

CHARACTERIZATION AND DISTRIBUTION OF MARBLE
FROM CAP DE GARDE AND MT. FILFILA, ALGERIA
J. J. Herrmann Jr., D. Attanasio, R. H. Tykot and A. van den Hoek

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CHARACTERIZATION AND DISTRIBUTION OF MARBLE FROM CAP DE GARDE AND MT. FILFILA, ALGERIA

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Abstract

Isotopic testing of samples from the quarries of white marbles on the coast in eastern Algeria makes it possible to give a preliminary characterization of the Filfila quarries and to separate them isotopically from the nearby quarries of Cap de Garde. Inspection and isotopic testing of artifacts from museums and sites in Algeria and elsewhere make it clear that architectural decoration was produced in marble from both quarries and was exported throughout the central Mediterranean, reaching Tunisia, western Libya, and central Italy. The most widespread product seems to have been vividly marked column shafts, primarily from Cap de Garde but also from Filfila. Other forms of architectural decoration, including capitals and plaques of streaked marble, were widely distributed as well. An early and unusual acanthus pillar in Cap de Garde or Filfila marble is carved in a rich Hellenistic style. In the 3rd century AD, capitals made of plain white marble from the two quarries closely follow designs seen in central Italy.

Keywords

Hippo Regius, Rusicade, Cap de Garde, Filfila, stable isotopes, Annaba, Skikda, Carthage, Ostia, Rome, capitals, column shafts.

Greco scritto and marble from Hippo Regius

The two main quarries of white marble in Algeria lie on or near the coast in the eastern part of the country. Close to the eastern frontier of the country are the quarries of Cap de Garde (Ras el Hamra), which lie near the ancient city of Hippo Regius and the modern city of Annaba. These quarries, which are no longer active, produced a coarse-grained marble, which frequently has gray markings. Not far to the west, near the city of Skikda, ancient Rusicade, rises Mount Filfila, whose quarries still produce marble that varies from pure white to solid dark gray and tends to have somewhat finer grain. In 1972 Cap de Garde took on considerable prominence, when Raniero Gnoli connected it with greco scritto, and it has been regarded as the source of this stone ever since (Gnoli 1971, 225, n. 1; Pensabene 1976; Marchei 1997a; Antonelli *et al.* 2009; Antonelli, Lazzarini and Cancelliere 2010). Greco scritto is the designation for a marble widely used in central Italy for marble revetments and pavements. It typically displays a tangle of twisting light- and dark-gray marks, which suggested the idea of unintelligible writing to marble workers of the past.

In 1976 Patrizio Pensabene visited the quarries of Cap de Garde and noticed the abundant use of marble from

the quarry at nearby Hippo Regius (Pensabene 1976). As he noted, columns at Hippo have conspicuous markings, which range from dense bluish gray diagonal or horizontal striations to widely spaced streaks and spots. On a visual basis, he cited such shafts in nearby cities in eastern Algeria and slabs as far away as Carthage in Tunisia.

Isotopic analysis: characterization of quarries

Scientific analysis has now come to the study of Algerian quarries. In 2009, Antonelli, Lazzarini, Cancelliere and Dessandier published the results of sampling in the quarries of Cap de Garde and compared them with samples of marble they considered to be greco scritto artifacts from across North Africa, from Libya to Morocco (Antonelli *et al.*, 2009; Antonelli, Lazzarini and Cancelliere 2010, 585-8). Their study confirmed that the grain of Cap de Garde marble was coarse, the maximum grain size (MGS) averaging from 3 to 3.5 mm. Their twenty quarry samples also produced a dense isotopic field. The artifacts, however, were spread over a much greater isotopic range, and the authors concluded that more than one quarry must have produced marble that could be considered greco scritto.

Through geographic exploration and multimethod analysis, Donato Attanasio *et al.* have shown that the true source of the most characteristic greco scritto is not Cap de Garde but the Hasançavuslar quarries near Ephesus (Attanasio *et al.*, 2012). If the marble with spotted markings of Cap de Garde can be classified as greco scritto at all, it should be considered "atypical". In our trips to Algeria since 2005, we have not seen the tangled, curling veins of typical or classic greco scritto. In revetment and blocks at Hippo, streaks and spots tend to be longer and flow smoothly in the same direction.

Since the paper by Antonelli *et al.*, we have conducted a program of systematic sampling in the quarries of Cap de Garde, and fourteen samples have been analyzed isotopically at the University of South Florida. Further EPR and petrographic analysis has been conducted on the samples at the Istituto per lo Studio della Materia at Rome (Attanasio *et al.* 2012, table 1). In large part, our results correspond to the isotopic field established by Antonelli *et al.*, but they also expand the field in the direction of negative values for $\delta^{13}\text{C}$ (Fig. 1). An outlier is even significantly more negative on the $\delta^{13}\text{C}$ axis. This enlarged field remains relatively distinct from that of other ancient white marbles. In our studies, MGS at Cap de Garde ranged from 2.0 to 4 mm. Theoretically Cap de Garde marble could be confused isotopically with that of Naxos/Apollonas, and there is a small overlap with Proconnesus 2 marble. Naxian marble, however,

is apparently unknown in the western Mediterranean after Classical Greek times, and Proconnesian marble tends to have finer grain. There is also a slight overlap of the isotopic fields of Cap de Garde and Pentelikon, but the differences in grain size, structure, and markings make for relatively easy distinction.

Recently an Italian team has studied the quarries on Mt. Filfila (Antonelli, Lazzarini and Cancelliere 2010, 589-594, figs. 12, b,c-14). We have also taken many samples from these large quarries. The results of our isotopic analyses at the University of South Florida are only partly

available, but at this point they describe an isotopic field adjacent to but separate from that of Cap de Garde (Fig. 1). Although it is highly variable, Filfila marble also tends to have smaller grain sizes than marble of Cap de Garde. Two-thirds of the samples that we have measured so far have a MGS of 1.5 mm. or less, but some areas of the quarries had values in the 2-4 mm. range, and occasionally samples had values far over that. Our measurements were taken on the samples themselves. This method takes a greater number of grains into consideration than do measurements on thin sections, and it can lead to higher

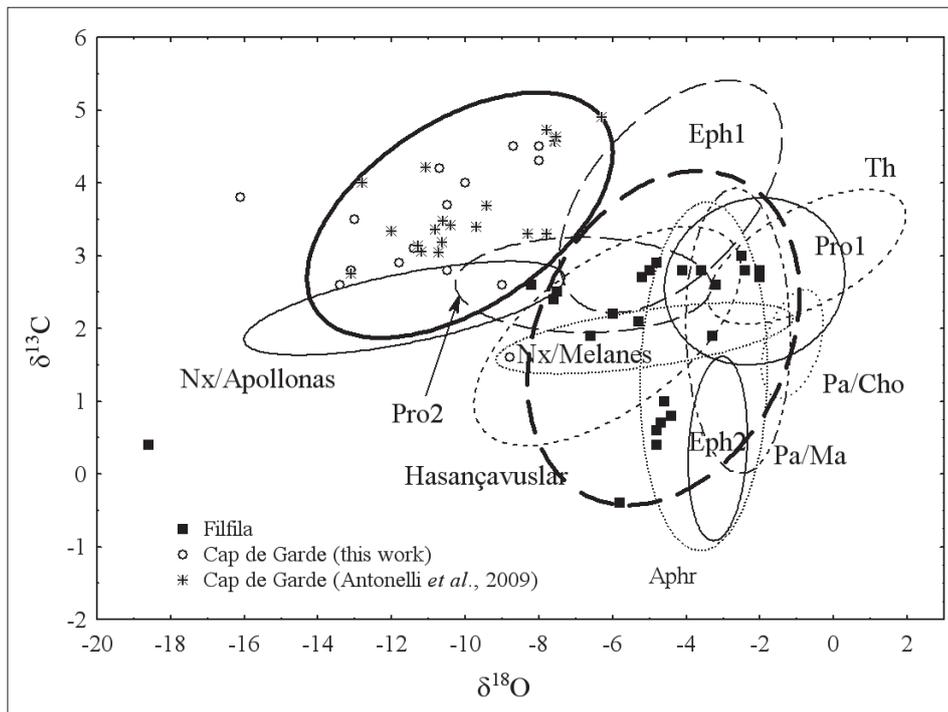


FIG. 1. Isotopic distribution of the Cap de Garde and Filfila quarry samples as compared to other medium- to coarse-grained white marbles. Key to abbreviations in all Tables and Figs.: Aphr = Aphrodisias; CG=Cap de Garde; Eph = Ephesos; F=Filfila; H = Hasançavuslar; Nx = Naxos; Pa/Ch = Paros 2 /Chorodaki/Lakkoi; Pa/Ma = Paros 1/ Marathi; Pe = Pentelikon; Pro = Proconnesos; Th = Thasos, Aliko. USF = Department of Anthropology, University of South Florida. ISM-CNR = Istituto di Struttua della Materia-Centro Nazionale delle Ricerche.

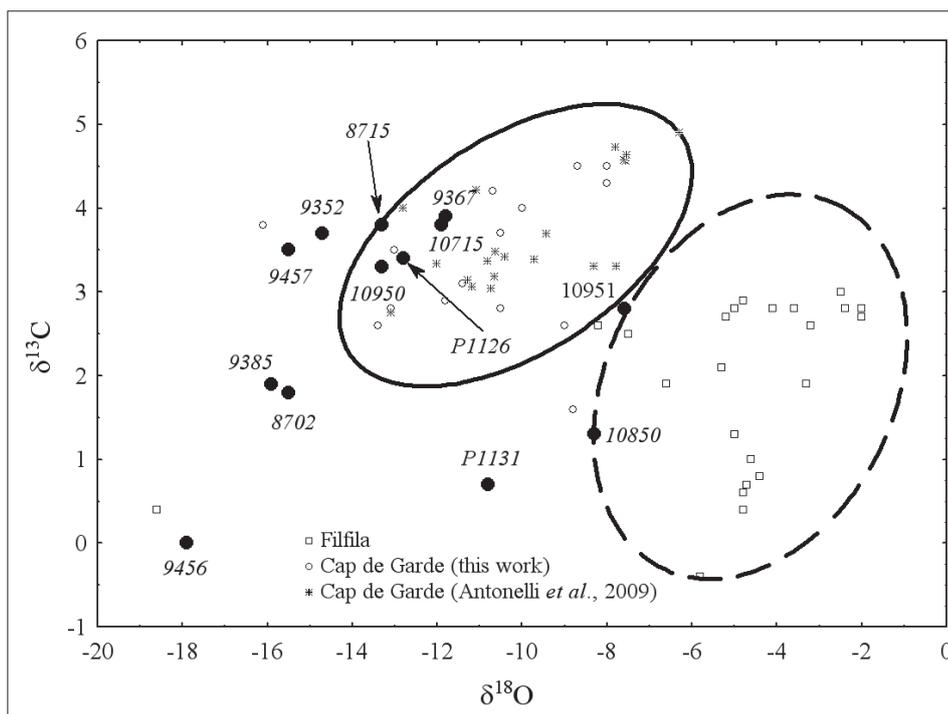


FIG. 2. Isotopic ratios of Cap de Garde and Filfila quarry samples and of column shafts listed in Table II. Two quarry outliers from Cap de Garde and Filfila respectively are shown at highly negative oxygen ratios but not used for drawing the 90% probability ellipses. The Cap de Garde ellipse takes into account the isotopic data reported in Antonelli *et al.* (2009). The Filfila ellipse does not include data from Antonelli *et al.* (2010).

values for mgs. The isotopic field for Filfila overlaps that of many of the main marbles of antiquity, and other criteria will be necessary in many cases to separate them. Petrographic analysis seems to be an effective tool for making the distinction (Antonelli, Lazzarini and Cancelliere 2010, 588, fig. 14b).

Isotopic analysis: column shafts

As noted above, many column shafts that appear to be marble from Cap de Garde can be seen in eastern Algeria and Tunisia. Such coarse-grained, streaked, and spotted shafts appear over a substantial area of the west-central Mediterranean, including central Italy and western Libya (Table I). None, it might be noted, were seen in central or western Algeria. A characteristic example is a coarse-grained, diagonally or horizontally banded and streaked shaft at Haïdra, Tunisia (Fig. 3). Testing confirms the Algerian provenance of this patterned marble (Table II, Fig. 2; Attanasio *et al.* 2012, Table 2), but it appears that Filfila as well as Cap de Garde was a source for this material.

We have sampled and analyzed isotopically twelve of these streaked and banded column shafts at the University of South Florida (Table II). The results confirm that the majority of these shafts, including the example from Haïdra (Fig. 3), are marble from Cap de Garde. Five fell into the ellipse of 90% probability for Cap de Garde, and two more fell between the ellipse and an outlying quarry sample (USF9352, 9457) (Fig. 2). Several other shafts at Djemila have been analyzed by Antonelli *et al.* and found to be from Cap de Garde (Antonelli *et al.* 2009, 14, Table II, D10a, D17).

Four shafts in our sampling, however, clearly come from another source, which is almost certainly the nearby quarries of Mt. Filfila. The possibility of ancient production at Filfila had long been noted (Ward Perkins 1951; Pensabene 1976, 185, n. 36; Marchei 1997b), and this has recently been confirmed by Antonelli and coworkers (Antonelli, Lazzarini and Cancelliere 2010, 592). The marble of Filfila is commonly thought of as pure white

and fine grained, but recent study is painting a more complex picture. As noted above, coarse grained marble is abundant, and inspection reveals many dark gray and gray-spotted areas. Two of the streaked and spotted shafts in this study have isotopic ratios that fall on the borders of the Filfila ellipse (USF 10850, 10951). A shaft at Khemissa (USF10850, Fig. 4) has widely spaced spots and streaks that are similar to some columns at Hippo, but it can also be paralleled in a few areas of the quarries at Filfila. One shaft in Announa, Algeria corresponds isotopically to a very distant Filfila outlier (Table I, USF9456). A shaft at Ostia (Table I, P1131; Attanasio *et al.* 2012, Table 2, O1131) has isotopic ratios that virtually coincide with two Filfila samples studied by Antonelli *et al.* (Antonelli, Lazzarini, and Cancelliere 2010, 592, fig. 12c). The coarse grain of some of these streaked and spotted shafts probably from Filfila increases their resemblance to shafts from Cap de Garde (USF 10850, mgs 3mm; P1131, mgs 3.5 mm).

The isotopic ratios of a spotted and streaked shaft at Guelma, however, cannot be easily accounted for (Fig. 4, USF 8702/9385). The values fall far from Filfila and are somewhat more negative than those of Cap de Garde. It would be easy to conclude, as Antonelli and his team have for an analogous situation at Djemila (Antonelli *et al.* 2009; Antonelli, Lazzarini and Cancelliere 2010, 588), that the Guelma shaft comes from from an unknown quarry. Four considerations, however, weigh against this conclusion. First, the shaft's isotopic values are rather close to those of Cap de Garde and far from the fields of any other known Mediterranean quarry of white or gray marble. Second, Guelma is not far from Cap de Garde, and third, the shaft strongly resembles products of Cap de Garde. Finally, the data from the Cap de Garde quarries may be incomplete or inadequate. Access to a large part of the quarry (to the west of the main road through the site) is restricted by the military. This area, moreover, seems to have been devastated by the use of dynamite (Pensabene 1976), and in a brief visit, no ancient surfaces could be seen.

Most column shafts collected in the ancient theatre at Skikda (Rusicade), the nearest city to the quarries on Mt.



FIG. 3. Streaked and spotted column shaft of Cap de Garde marble, Byzantine church, fortress of Haïdra, Tunisia (USF8715)



FIG. 4. Streaked and spotted column shaft of Filfila marble, Boutiques of Old Forum, Khemissa, Algeria (USF10850).

Filfila seem to be Filfila's typical pale, fine-grained marble. An isotopic test of one such "typical" example supports this idea (Fig. 2; Table II, USF10951). The shaft is a pale gray with faint grayish-white cloud-like markings and has relatively fine grain (mgs 1.5 mm.). Other shafts at Skikda can be whiter with a few fine gray lines. The clear contrast between the two types of shaft produced at Filfila, one fine-grained and relatively uniform and the other coarse grained with conspicuous streaks and spots, indicates that the quarrymen made a conscious effort to produce a variety of well-defined products. The streaked shafts may have been intended as competition for those from Cap de Garde.

A chronological framework for this phenomenon is provided by the portico of the Forum at Ostia, which contained shafts from both Cap de Garde and Filfila (Fig. 2, P1126, P1131; Table II, ISM-CNR). The Forum and its portico date from the time of Hadrian (Becatti 1953, 129-139).

Isotopic analysis: column capitals

Pensabene hypothesized in 1976 that capitals were produced in a plain white version of Cap de Garde marble and widely distributed at Hippo Regius and in nearby cities. This can now be demonstrated with isotopic evidence. It can also be shown that this production reached Tunisia and central Italy. Cap de Garde was, however, not the only source for such capitals. Our program of testing shows that capitals made of marble from Mt. Filfila were distributed through these same areas. Capitals in Algeria, Tunisia, and Italy whose marble appeared to be from Hippo or Filfila were sampled. The isotopic matches between the artifacts and the quarry data in this case were much better than with the column shafts. The capitals fell either into or very close to the ellipses of 90% probability for either Cap de Garde or Filfila (Fig. 5, Table III). One of the artifacts with isotopic ratios beyond the upper edge of the ellipse for Cap de Garde is a capital from the theatre at Hippo, and in spite of the fact that it is not a perfect isotopic fit, it is almost certainly a local product made of local marble (USF8705, figs. 5-6). Two capitals have isotopic values just below the lower edge of the ellipse for Cap de Garde, and they can also be attributed to Filfila (USF10813, 10849). Their isotopic values correspond to quarry samples from Filfila recently published by Antonelli *et al.* (Antonelli, Lazzarini and Cancelliere 2010, 592, Fig. 12c).

In general the Corinthian capitals surviving at Hippo and Skikda seem to be uninspired work in the tradition of carvers from central Italy, largely dating from the second and third centuries. Comparisons are particularly

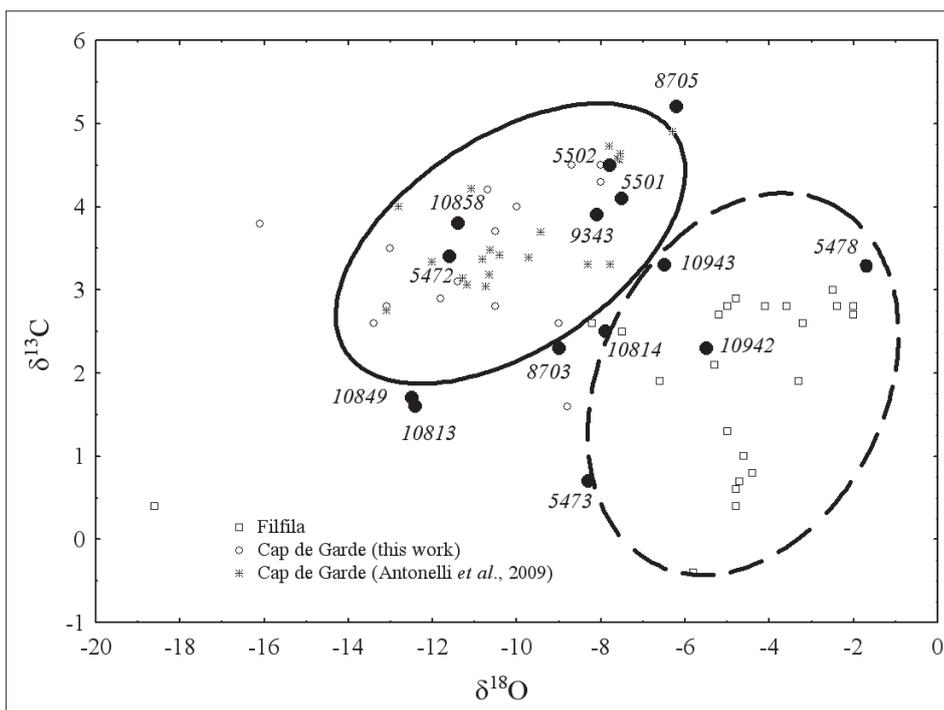


FIG. 5. Isotopic diagram: column capitals and other forms of architectural decoration.



FIG. 6. Corinthian capital, Cap de Garde marble, 3rd century AD, formerly Theatre, Hippo Regius (USF8705).



FIG. 7. Corinthian capital, Cap de Garde marble, 3rd century AD, Jardin Archéologique, Guelma (USF10858).

close with capitals at Ostia (for comparable pieces, see Pensabene 1973). In eastern Algeria, Corinthian capitals frequently lack a stem rising from a leaflet to support the abacus flower (as in Fig. 6), an omission that is rare at Ostia. A Corinthian capital made of Cap de Garde marble in Guelma is relatively well-preserved and carefully made, and, in this case, a stem springing from a leaflet leads to the abacus flower (Figs. 5, 7; USF10858; Table III).

Several Corinthian capitals at Carthage proved to be Algerian marble, as indicated by isotopic testing and mgs (Table III, Figs. 5, 8-11, USF5501-02, 10813-14). Typologically the Carthage capitals follow much the same Italianate standards seen in eastern Algeria, and their sculptors as well as their marble could have been from Hippo Regius or Rusicade.

Two of the Corinthian capitals in the Carthage Museum are unmistakably Cap de Garde marble. In one

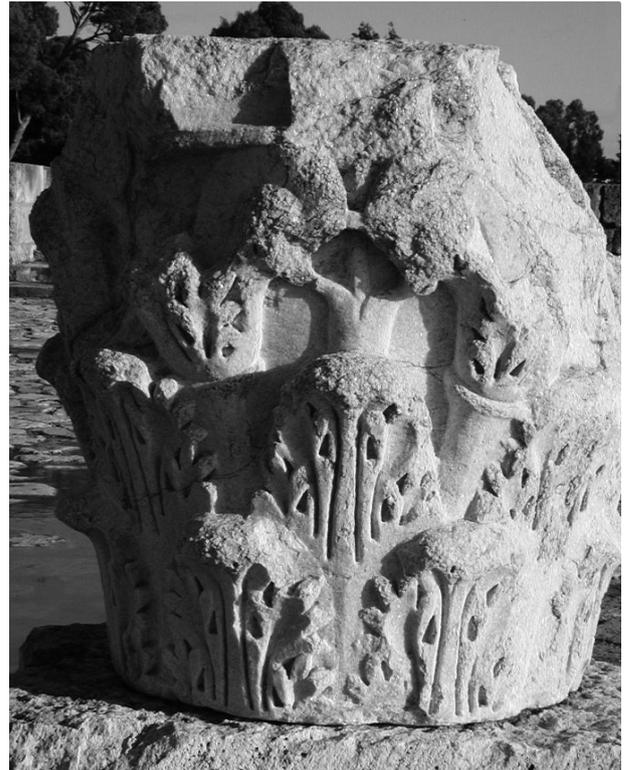


FIG. 8. Corinthian capital, Cap de Garde marble, second half of the 2nd century AD, Carthage Museum (USF5501).



FIG. 9. Corinthian capital, Cap de Garde marble, second half of the 2nd century AD, Carthage Museum (USF5502).

of them, the stem to the abacus flower springs from a robust two-part calyx, a feature that appears in the capitals of the Macellum at Hippo, and the Carthage capital could well have been carved by a sculptor from Hippo (USF 5501, Fig. 8, Table III). It is difficult to find



FIG. 10. Corinthian capital, Filfila marble, 110-140 AD, Carthage, Museum (USF10813).



FIG. 11. Corinthian capital, Filfila marble, late 3rd century AD, Carthage, Museum (USF10814).

parallels at Hippo for details of the other capital (USF 5502, Fig. 9, Table III), and the origin of its sculptor is uncertain.

In two other Corinthian capitals in the Carthage Museum, the isotopic values and mgs favor an attribution of their marble to Filfila (USF10813-4, Figs. 5, 10-11, table III). As noted above, the first of these capitals has isotopic values corresponding to quarry samples from Filfila published by Antonelli *et al.* (Antonelli, Lazzarini and Cancelliere 2010, 592, fig. 12c). This capital may have been carved at Carthage, since it has a relatively rich typology and is carved in a robust

style that finds few parallels in the multitudes of mass-produced Corinthian capitals apparently made of Filfila marble at Skikda. The other Corinthian capital of Filfila marble lacks a stem to the abacus flower, has a rather amorphous chalice, and is carved in a flattened, linear style (USF10814, Figs. 5, 11). This capital probably was carved by a sculptor from northeast Algeria, since it finds an extremely close parallel in the capital from the Hippo theatre (USF8705, Fig. 6).

Isotopic testing of several small capitals of a variety of types at Ostia make it clear that eastern Algerian marble also reached central Italy. Pensabene conjectured that the marble of a fragmentary Corinthian capital in Ostia came from Cap de Garde (Pensabene 1973, cat. no. 320), and its isotopic ratios, in fact, indicate an Algerian origin – but from the Filfila quarries (Fig. 5, Table III, USF5473). The simple typology and the poor quality of the capital are compatible with what is seen at Hippo, Rusicade, and Carthage, and the capital could have been exported to Ostia in a prefabricated state.

An Ionic capital at Ostia has the very distinctive, unclassical structure characteristic of western North Africa (Herrmann 1988, 119-120 figs. 229-230). Pensabene has attributed its marble to the Proconnesus (Pensabene 1973, cat. no. 184), which is possible on the basis of its isotopic signature (Fig. 5; Table III, USF5478). An assignment to Filfila is also possible isotopically, and this seems more likely, given the “African” structure of the capital.

Composite capitals are very distinctive products of architectural sculptors at Hippo Regius and Rusicade. These capitals have several characteristic features, which go back to the splendid Composite capitals of the first-century forum of Hippo (Pensabene 1976, 182, n. 20, pl. 49, fig. 1). Northeast Algerian Composite capitals are simplified variants of the orthodox Italian Composite type (Strong 1960). Their volute channel is not decorated with a vine, and smooth, pointed leaves usually decorate the chalice above the rings of acanthus leaves. These capitals may be fully finished or left in schematic form (that is, with smooth leaves and mouldings). A schematic example in the Hippo museum is Cap de Garde marble and another in the Skikda Theatre is Filfila marble (USF9343, 10942, Fig. 5, Table III). A finished example in Ostia, datable around 300 AD, is made of Cap de Garde marble, (USF5472, Fig. 5, Table III; Pensabene 1973, cat. no. 402). The Ostia capital may have been carved in Italy rather than in Hippo, since it lacks the distinctive fillets above as well as below the astragal, a feature of virtually all Composite and Ionic capitals in eastern Algeria.

This picture of exportation from the northeastern Algerian quarries to their immediate neighborhood and to the east-central Mediterranean contrasts sharply with what is seen at Cherchel, a royal, then provincial capital to the west (Pensabene 1982; Herrmann *et al.* forthcoming). There, marble for capitals largely came from Carthage, and many types were produced by sculptors from

central Italy. There is little overlap in the realm of architectural decoration in white marble between Cherchel and the northeast.

Revetment plaques

Marble from Cap de Garde was also used for veneer, much as true greco scritto was. The distinctive streaked patterns seen in the quarries appear in the veneer of a fountain in one of the “villas” along the ancient seafont in Hippo Regius (Herrmann, van den Hoek and Tykot 2012, Figs. 10-11). Multimethod testing has identified plaques in Carthage and Utica, as well as at another site in Hippo (Antonelli *et al.* 2009, 12, 14, table 2). Marble plaques were also exported from Cap de Garde to Italy. Multimethod testing indicates that a streaked plaque in the Caupona of Alexander and Helix at Ostia is marble from Cap de Garde (Attanasio *et al.* 2012, Table 2, O3). The plaque was used in the veneering of the basin of the Caupona along with true greco scritto from Hasançavuslar near Ephesos (Attanasio *et al.* 2012, Table 2, O1). The Cap de Garde plaque was used with others apparently of the same origin on the back of the basin. True greco scritto was used on the upper niche, bigio antico on top of the rim of the basin, and black-and-white-speckled granite from the Mons Claudianus on the front. This clearly demarcated distribution of marble types suggests a hierarchy of values for the various sources.

Other forms of architectural decoration

A remarkable pillar with huge and elaborate acanthus leaves in the theatre at Hippo Regius stands out from other architectural products of eastern Algeria (Bizot *et al.* 2005, 109). The coarse grain and the isotopic values make it clear the marble came from either Filfila or Cap de Garde (USF8703, Fig. 5, Table III). The leaves find their closest parallel in the Hellenistic Corinthian capitals of the temple of the Olympian Zeus at Athens, which stem from the construction sponsored by Antiochos III of Syria (222-187 BC) (Heilmeyer 1970, 57, pl. 16.1-3, 17.1.2). The pillar in Hippo in all likelihood is the work of a migrant from Greece during the 2nd century BC. The twisting tips of the pillar's leaves are another Hellenistic feature. Such leaves often appear on Hellenistic silver bowls (Oliver 1994). The pillar must have been an older element reused in the theatre, which otherwise appears to date from the Roman Imperial period.

Conclusions

This program of art historical research and isotopic testing has confirmed and amplified ideas about the production of marble products from the quarries of

Cape de Garde and Mt. Filfila. The latter is proving to be a significant source and is highly variable in terms of isotopic ratios, mgs, and markings. Marble from the two northeastern Algerian quarries was exploited as early as the time of the Numidian kingdom (2nd century BC). Typical greco scritto was not produced in the quarries of Cap de Garde, contrary to previous opinion, but streaked plaques from Cap de Garde were similar to and used alongside true greco scritto from Ephesos (Hasançavuslar). The production of columns and capitals of Cap de Garde and Filfila marble proves to be more widespread than previously thought. In Roman Imperial times these quarries exported column shafts, which were probably prized for their vivid markings, throughout in the central Mediterranean. Shafts at Ostia indicate that some of this exportation took place in Hadrianic times. Capitals of Cap de Garde and Filfila marble were also exported to Tunisia and Italy in the third and early 4th century AD. Capital production in the two Algerian quarrying centers was quite similar, and at times it is difficult to distinguish them, even with isotopic means. By and large the Algerian capitals followed designs established in central Italy, but their execution and typology tends to be simpler. Some independent variants of the Composite and Ionic capital were produced. No matter where they were found, most capitals made of marble from Filfila and Cap de Garde were evidently carved by sculptors from eastern Algeria.

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City	Location	Position
Carthage	Archaeological Park	Museum; Five-aisled basilica, in front of entrance to baptistery
Le Kef	Church of St. Peter	
Kairouan	Great Mosque	
El Jem	Traffic circle and Museum	
Rome	Museo Nazionale Romano	Garden, alongside Aula X
Rome	Palazzo Altemps	pedestal, bust of Lucius Verus 463202
Ostia	Schola del Traiano	exedra at right (SW)
Ostia	Basilica Cristiana	lateral exedra
Ostia	Reg. II, ins. 2	Portico del Tetto Spiovente
Pozzuoli	Amphitheatre	
Nocera Superiore	Baptistery	excavation by access ramp

TABLE I. Locations of column shafts of diagonally streaked marble in Tunisia and Italy: marble from Cap de Garde or Filfila? Isotopes untested.

Test number	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$	MGS	Location	Quarry assignment preference underlined
USF 8702	1.8	-15.5		Jardin Archéologique, Guelma, Algeria. Col JAG 001	N, <u>CG</u> , or unknown
USF 9385	1.9	-15.9			
USF 8715	3.8	-13.3		Church in fortress, Haïdra, Tunisia	<u>CG</u>
USF 9352	3.7	-14.7		Antiquarium in theatre, Skikda, Algeria	<u>CG</u> , or unknown
USF 9367	3.9	-11.8		Museum in temple, Tebessa, Algeria	<u>CG</u>
USF 9456	0.0	-17.9		South Church, Announa, Algeria	<u>F</u>
USF 9457	3.5	-15.5		Deposit below S. Church, Announa, Algeria	<u>CG</u> , or unknown
USF 10715	3.8	-11.9		Antichità Alberto Di Castro, Rome	<u>CG</u>
USF 10850	1.3	-8.3	4.0 m	Old Forum, "Boutiques", Kemissa, Algeria	Pe, N, <u>F</u> , H,
USF 10950	3.3	-13.3	2.0 mm	Antiquarium in theatre, Skikda, Algeria, col. 51	<u>CG</u>
USF 10951	2.8	-7.6	1.5 mm	Skikda, Antiquarium in Roman theatre COL67bis	<u>F</u> , CG Pe, N, Pr2
ISM-CNR	ca. 3.4	ca. -12.8		P1126, W. Portico, Forum, Ostia	<u>CG</u>
ISM-CNR	ca. 0.7	ca. -10.8		P1131 W. Portico, Forum, Ostia	Unknown or <u>F</u>

TABLE II. Analyses of column shafts: all but USF10951 have diagonally streaked and spotted, coarse-grained marble.

USF #	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$	MGS	Description	Museum or site + inventory #	Possible quarries (preference underlined)
5472	3.4	-11.6		Composite capital	Ostia 18590	<u>CG</u> , Pe, N
5473	0.7	8.3		Fragmentary Corinthian capital without stem to abacus flower	Ostia 17268	N, <u>F</u>
5478	3.3	-1.7		Ionic capital with disk volutes	Ostia 17628	Pr1, <u>F</u>
5501	4.1	-7.5		Corinthian capital with stem to abacus flower	Carthage, Museum	<u>CG</u> , Pe, N
5502	4.5	-7.8		Corinthian capital without stem to abacus flower	Carthage, Museum	<u>CG</u> , Pe, N
8703	2.3	-9.0		acanthus pillar	Hippo Regius, theater	<u>CG</u> , <u>F</u> , N
8705	5.2	-6.2		Corinthian capital without stem to abacus flower	Hippo Regius, theater	<u>CG</u>
9343	3.9	-8.6		Schematic Composite capital	Hippo Regius Museum, 1032	<u>CG</u>
10813	1.6	-12.4	1.5 mm	Corinthian capital with stem to abacus flower	Carthage, Museum, 4th from entrance	N, CG, <u>F</u>
10814	2.5	-7.9	1.2 mm	Corinthian capital without stem to abacus flower	Carthage, Museum, 17th from entrance	Pe, N, Pr2, <u>F</u>
10849	1.7	-12.5	2.0 mm	Partly finished Corinthian capital without stem to flower	Old Forum, "Boutiques" Khemissa	N, <u>F</u> , CG
10858	3.8	-11.4	3.0 mm	Corinthian capital with stem to abacus flower	Guelma, Jardin Archéologique	<u>CG</u>
10942	2.3	-5.5	2.5 mm	Schematic Composite capital	Skikda, Theatre, C47	Pe, N, Pr2, <u>F</u>
10943	3.3	-6.5	8.0 mm	Corinthian capital without stem to abacus flower	Skikda, Theatre, C56	Pe, N, Pr2, <u>CG</u> , <u>F</u>

TABLE III. Analyses of capitals and other ornament.

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