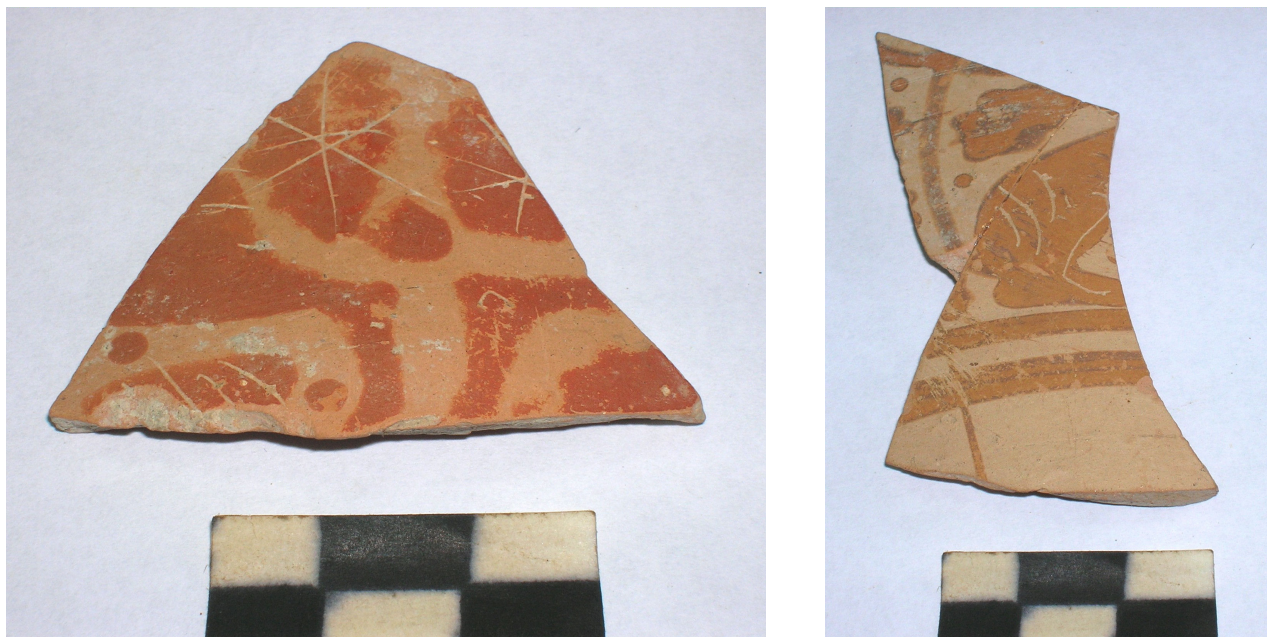


Fig. 4a-b - Sherds of Corinthian type *kotylai* (Inv. Nr. K96.1747a and K2002A.700b) with animals and rosettes (phot. by E. Manakidou).

kotylai, *oinochoai*, and *column kraters*. As for the decoration, there are black-figured examples dated mostly in the Early and Middle Corinthian period. They carry animal friezes or groups, comasts, processions, symposium, and battle scenes. Shapes not very common in the Corinthian repertory such as *lekanai*, miniature *phialai*, and plates, are also found in Karabournaki. The Corinthian imports that date to the late Corinthian period belong to the so-called conventionalizing pottery.

Group B: Corinthian type pottery

The second group includes a significant number of fragments with certain corinthianizing character. They have a fine reddish orange or light brown fabric with a good quality orange or brown firnis and a similar paint for the decoration. The shapes occurred in this group are mainly large *kotylai*, *oinochoai* and few amphorae. They are all decorated in black figure technique with the depiction of various animals among rosettes (fig. 4a-b). All the fragments belonging to this group reveal close similarities to the imported Corinthian vases in terms of shape, technique, and decoration (primary and secondary). Their good quality, with only a few imperfections due to the firing process, indicates experience and knowledge.

The *kotylai* (fig. 5) belonging to this group are decorated with wavy lines on the rim and rays in the lower part of the body. The figural decoration on the main part of the body includes large animals real or imaginary, such as lion, boar, wild-goat, birds, panther, Siren, and Sphinx. They are placed opposite or facing each other³ with various size rosettes to surround them. They have added purple on their bodies and

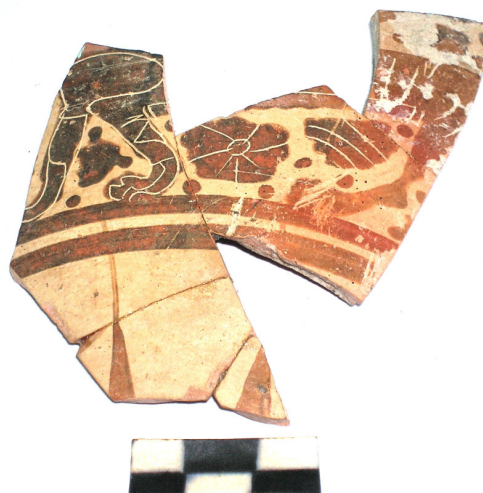


Fig. 5 - Fragmentary Corinthian type *kotyle* (Inv. Nr. K2002A.696b) (phot. by E. Manakidou).

³ Similar in terms of shape and decoration are some Corinthian type *kotylai* from Taras: NEEFT 1996, 288–90; ALESSIO 1996, 295–6. Parallels for Corinthian type *kotylai* also from the cemetery of Assos: UTILI 1999, 213, 224–226.



Fig. 6 - Fragmentary Corinthian type "double decker" *kotyle* (Inv. Nr. K99A.248a - K99A.331) (phot. by E. Manakidou).



Fig. 7 - Corinthian type *oinochoe* (Inv. Nr. K97.1675) (phot. by E. Manakidou).

they are rendered in a naturalistic way carrying plenty and careful incision, even though in some cases they get a *surplus* - almost decorative - form that is found especially in the legs and the feet of the animals. A special category among this group is the so-called by us, "double decker" *kotylai* that carry figural decoration not only on the body of the vase but on the rim as well (fig. 6). This type of decoration, although not common, is found in the Corinthian workshop⁴. The rim zone⁵ is decorated with birds rendered in silhouette, in contrast to the black-figured animals on the body.

The *oinochoai* of this Corinthianizing group (fig. 7) have trefoil mouth, circular double handle that extends the rim of the vase, and broad spherical body. Their figural decoration is placed on a wide zone on the shoulder, while the rest of the body, the handle, and the interior of the rim are covered with a brown firnis. White and red thin bands highlight the part of the body with the largest diameter whereas rays decorate the lower part. Panthers with elongated body often with a Siren between them are depicted in the preserved examples. Added red and incision are used on the body of the animals. A variety characterizes the rosettes in terms of type and size. A similar type of decoration with an animal frieze occurs on a fragmentary amphora that preserves parts of another smaller frieze.

Although it is not known so far the existence of similar vases coming from the area of the Thermaic gulf, it can be assumed that there was a pottery workshop somewhere nearby, which manufactured this type of pottery under immediate Corinthian influence. It cannot be rejected the possibility that the workshop was ran by Corinthian potters⁶ who had been settled in a Corinthian colony nearby, as for example Potidaia in Chalkidike. This group of the Corinthian type vases (Group B) should be dated in the Middle Corinthian period⁷.

⁴ Very similar in decoration and the clay is a *kotyle* from Aigina that is considered to be an "imitation" and dates in the Transitional or Early Corinthian period: KRAIKER 1951, 78 nr. 487 pl. 36. For similar Corinthian *kotylai* and *kotylai-pyxides* with birds on the rim (black-figured or in silhouette) see KRAIKER 1951, 56 nr. 313, pl. 24, 70 nr. 422-423 pl. 32; AMYX 1988, 127 pl. 51, 1a-b (Royal Library Painter), 131 pl. 54, 3 (Restauri Painter); DEHL-VON KAENEL 1995, 252 note 528, 290 nr. 2421, pl. 53; IGNOGLIA 1999, 37, nr. 6-7, pl. 1, 6-7; 40 nr. 35, pl. 5, 35; 43 nr. 57, pl. 10, 57. Also from Corinth: STILLWELL, BENSON 1984, 82 nr. 368, 83 nr. 371, pl. 19; AMYX 1996, 15 nr. 40-41, pl. 10.

⁵ KRAIKER 1951, 78 nr. 487 calls them "ducks" (Enten); STILLWELL, BENSON 1984, 83 "perhaps herons". See also AMYX 1988, 669-70 ("swans"); IGNOGLIA 1999 names them variously: 37 "swans" (cigni), 40 "geese" (oche), 43 "little geese" (ocherelle).

⁶ As Corinthian migrant potters recognizes also NEEFT 1996, 282 (Kurashiki Painter, Piemonte Painter) for some "corinthianizing" *kotylai* from the Taras' region.

⁷ The "double-decker" *kotylai* with the bird frieze could be dated somewhat earlier (Early Corinthian phase).



Fig. 8 - Sherds of local imitations, Group C (phot. by E. Manakidou).

Group C: Local Imitations under Corinthian influence

Group C (fig. 8) refers to a category of fragments made of dirty brown clay with inclusions and large grain size. They are covered with brown firnis and they could generally be called “Corinthian imitations”. They are mostly small-sized *kotylai* and *exaleiptra* with simple linear decoration and occasionally animals in silhouette. They look like the Corinthian vases in shape and in the placement of the decorative motifs (vertical wavy lines or dots under the rim, rays in the lower part of the body, wide bands on the body). The decorative motifs are not very carefully rendered. They could be considered as “purely” local productions under an indirect influence of the Corinthian pottery imports⁸. Similar imitations of Corinthian ceramics, in terms of shape and with a limited-conventional decoration or undecorated, are known also from other areas related to Corinth (such as the Corinthian colonies and the Doric settlements)⁹ as well as from certain settlements in Macedonia (e.g. Akanthos and Mieza)¹⁰. The large quantity of this group coming from Karabournaki could be indicative for the existence of a local pottery workshop somewhere in this area.

Archaeological problems and questions

Everything that has been described so far regard the archaeological study and observation of the pottery material that resembles the production of the workshops in Corinth. In order to supplement and

⁸ For similar *kotylai* found in the cemetery in Karabournaki see PANTI 2008, 193–4.

⁹ In areas with a long tradition in the Corinthian pottery imports, such as the indigenous settlements and the colonies in Magna Grecia, the local imitations date back in the Protocorinthian period: MANAKIDOU forthcoming, note 33. They are found in different places and especially in southern Italy they continued until the Late Corinthian. A similar to ours case are the workshops of Taras (findings from the settlement and the cemeteries, and the sanctuaries in Saturo and Pizzone), and their “Corinthianizing” black-figured production: NEEFT 1996; ALESSIO 1996. From Francavilla Maritima: TOMAY ET ALII 1996. From Locri Epizefiri: MILANESIO 1996.

A different case is the Etruscan-Corinthian production that was manufactured in local Etruscan workshops imitating obviously Corinthian prototypes. In this case, however, there is not agreement for the provenance of the earlier potters (such as the Painter of the bearded Sphinx and the Painter of the colored frames): CRISTOFANI, MARTELLI 1987, 25–6; SZILAGYI 1992, 30 note 38, 107–8, 178.

For Corinthian imitations in Corfu and Rhodes: DONTAS 1968; ARCHONTIDOU, ARGYRI 1977; FARNSWORTH ET ALII 1977; PREKA, ALEXANDRI 1992.

¹⁰ PANTI 2008, 90–2, 256.

confirm the assumptions coming out the archaeological research, it has been employed the possibilities offered by the Archaeometry. The main axis of questions that were raised by the archaeologists to be answered by the Archaeometric study of the three groups, regard the following:

- Inspection of the homogeneity of the three groups for the confirmation of the archaeological categorization and identification as it was described above, based on elemental analysis
- Detection of any compositional differences between the three groups that could imply a different origin of the clay and possible clay relation between the three groups

For the archaeometric analysis were chosen to be examined 64 fragments, 22 from group A, 20 from group B and 22 from group C.

Experimental part

Method

Micro-XRF measurements were performed directly on the clay of the profiles of the ceramics, after simple cleaning and careful removal of approximately 1 mm of the upper clay layer¹¹.

A compact portable instrument with a side-window x-ray tube with Mo anode (Series 5011, Oxford Instruments) and tube voltage/current of 35 kV/0.9mA was used. The x-ray optics include a straight mono capillary. The detection of the fluorescence x-rays is performed by a solid state Si(Li), Peltier-cooled detector, oriented at 90° relative to the micro beam. The nominal beam size is ~150µm. The time of measurement was 300s per spot. Three different spots were measured and analyzed for each sample (=fragment) and the average composition was used in the subsequent study.

The µ-XRF data were interpreted with suitable multivariate statistical exploratory tools such as Principal Component Analysis (PCA), Cluster Analysis (CA) and Discriminant analysis (DA)¹².

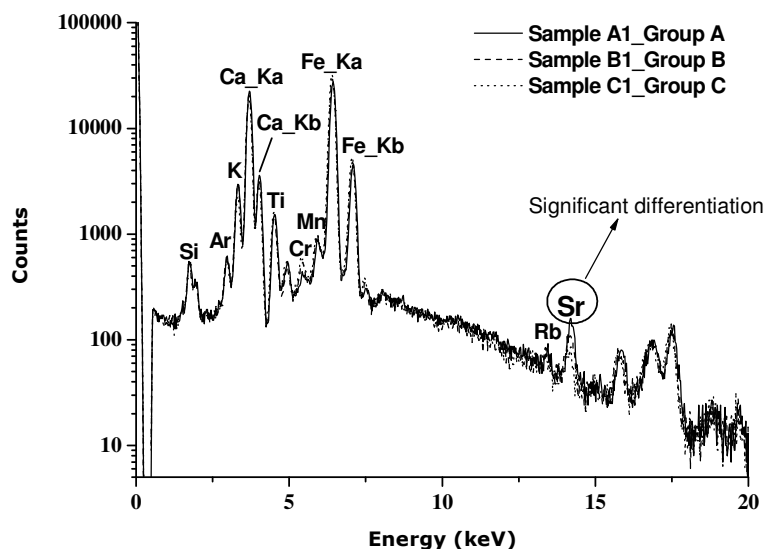


Fig. 9 - XRF spectra of samples A1, B1 and C1.

Results and discussion

All samples of the three groups seem to have similar qualitative composition as seen in figure 9.

The main elements presented are silica (Si), calcium (Ca), iron (Fe), potassium (K) and titanium (Ti), while secondary and trace elements are chromium (Cr), manganese (Mn), rubidium (Rb) and strontium (Sr).

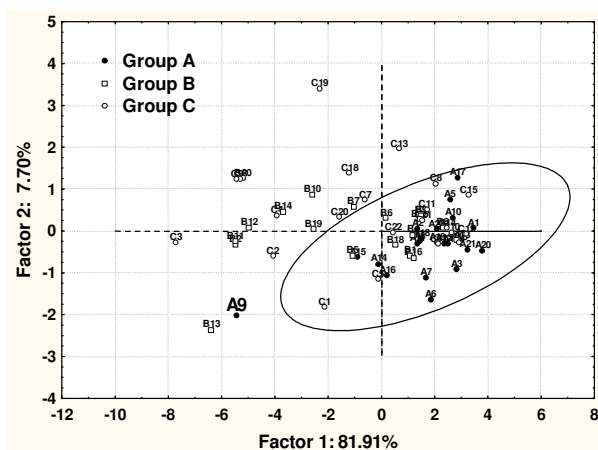


Fig. 10 - Principal Component scores for the three groups, presenting the discrimination of the samples.

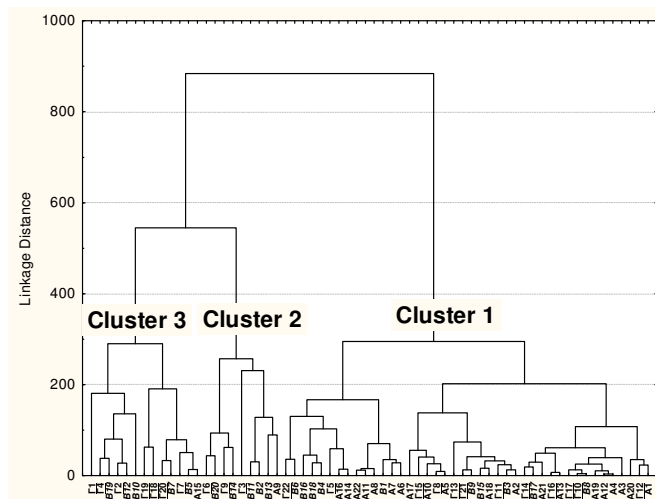


Fig. 11 - Hierarchical tree, clustering the samples using all elements as variables, complete linkage and Euclidian distances.

Therefore, qualitatively a common composition is observed. However, quantitatively, a rather significant differentiation concerning strontium (Sr) is shown, while the other elements are present in similar amounts. In similar cases, differentiation between samples belonging to different groups is rather difficult and not easily demonstrated. As M.I. Dias and M. I. Prudêncio¹¹ report, a useful tool to magnify any existed geological difference between archaeological groups is the normalization of the chemical content relatively to a geochemically conservative element. Strontium (Sr) as scandium (Sc) is an element which is lithogenic and shows very good stability and conservative behavior in weathering even in superficial environments¹². In a simple way, normalization in relation to a reference element is accomplished by dividing all concentrations with the concentration of the reference material, in this case strontium (i.e. $\%W/W_{\text{element}} / \%W/W_{\text{Sr}}$). The resulting ratios can then be statistically treated in order to observe any possible differentiation. In figure 10 the Principal Component Analysis (PCA) results of the normalized data are presented.

A rather good homogeneity for group A compared to the other groups is observed with the exception of sample A9 which is excluded from the 95% confidence level ellipse. This indicates that the group A samples that are claimed to be imported from Corinth have similar chemical concentration. Sample A9, should be re-examined archaeologically for the possibility to belong to a different group (primarily group B). Groups B and C on the other hand, exhibit higher variation than group A, suggesting significant chemical differences. Archaeologically this can be attributed to the fact that the provenance of group B is uncertain thus some of the samples could be manufactured around Corinth (i.e. those included in the group A ellipse, namely samples B1, B3, B4, B5, B6, B8, B9, B15, B16, B17, B18) and others could be manufactured somewhere else. Similarly, group C is claimed that is manufactured in the general area around Thermaic gulf, thus geological differences in the clay is possible. All samples of group B and C that are included in the ellipse of group A should be archaeologically re-examined for their possible Corinthian origin.

Three distinctive clusters are observed. Almost all of the Corinthian samples (group A) are included in cluster 1, with the exception of samples A9 and A15 which belong to cluster 2 and 3 respectively. Certain samples from the groups B and C (namely the B1, B3, B4, B6, B8, B9, B15, B16, B17, B18, C1, C5, C8, C10, C11, C12, C15, C16, C17, C21, and C22) are also included in cluster 1. The other two clusters contain

¹¹ PAPADOPOULOU *ET ALII*, 2006, 1692–1699.

¹² DIAS and PRUDENCIO 2008, 136–141; JANSSENS *ET ALII*, 2000; MANLY 2005; MARQUES 2007.

each samples from both groups B and C indicating a significant variation apparently due to their different origin.

Discriminant analysis of the studied material confirms quantitatively the findings of PCA and Cluster analysis. In table 1, is shown that the overall archaeological classification is confirmed to a level of 73.43%.

Table 1 - Discriminant analysis of the archaeological material

group	percent correct	A p=0.3333	B p=0.3333	C p=0.3333
A	86.36	19	3	0
B	60.00	6	12	2
C	72.72	3	3	16
Total	73.43	28	18	18

Group A shows the greater confirmation (86.36%), followed by Group C (72.72%) and Group B (60%). Group C shows greater confirmation compared to Group B possibly due to its narrower geographical provenance, according to the archaeological information. Three samples of Group A (A2, A9, A17) seem to belong to Group B, six samples of Group B (B4, B5, B9, B16, B17, B18) seem to belong to Group A, while two of them (B8, B15) seem to belong to Group C. Finally, three samples of Group C (C2, C3, C6) seem to belong to Group A and another three of them (C10, C12, C17) seem to belong to Group B. A notable observation is that none from group A samples (Corinthian samples) seem to belong to group C (domestic samples from Thermaic gulf area) and only three samples from the group C could possibly belong to group A.

These observations strongly suggest a different origin of group A and the majority of the samples of group C. Sample C2, C3 and C6 could be Corinthian in origin although the archaeological observation suggests otherwise. The same stands for samples B4, B5, B9, B16, B17, and B18 which also appear to be Corinthian in origin.

On the other hand, sample A9 most probably is not Corinthian, and this could also be the case for samples A2 and A17. Two samples from group B (B8 and B15) seem to be of the same origin as group C (presumably the area of the Thermaic gulf), while samples C10, C12 and C17 appear to have an origin rather similar to this of group B.

The discrimination of the samples can also be demonstrated by cluster analysis as shown in figure 11. The above exceptions, revealed by the archaeometric analysis, could be re-examined by archaeological means in order to evaluate the possibility of different categorization.

Conclusions

The archaeometric analysis and the statistical treatment of the examined samples indicate that the fragments belong at least to three groups. The Corinthian samples (Group A) show the greater homogeneity (86-90%), confirming the archaeological claim that they belong to a group of objects which were probably manufactured somewhere around Corinth. This homogeneity of Group A also indicates that the Corinthian imports are clearly distinguished from the other two groups.

Homogeneity to a certain extent was shown also in Group C (72.72%) and Group B (60%), confirming the archaeological distinction among the various groups. The lower confirmation levels exhibit by those two groups can be attributed to their uncertain origin especially for group B. Six samples from group B seem to be Corinthian and two imitations similar to group C, while the remaining of the group B belong to the Corinthian type pottery as it has been archaeologically described in *Group B*. From group C three of the samples seem to be Corinthian, so all the other samples of this group are considered as imitations as it has been archaeologically describe in *Group C*. The exceptions that have been revealed by the statistical study of the material should be archaeologically re-examined for any possible classification to a different group.

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