On the Ephesian Origin of Greco Scritto Marble
D. Attanasio, A.B. Yavuz, M. Bruno, J.J. Herrmann Jr., R.H. Tykot and A. van den Hoek

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ON THE EPHESIAN ORIGIN OF GRECO SCRITTO MARBLE

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Abstract
A new, massive source of greco scritto marble, the Hasançavuslar quarries near Ephesos, is reported and shown to be isotopically quite distinct from Cap de Garde, the Algerian marble site traditionally considered to be the main source of greco scritto. Isotopic and EPR analyses carried out on 58 artifacts from North Africa, Italy and Asia Minor demonstrate that all the true greco scritto samples (36 artifacts) come from the newly discovered site. The remaining 22 samples are related veined varieties originating from different sites including Hasançavuslar (45%), Cap de Garde (23%) and other not identified marble quarries (32%). It is suggested that Hasançavuslar was the major, if not unique, source of the greco scritto marble actually used in antiquity.

Keywords
Greco scritto, marble provenance, Ephesos, Hasançavuslar, Cap de Garde, isotopes, EPR.

Introduction

Greco scritto is a medium to coarse, white to gray marble bearing numerous thin, convoluted dark veins, which are in some way reminiscent of unintelligible writing and explain the name given to this marble by the Italian marble collector Francesco Belli in the mid 19th century (Belli 1842, 17 no. 86). Although not among the most prized marbles greco scritto was widely used in Rome, southern Italy and North Africa from the end of the 1st century AD till at least the 4th century for wall and floor revetments, columns, capitals and other architerctural elements, mostly found in private contexts (Borghini 2001, 237; Pensabene 2002, 220). Greco scritto was also common in Asia Minor, a fact that has generally been overlooked but was a crucial starting point for this work.

The problem of the source or sources of greco scritto seemed to have been solved long ago but has again become controversial. In 1971 Raniero Gnoli pointed out the strong similarity of greco scritto with the marbles quarried at Cap de Garde near the ancient Hippo Regius, modern Annaba, Algeria (Gnoli 1971, 225). Soon thereafter additional work (Pensabene 1976) reinforced this observation and in the following decades the Cap de Garde quarries were almost universally regarded as the sole source of greco scritto marble despite doubts cast by some authors (Mielsch 1985; Lazzarini and Sangati 2004). Recently, however, Antonelli and co-workers carried out detailed archaeometric studies at Cap de Garde and on many greco scritto artifacts collected in North Africa (Antonelli *et al.* 2009) and concluded that most of the archaeological samples they tested did not belong to the Cap de Garde quarries. These authors suggested that the results reinforced their previous hypothesis on the multiple origins of greco scritto. They proposed that the marble could have been extracted from a variety of sites, including additional quarries in the region of Annaba as well as elsewhere in North Africa.

The new quarries reported here, however, lie in a totally different region and seem to be the most important, if not the only, source of "true" greco scritto marble. As in other cases terminology may have contributed to the complication. Greco scritto is basically a kind of veined marble, and, although its most typical varieties are easily identified by eye, it is not always easy to draw a clear boundary between "true" or "classic" greco scritto and other, less typical veined, spotted, or banded varieties, often present in the same quarries and given the same name.

Since a clear nomenclature that can characterize the lithotype and its macroscopic appearance exactly and univocally is crucial in marble studies, the possible misapplication of the term greco scritto should be carefully considered when attempting to provenance marble artifacts.

Greco scritto was commonly used not only at Ephesos, where it is present as columns and wall revetments in the Terrace Houses and other places in the city, but also in other minor archaeological sites of the region. At Metropolis, a small Hellenistic and Roman city and an important trading post on the road from Smyrna to Ephesos, there are various examples, most notably in the floor of the Odeion, which is entirely covered with typical slabs of greco scritto. It is unlikely that marble from distant sources was imported into this small city located in the middle of a marble-rich area. Information obtained at Metropolis has, in fact, indicated that the greco scritto used there may have come from the quarries near Hasançavuslar, a village located approximately 21 km NE of Ephesos. Long ago Marc Waelkens briefly noted the existence of the largest Hasançavuslar quarry and observed that its marble was used at Ephesos, without identifying it as greco scritto (Waelkens 1986, 113). Discussion of the quarry, however, was not pursued further. The site has remained virtually unknown and its marbles have never been characterized.

Hasançavuslar includes several quarries, which produced not only greco scritto but also white, dark gray and variously spotted varieties of marble. It is part of the wider Ephesos marble site, and some preliminary data have already been included in a recent update of the Ephesos database (Yavuz *et al.* 2011).

In connection with the greco scritto issue, the Cap de Garde marble quarries were also surveyed and sampled, a work carried out by J. Herrmann, R. Tykot and A. van den Hoek within the framework of a wider project on the ancient marbles of Algeria reported elsewhere in this volume (Hermann *et al.* 2012). Our study also presents also the data of 58 archaeological samples, which are primarily from North Africa, but also from Italy and Asia Minor and include not only typical greco scritto but also various other banded or spotted marbles in some respects similar to it. The aim is that to discriminate clearly between greco scritto and other visually comparable marbles, trying, at the same time, to obtain conclusive evidence of their provenance.

Quarry sites and sampling

The Hasançavuslar marble site

The Hasançavuslar marble quarries are grouped into three districts named Hasançavuslar East (HCE), Hasançavuslar West (HCW) and Zimparà. HCE is found 1.5 km north of the village immediately to the east of the road that leads from Hasançavuslar to Aya Klıkiri (Fig. 1). The first quarry encountered on entering HCE is a modern excavation site that produced a low quality, heavily veined bluish stone mostly used to obtain lime as shown by the presence of several large kilns. The largest greco scritto quarry of the district, HCE1, is found a few hundred metres to the north (Fig. 2). Like all other quarries at Hasançavuslar, HCE1 is abandoned and beautifully preserved. Ancient working traces, piles of marble débris, and unfinished items, such as the two blocks still on the bedrock shown in Fig. 2, are common. The working front is approximately 130 m long, 20 m high and 25 m deep, corresponding to a total volume of extracted material of well over 50000 m^3. Further into the quarry the typical greco scritto stone present in the outer part becomes progressively darker and more heavily veined, eventually changing to a marble closely resembling bigio antico, as shown by the samples of Fig. 3. In the neighborhood of HCE1 are several other quarries, both smaller and larger, that produce mostly white marble and limited amounts of greco scritto. Three quarries were sampled, the most notable of which is certainly HCE4, a huge pit roughly 200 m wide and 20 m deep, corresponding to a total volume of more than 500000 m^3.

The western Hasançavuslar quarrying district is located approximately 2.5 km west of the village and includes several quarries that produced greco scritto marble almost exclusively. Finally the two Zimparà quarries, which were brought to our attention by Walter Prochaska, are on top of a hill almost 5 km SW of Hasançavuslar and only 2.5 km NE of the Belevi quarry. HCW1, the main quarry of the western district, is only slightly smaller than HCE1 and produced similar marbles. The two Zimparà quarries are pit quarries of smaller size with an estimated total volume not larger than 20000 m^3.

84 marble samples were collected at Hasançavuslar including 62 samples from seven greco scritto quarries and 22 samples from predominantly white marble quar-

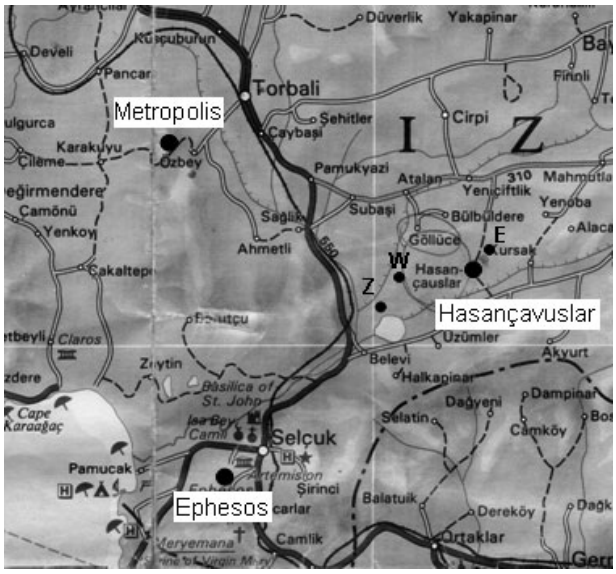

Fig. 1. Location map of Hasançavuslar and the quarry site. E, W, and Z are the eastern, western and Zimparà districts, respectively.

Fig. 2. General view of quarry HCE1 at Hasançavuslar and detail of the quarry wall showing in the centre two marble blocks ready to be cut from the bedrock.

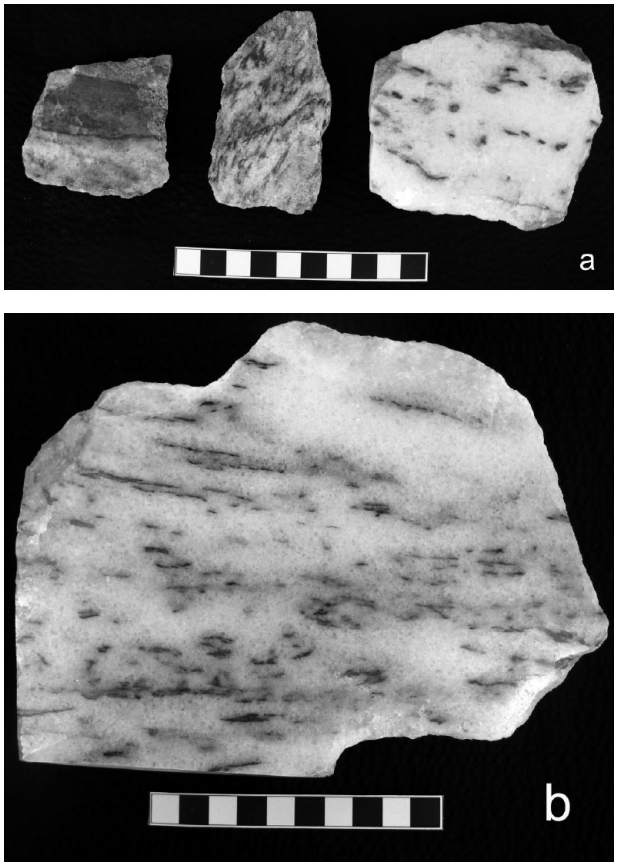

Fig. 3. Hasançavuslar marble samples: eastern district (a); Zimparà (b).

ries. The data of Table 1 underline some variability of the marble properties, nevertheless, taken as a whole, the greco scritto samples, differ appreciably from the white Hasançavuslar samples in terms of isotopic values. The differences between the Hasançavuslar greco scritto samples and the samples from the Cap de Garde site are even more pronounced and concern isotopes as well as other marble properties.

The Cap de Garde marble site

As already reported by Pensabene (1976) and more recently by Antonelli *et al.* (2009) the extensive use of explosives during the quarrying activities carried out at Cap de Garde in the last century has almost competely obliterated the ancient site located on the tip of the small peninsula north-west of Annaba. The presence of military installations makes direct observation of the few remains even more difficult. What is visible now are a few small ancient quarry faces and piles of marble débris and chips scattered amid the marble outcrop and the rocky walls present on the promontory. Probably the most interesting outcome of the survey were the observations that only limited amounts of true greco scritto marbles (Fig. 4a) are present at Cap de Garde and that striated or banded marble varieties are much more common (Fig. 4b).

A total of 25 marble samples, which included all the different marble varieties present in the site, was collected from both ancient and modern quarry faces and. Despite this, all the samples turned out to be analytically homogeneous and no systematic differences were found between the different varieties or between the samples from ancient and modern fronts.

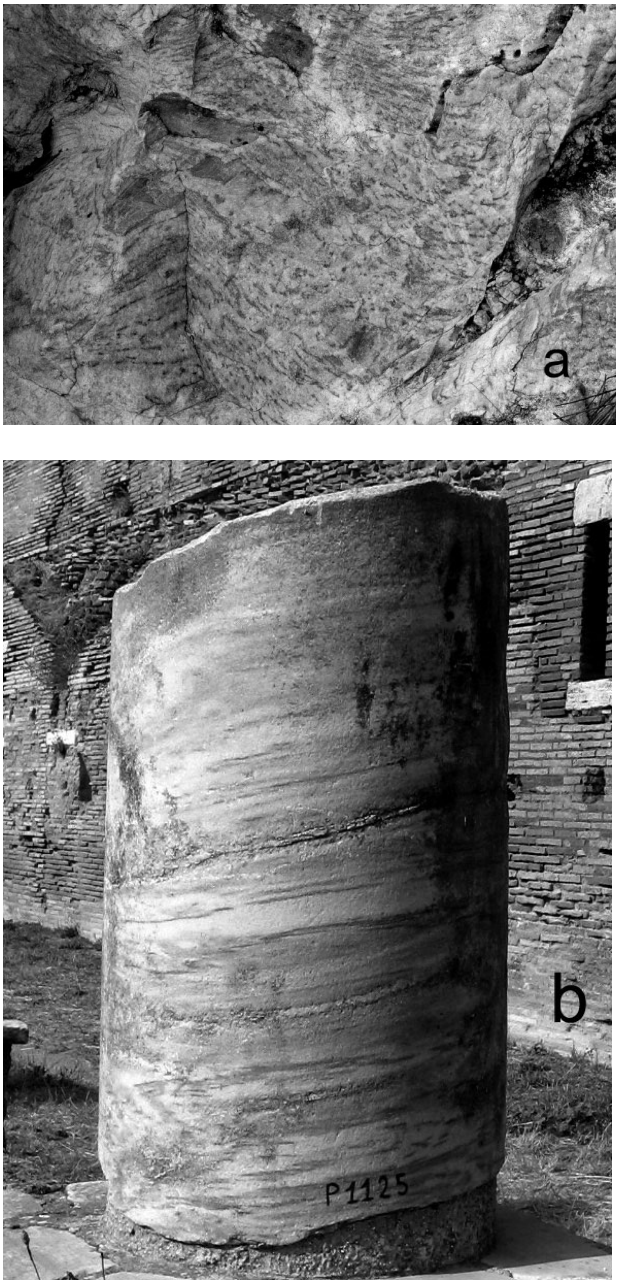

Fig. 4. Cap de Garde marble samples: outcrop of greco scritto (a); column shaft at Ostia made of the typical Cap de Garde banded variety (b).

Site discrimination

The graph of Fig. 5 shows that the Cap de Garde and Hasançavuslar sites are easily distinguished simply on the basis of their isotopic values. The Cap de Garde results presented here compare favourably with the data reported recently by Antonelli and coworkers (Antonelli

Quarry		Lat N	Long E	$\delta^{18}O$	$\delta^{13}C$	MGS	Intens	Linewidth	Color
HCE1, GS	19	38.07214	27.53968	-6.1 1.6	1.6 0.8	1.68 0.5	0.534 0.6	0.573 0.08	135 37
HCE2, white	5	38.07105	27.53039	-3.2 0.7	4.2 0.2	1.70 0.2	0.254 0.09	0.505 0.04	201 6
HCE3, white	5	38.07064	27.53362	-4.8 2.0	3.8 0.7	1.78 0.3	0.461 0.2	0.551 0.08	200 9
HCE4, white	12	38.07189	27.53699	-3.9 1.4	4.1 0.7	1.83 0.3	0.470 0.16	0.546 0.06	194 11
HCW1, GS	19	38.06656	27.49798	-4.7 1.2	2.2 0.3	1.82 0.4	0.765 0.5	0.562 0.05	149 24
HCW2, GS	2	38.06734	27.49938	-7.1 1.7	2.1 0.15	1.55 0.2	1.271 0.2	0.638 0.05	155 6
HCW3, GS	2	38.06834	27.50092	-6.9 2.0	0.1 2.4	2.10 0.2	0.133 0.03	0.548 0.06	193 4
HCW4, GS	4	38.06947	27.50179	-5.6 1.3	0.8 3.0	1.69 0.7	0.809 0.7	0.539 0.06	133 45
Zimparà1, GS	9	38.05099	27.47213	-6.4 0.5	2.3 0.1	1.98 0.5	0.206 0.14	0.499 0.02	140 34
Zimparà2, GS	7	38.05192	27.47213	-7.9 1.0	1.8 0.9	1.45 0.5	2.256 1.7	0.660 0.2	146 35
Total typical GS	62			-6.0 1.6	1.8 1.2	1.75 0.5	0.782 0.9	0.566 0.09	143 34
Total white	22			-4.0 1.5	4.0 0.6	1.79 0.4	0.419 0.2	0.538 0.06	197 10
Cap de Garde	25			-10.7 2.0	3.5 0.8	2.08 0.6	2.054 2.4	0.671 0.10	142 26

Table 1. Details of the sampling carried out in the Hasançavuslar and Cap de Garde quarries together with average values and standard deviations (second row) of the most important discriminant variables.

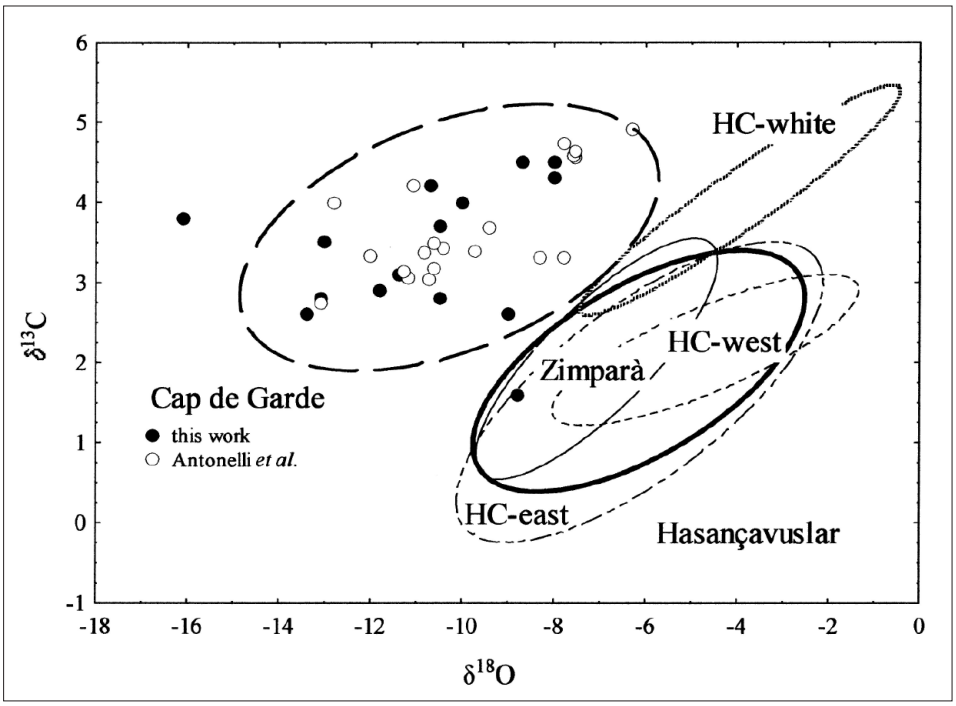

Fig. 5. Cap de Garde and Hasançavuslar isotopic fields. The Cap de Garde ellipse (90%) is drawn using all available samples (this work and Antonelli *et al.* 2009). In the case of Hasançavuslar both the overall (bold line) and the single district ellipses are shown.

et al. 2009) and for this reason the two data sets have been merged to obtain a more accurate source field represented, as usual, with a 90% probability ellipse. Full isotopic discrimination is also possible for the white marbles quarried at Hasançavuslar which exhibit a rather different isotopic signature with respect to the greco scritto or veined varieties quarried in the same site or at Cap de Garde. The quantitative result is that 96.7% of the quarry samples can be correctly reassigned to their provenance sites simply by using isotopic data. Including additional variables slightly increases the performance, but does not change the overall result or the assignment of the archaeological samples and was, therefore, deemed to be unimportant.

The high level of discrimination between the three groups nicely corresponds to the different visual appearance of their marbles. Leaving aside the white marbles it must be recalled that most of the Hasançavuslar samples are typical greco scritto marbles, whereas the most common variety quarried at Cap de Garde is the very different banded marble shown in Fig. 4b. The three Hasançavuslar districts, however, are not easily distinguished. The level of discrimination is 67% using only isotopes and can reach 82% by including additional variables in the analysis. Considering that only three groups are taken into account, even this latter value is not fully satisfactory.

Fig. 6 compares the marbles under investigation with several other Mediterranean white marbles of similar grain size and gives some perspective on the recently proposed hypothesis of multiple origins for greco scritto. The isotopic data suggest that the Cap de Garde marbles, owing to their highly negative oxygen values and positive carbon values, are virtually unmistakable. Some superposition exists with the marbles quarried at Apollonas (Naxos) which, however, are usually much coarser. Discrimination of the Hasançavuslar marbles appears to be much more problematic. Extensive superposition exists with other Naxos quarries and with the marbles of the Aphrodisias city quarries and limited superpositions occur with several other marbles sites. Detailed calculations have not been attempted, but it is likely that these problems can be reduced although not fully solved, by taking into account EPR and other marble properties.

In the present case, however, using the data without taking into account the macroscopic appearance of the marbles would be unwise and might lead to comparing marbles which are completely different optically. In the case of the Cap de Garde marbles, data is of primary importance because more-or-less similarly banded white and grey marbles are commonly present in several other marble sites, making analytical discrimination indispensable. On the other hand the discrimination difficulties presented by the Hasançavuslar site are of little relevance because so far significant amounts of typical greco scritto marble have not been found outside Hasançavuslar or Cap de Garde.

The provenance of archaeological samples

The 58 marble samples discussed in this section were collected within the framework of different marble projects, and this explains their disparate and to some extent unbalanced geographic representation. Most of them come from North Africa (29 from Leptis Magna, 1

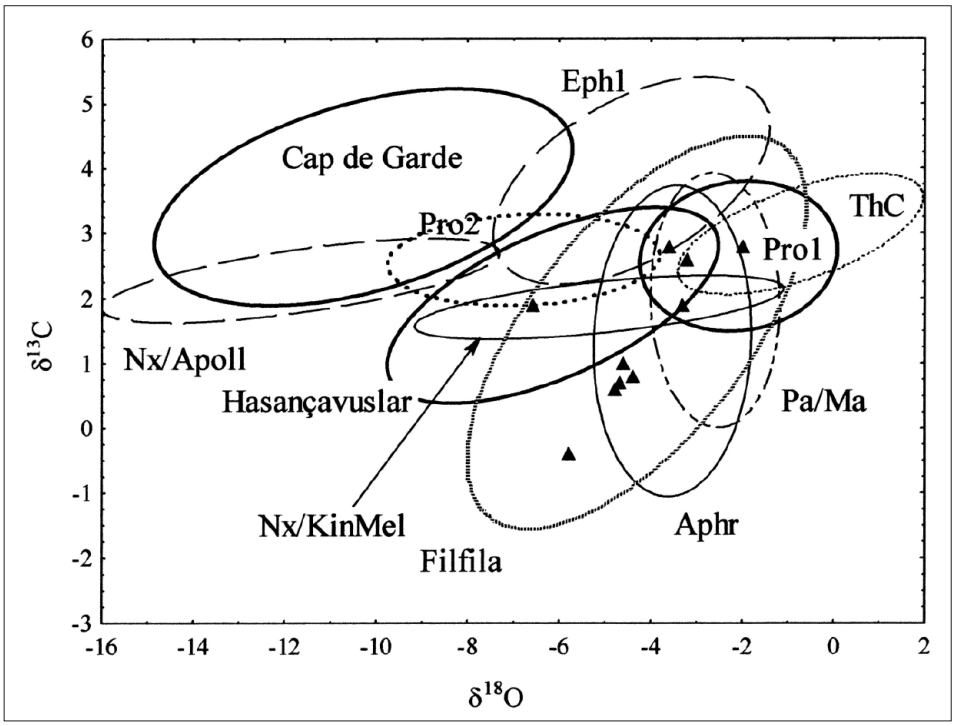

Fig. 6. The Cap de Garde and Hasançavuslar isotopic fields in comparison with other medium to coarse white marble sites: Aphrodisias (Aphr), Ephesos-1 (Eph1), Filfila (Filfila), Naxos/Apollonas (Nx/Apoll), Naxos/Kinidaros-Melanes (Nx/KinMel), Paros/Marathi non-*lychnitic* (Pa/Ma), Proconnesos 1 (Pro1); Proconnesos 2 (Pro2), Thasos calcitic (ThC).

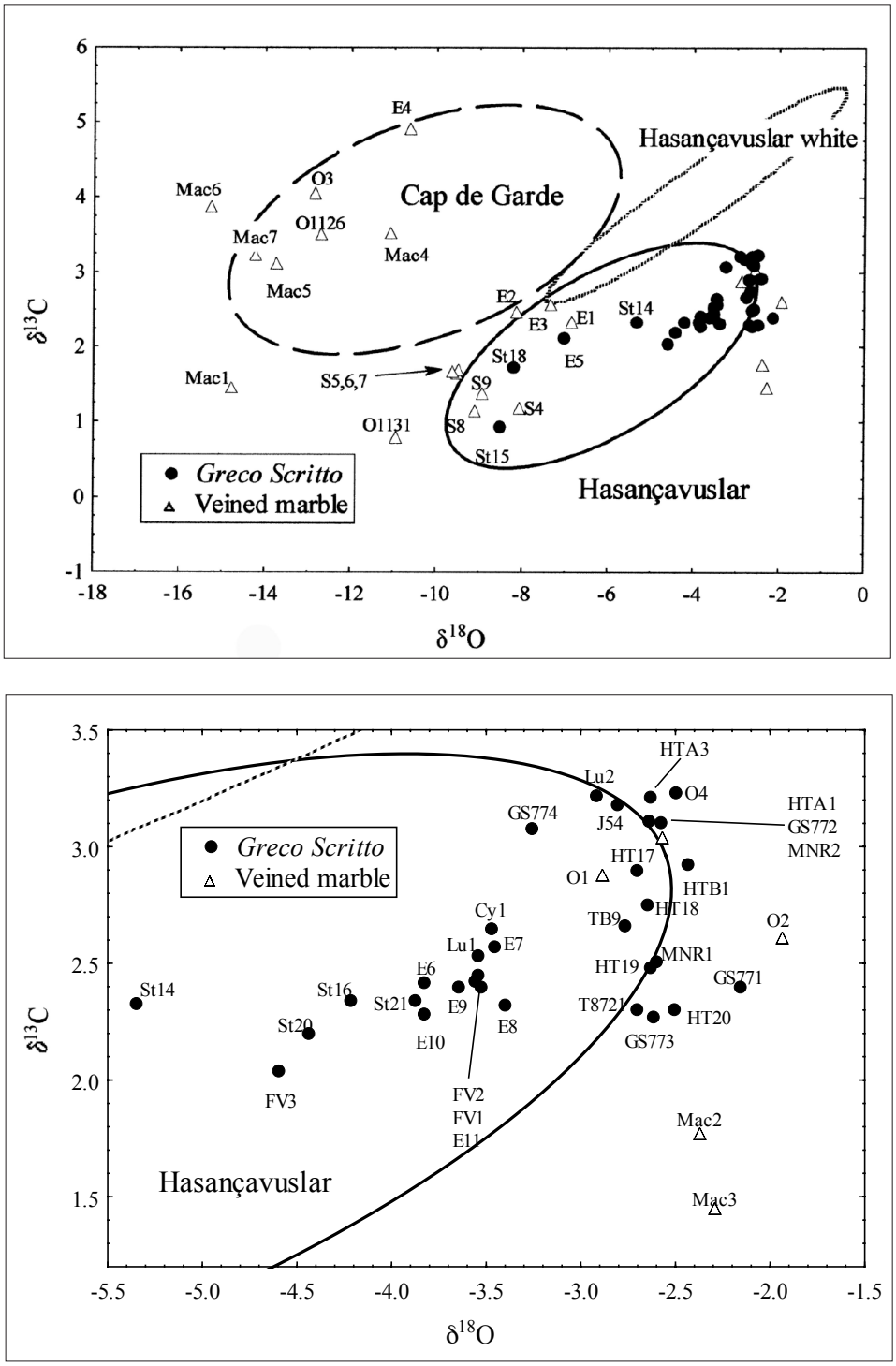

Fig. 7. Isotopic data (general and magnified presentation) of the 58 archaeological artifacts analysed in this study.

each from Cyrene and Tolmeita, in the Libyan Pentapolis, and 1 from Sidi Marzouk Tounsi in Tunisia), others from Rome, Ostia and Ephesos (9, 6 and 11, respectively). 36 samples are typical greco scritto marbles, whereas the remaining 22 are quite different and are generically termed "veined" in Table 2 where the most important properties of all samples and their provenances are listed. Graphic presentation of the results is given in Fig. 7.

The probability values have been calculated by discriminant function analysis using only the two isotopic variables and following a procedure described in detail elsewhere (Attanasio *et al.* 2006, 213-258). The high values of the relative probabilities[1] are not especially informative: the three groups taken into account are quite different and, for most samples, the closest or most probable group can be easily and unambiguously identified.

1. This is the probability that the sample belongs to some group, within the assumption that it originates from one of the groups in the selection. Values below 60% indicate that the assignment is in doubt between two or more groups.

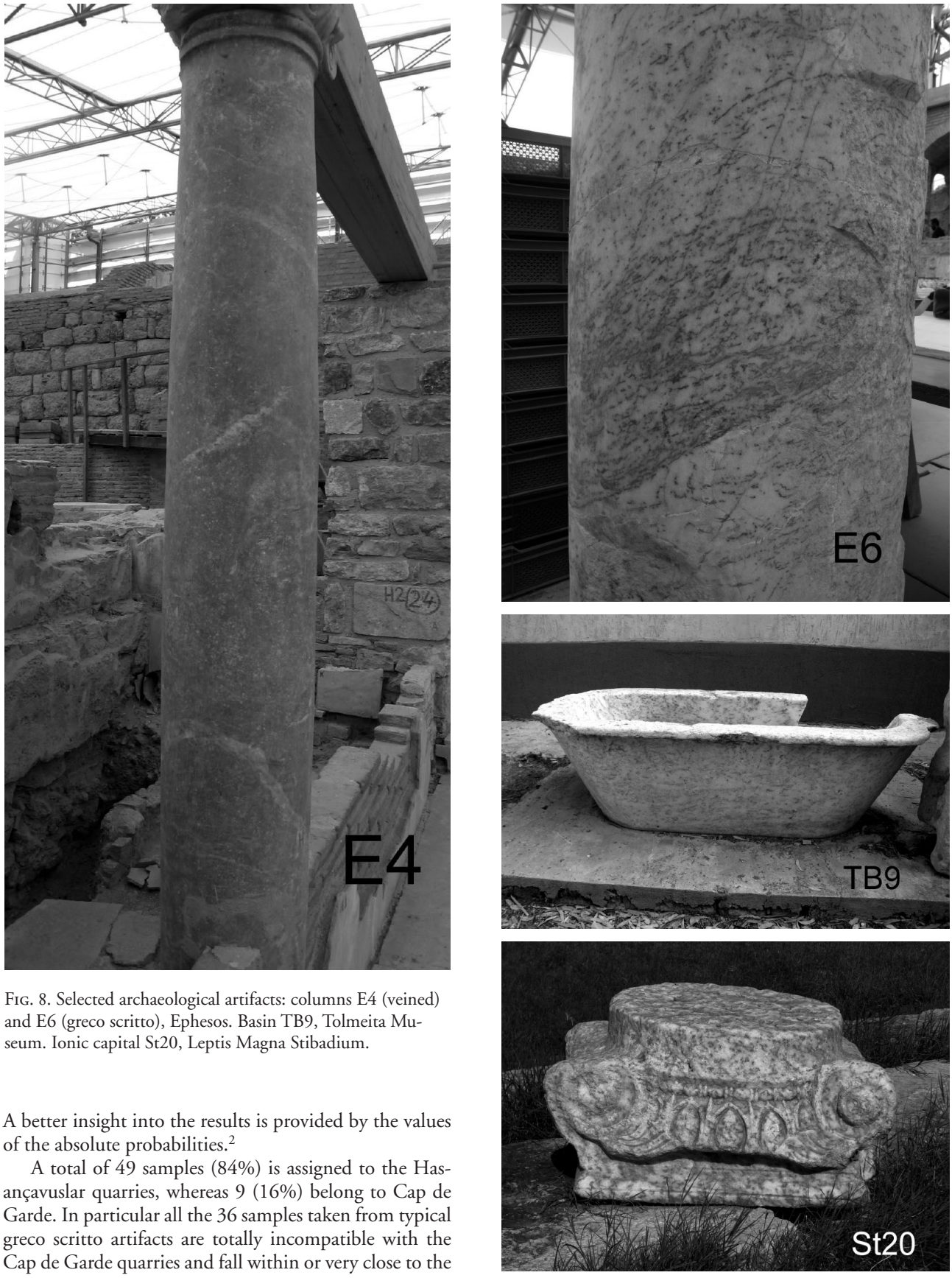

Fig. 8. Selected archaeological artifacts: columns E4 (veined) and E6 (greco scritto), Ephesos. Basin TB9, Tolmeita Museum. Ionic capital St20, Leptis Magna Stibadium.

A better insight into the results is provided by the values of the absolute probabilities.[2]

A total of 49 samples (84%) is assigned to the Hasançavuslar quarries, whereas 9 (16%) belong to Cap de Garde. In particular all the 36 samples taken from typical greco scritto artifacts are totally incompatible with the Cap de Garde quarries and fall within or very close to the

2. This is a distance-dependent parameter measuring in absolute terms the probability that the sample belongs to the chosen group and is a typical representative of the group properties. Values below 10%, corresponding to data points on the edge of the probability ellipse, indicate anomalous samples (outliers) or samples possibly not belonging to any group in the selection.

Label	Location and Description	Type	$\delta^{18}O$ ‰	$\delta^{13}C$ ‰	EPR intensity	MGS mm	Site	Rel. Prob.	Abs. Prob
E1	Ephesos, Hanghaus, column	Veined	-6.9	2.3	0.6759	2.50	HC	93	46
E2	Ephesos, Hanghaus, column	Veined	-8.1	2.5	0.2774	1.30	HC	71	6
E3	Ephesos, Hanghaus, column	Veined	-7.3	2.6	0.9945	1.20	HC	71	14
E4	*Ephesos, Hanghaus, column*	*Veined*	*-10.6*	*4.9*	*0.3287*	*1.30*	*CdG*	*100*	*5*
E5	Ephesos, Hanghaus, column	GS	-7.0	2.1	0.8817	1.20	HC	98	62
E6	Ephesos, Hanghaus, column	GS	-3.8	2.4	0.4143	1.40	HC	98	39
E7	Ephesos, Hanghaus, column	GS	-3.5	2.6	0.0524	1.70	HC	97	28
E8	Ephesos, Hanghaus, column	GS	-3.4	2.3	0.1291	2.20	HC	99	24
E9	Ephesos, Hanghaus, column	GS	-3.7	2.4	0.0832	1.20	HC	99	33
E10	Ephesos, Hanghaus, column	GS	-3.8	2.3	0.0967	1.70	HC	99	37
E11	Ephesos, Hanghaus, cornice,	GS	-3.5	2.4	0.2284	2.20	HC	99	29
St14	Leptis, Stibadium, column 14	GS	-5.4	2.3	0.1131	2.00	HC	97	80
St15	Leptis, Stibadium, column 15	GS	-8.5	0.9	0.4898	0.90	HC	100	27
St16	Leptis, Stibadium, column 16	GS	-4.2	2.3	0.2059	3.50	HC	99	52
St18	Leptis, Stibadium, column 18	GS	-8.2	1.7	6.8659	1.30	HC	100	40
St20	Leptis, Stibadium, capital 20	GS	-4.4	2.2	0.1921	1.30	HC	99	59
St21	Leptis, Stibadium, capital 21	GS	-3.9	2.3	0.1600	1.70	HC	99	40
HT17	Leptis Hadr. Th., column 17	GS	-2.7	2.9	0.0401	1.30	HC	86	12
HT18	Leptis Hadr. Th., column 18	GS	-2.7	2.8	0.5092	1.30	HC	94	12
HT19	Leptis Hadr. Th., column 19	GS	-2.6	2.5	0.4726	1.00	HC	99	10
HT20	Leptis Hadr. Th., column 20	GS	-2.5	2.3	0.1176	1.20	HC	100	7
HTA1	Leptis Hadr. Th., Slab A1	GS	-2.6	3.1	0.1160	1.40	HC	65	9
HTA3	Leptis Hadr. Th., Slab A3	GS	-2.6	3.2	0.0549	1.00	HC	50	7
HTB1	Leptis Hadr. Th., Slab B1	GS	-2.4	2.9	0.0385	0.90	HC	86	8
S4	Leptis Serapeion, column 4	Veined	-8.1	1.2	0.5435	1.40	HC	100	47
S5	Leptis Serapeion, column 5	Veined	-9.5	1.7	0.1998	1.60	HC	99	8
S6	Leptis Serapeion, column 6	Veined	-9.5	1.7	1.0953	1.00	HC	99	7
S7	Leptis Serapeion, column 7	Veined	-9.6	1.7	0.5347	0.90	HC	99	6
S8	Leptis Serapeion, column 8	Veined	-9.1	1.2	0.3010	1.40	HC	100	21
S9	Leptis Serapeion, column 9	Veined	-8.9	1.4	0.2698	1.75	HC	100	24
Mac1	*Leptis Macellum, column 1*	*Veined*	*-14.8*	*1.5*	*0.4785*	*2.50*	*CdG*	*100*	*1*
Mac2	*Leptis Macellum, column 2*	*Veined*	*-2.4*	*1.8*	*13.9111*	*1.70*	*HC*	*100*	*1*
Mac3	*Leptis Macellum, column 3*	*Veined*	*-2.3*	*1.5*	*0.2620*	*1.20*	*HC*	*100*	*0*
Mac4	Leptis Macellum, column 4	Veined	-11.1	3.5	0.0535	2.00	CdG	100	100
Mac5	Leptis Macellum, column 5	Veined	-13.7	3.1	1.4839	2.00	CdG	100	22
Mac6	*Leptis Macellum, column 6*	*Veined*	*-15.3*	*3.9*	*5.9264*	*2.30*	*CdG*	*100*	*0*
Mac7	Leptis Macellum, column 7	Veined	-14.2	3.2	3.3803	1.60	CdG	100	10
FV1	Leptis Old forum, column 1	GS	-3.6	2.4	6.7395	2.50	CdG	98	30
FV2	Leptis Old forum, column 2	GS	-3.6	2.5	0.0707	2.10	HC	98	30
FV3	Leptis Old forum, column 3	GS	-4.6	2.0	0.0614	1.60	HC	100	60

Cy1	Cyrene, Ain Hofra, slab	GS	-3.5	2.7	0.38295	1.25	HC	94	27
TB9	Tolmeita Museum, basin	GS	-2.8	2.7	0.0728	1.80	HC	96	13
T8721	Tunisia, Sidi Marzouk Tounsi	GS	-2.7	2.3	0.2224	0.75	HC	100	9
GS771	Rome, Quintili, floor slab	GS	-2.2	2.4	0.2489	1.00	HC	99	4
GS772	Rome, Quintili, floor slab	GS	-2.6	3.1	0.0991	1.60	HC	67	8
GS773	Rome, Quintili, floor slab	GS	-2.6	2.3	0.0398	1.40	HC	100	8
GS774	Rome, Quintili, floor slab	GS	-3.3	3.1	0.0829	1.35	HC	60	14
Lu1	Rome, Lucus Feroniae, slab	GS	-3.5	2.5	0.1929	2.50	HC	97	30
Lu2	Rome, Lucus Feroniae, slab	GS	-2.9	3.2	0.1461	1.30	HC	56	11
MNR1	Rome, Natl. Mus., column 1	GS	-2.6	2.5	0.7335	0.75	HC	99	10
MNR2	Rome, Natl. Mus., column 2	Veined	-2.6	3.0	0.4596	1.10	HC	74	9
J54	Rome, Diocletian Thermae	GS	-2.8	3.2	0.1304	1.70	HC	52	9
O1131	*Ostia, column 1131*	*Veined*	*-10.9*	*0.8*	*3.5006*	*2.50*	*CdG*	*100*	*2*
O1126	Ostia, column 1126	Veined	-12.7	3.5	3.6336	3.0	CdG	100	46
O1	Ostia, Caup. Alex. Helix, basin 1	GS	-2.9	2.9	0.6496	1.40	HC	86	14
O2	*Ostia, Porta Marina, column*	*Veined*	*-1.9*	*2.6*	*0.4815*	*1.70*	*HC*	*98*	*4*
O3	Ostia, Caup. Alex. Helix, basin 2	Veined	-12.9	4.0	2.0061	1.70	CdG	100	11
O4	Ostia, Domus Ninfeo, basin	GS	-2.5	3.2	0.2973	1.20	HC	51	6

Table 2. Analytical data and provenance of 58 archaeological samples from Rome, Ostia, Ephesos, Leptis Magna and other North African Roman cities. Depending on their macroscopic aspect the samples are classified as greco Scritto or veined marbles. Seven sample, whose provenance is statistically unreliable and, in fact, unknown are highlighted in italics.

boundaries of the data field for the Hasançavuslar source. Only sample GS771 turns out to be atypical and is difficult to assign on analytical basis. Several of the veined samples, on the other hand, seem to have originated in each of these sites (10 from Hasançavuslar and 5 from Cap de Garde), while others (7 samples or 32% of all the veined samples) are well outside their data fields and cannot be safely assigned to either site. They probably originate from other, known or unknown, marble quarries. To complete this brief analysis we may note that several greco scritto samples cluster near the border of the Hasançavuslar ellipse. This may suggest that the site has not yet been fully explored and that more greco scritto quarries may exist in the area.

In any case the conclusion is unequivocal: at present the Hasançavuslar quarries seem to be the only possible source site for true greco scritto marble, whereas related veined varieties may originate from a number of different quarries.

Generally, greco scritto or veined marbles tend to be used on an exclusive basis, and even when multiple provenances are possible, as in the case of veined marbles, the samples generally come from a single quarrying site. The 11 artifacts sampled at Ephesos, which include both greco scritto and veined marbles (7 and 4 samples, respectively), all originated from Hasançavuslar with the sole exception of the veined column E4, which fell within the Cap de Garde field. The Algerian provenance is obviously quite unlikely, but at present no alternative explanation exists, and the analytical result should be checked using a new sample. There is also a strong tendency to have consistent groups at Leptis Magna. This has been verified at the Stibadium (4 columns and 2 capitals made of greco scritto), the Serapeion (6 veined columns), and the Hadrianic thermae (4 greco scritto columns and 3 slabs); the marble of all of these artifacts comes from Hasançavuslar. The seven veined columns tested in the side hall close to the Macellum, however, are more problematic. Three of them, in fact, are undoubtdedly Cap de Garde marble, but the other four, which split into two groups with widely different isotopic values, cannot be reliably identified (note the low probabilty values in Table 2). One of the two groups, however, could also come from Cap de Garde, and the other is isotopically compatible with the nearby Algerian quarry of Filfila (see Herrmann *et al.* 2012). The Caupona of Alexander and Helix at Ostia (O1, O3) presents a clear case of mixed sources. While only one sample was taken from each side of the basin's veneering, the front of the basin (O1) consistently appears to be greco scritto, while the back (O3) seems to come from Cap de Garde. The arrangement may reflect differences in popularity and/or price.

Conclusions

The results discussed so far seem to demonstrate that greco scritto, a marble identified by the presence of

dark marks resembling unintelligible writing, originated from the newly reported quarries at Hasançavuslar near Ephesos and not from the Cap de Garde marble site in Algeria, as traditionally and almost universally thought. In contrast to this, related veined or banded marble varieties seem to have multiple provenances, which include Hasançavuslar, Cap de Garde, and, probably other sites. All the 36 greco scritto artifacts tested belong to the Hasançavuslar quarries, whereas 22 additional veined samples are split among Hasançavuslar (45%), Cap de Garde (23%), and other quarries that could not be identified (32%). Excluding *a priori* the possibility of alternative greco scritto provenances is, obviously, impossible. All the data presently available, however, strongly support the single provenance hypothesis and suggest that the name greco scritto should not be extended to related veined varieties.

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