

otros elementos nos ayudan a descubrirlas: La ubicación en la escena claramente individualizadas, bien como retratos alegóricos o en relación con la divinidad como vemos en El Olivar del Centeno, Baños de Valdearados (Burgos), La Garriga (Barcelona) o en Cartago. Su disposición es un elemento definitorio y coincidimos con G. López Monteaudo⁶⁴ en que estos bustos frontales en medallones pueden ser interpretados como retratos o como alegorías. Por otro lado la inclusión de estas dominas en escenas de la vida cotidiana mostrando su poder, Dominus Iulius, El Alia, Sidi Grib, es muy evidente y además podemos encontrarlas formando parte de la temática principal junto a otros dioses y a otros personajes literarios, cual retrato familiar como vemos en La Olmeda, La Malena, posiblemente Noheda, sin olvidarnos de Arellano y Rabaçal. También el realismo de las fisonomías, la exhibición de vestimentas y joyas siguiendo la moda del momento o la disposición privilegiada en la composición, son suficientes elementos como para pensar que estamos ante las dominas y *dominus* de aquellas mansiones que imbuidos de la solemnidad de las diversas escenificaciones mitológicas o literarias, perpetúan de forma indirecta y a través de los mosaicos, su poder y su riqueza.

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Robert H. Tykot, Annewies van den Hoek
Aspects of the Trade in White and Gray
Architectural Marbles in Algeria

Quarries at Cap de Garde, Djebel Filfila and Mahouna in Algeria are characterized isotopically and in terms of their grain size and optical characteristics. On this basis the marble of architectural decoration from the cities of *Hippo Regius*, *Rusicade*, *Calama*, *Thibilis* and *Caesarea* is assigned to these quarries, as well as to Carrara in Italy and Proconnesus in Asia Minor.

Key words: quarries, stable isotopes, Cap de Garde, Djebel Filfila, Mahouna.

Methodology

Algeria is richly endowed with quarries of marble, calcite-alabaster, and high quality travertine (sometimes called onyx marble), but the archaeological role of these quarries has only recently begun to be explored with the support of scientific techniques. With the assistance of Algerian Ministry of Energy and Mines, we have undertaken systematic surveys of eight Algerian quarries, primarily those managed by Enamarbre, the national marble company, and with the assistance of the Ministry of Culture we have taken samples from objects in Algerian museums and archaeological sites to identify possible ancient use of these quarries. Robert Tykot is measuring the samples' maximum grain size (MGS) and analyzing their ratios of stable isotopes of carbon and oxygen¹. Donato Attanasio has begun analysis by paramagnetic resonance spectroscopy (EPR)². This paper is a report on work in progress. In many cases, the scientific analy-

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1. On this widely used technique, see, for example, D. ATTANASIO, *Ancient White Marbles: Analysis and Identification by Paramagnetic Resonance Spectroscopy*, Rome 2003, pp. 44-8.

2. On this technique, see *ibid.*, pp. 55-100.

64. LOPEZ MONTEAGUDO *et al.*, *Recientes hallazgos*, cit., p. 514.

L'Africa romana XIX, Sassari 2010, Roma 2012, pp. 1315-1330.

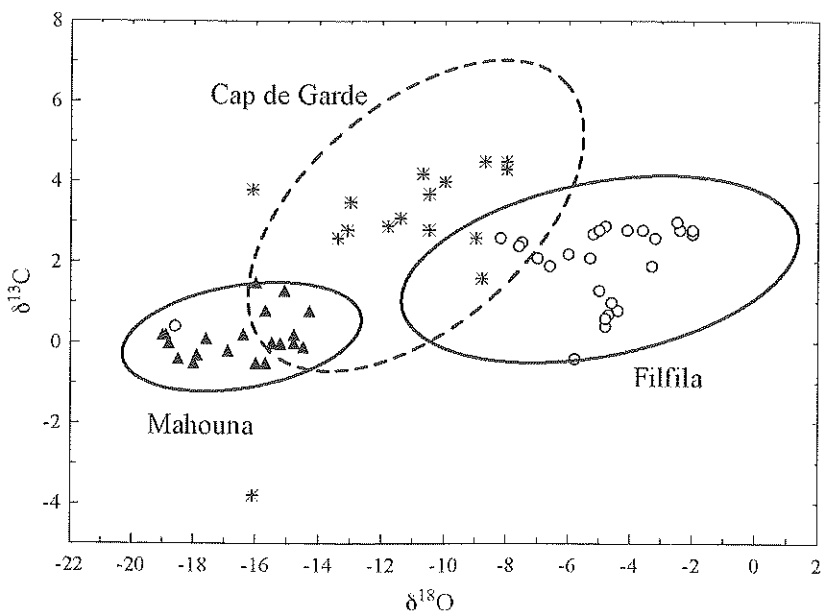


Fig. 1: Isotopic fields of the main Algerian quarries of white marble and travertine.

ses completed so far do not provide definitive evidence to identify the quarry from which a specific object came, but archaeological considerations and optical criteria can indicate the most probable option offered by the analyses.

The focus of this paper is on the white and gray marbles used for ancient architecture: that is, column shafts, capitals, bases, pavements and wall incrustations. Architectural accessories, such as altars and statue bases, are also included. Algeria has two celebrated quarries of white marble, one on Cap de Garde near Annaba and another on Mt. Filfila near Skikda, both on the Eastern coast of the country. Clear signs of Roman work have appeared in both³. On the basis of isotopic data collected in our research and supplement-

3. F. ANTONELLI *et al.*, *Minero-petrographic and Geochemical Characterization of "greco scritto" Marble from Cap de Garde, Near Hippo Regius (Annaba, Algeria)*, «Archaeometry», 51, 3, 2009, p. 355, fig. 5; IDD., *On the White and Coloured Marbles of the Roman Town of Cuicul (Djemila, Algeria)*, «Archaeometry», 52, 4, 2010, p. 588, fig. 13.

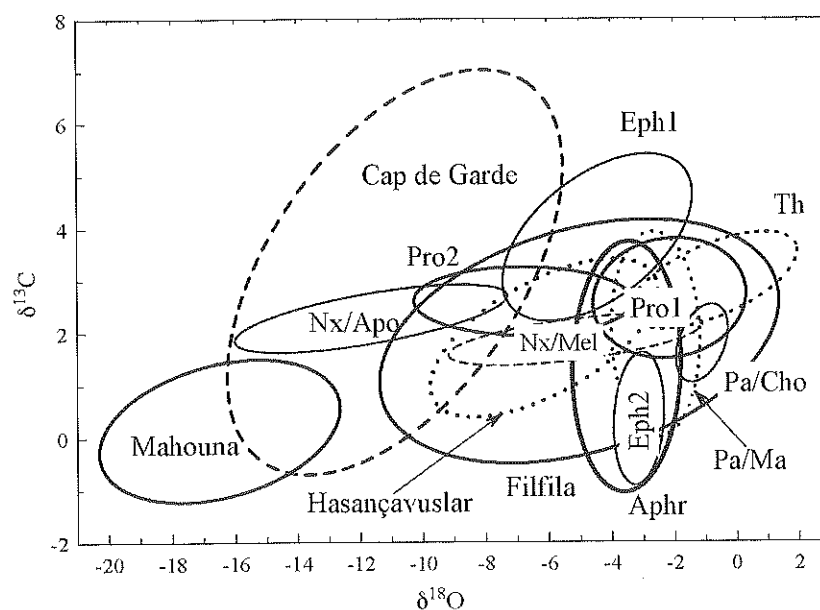


Fig. 2: Isotopic fields for coarse-grained white marbles used in antiquity.

ted by data from studies by Antonelli and co-workers⁴, we have defined fields for these quarries and established ellipses of 90% probability (FIG. 1). Our studies have indicated that the quarry at Mahouna also produced white architectural decoration during antiquity. In modern times, Mahouna, which is located near Guelma in Eastern Algeria, is primarily known for gaudy colors of pink, gray, and brown, but in antiquity its areas of white or almost-white marble were evidently exploited for columns and altars. The isotopic fields for these three quarries overlap to some degree. Grain size measurements can help to resolve some ambiguities. Cap de Garde generally produced coarse-grained marbles. In a study by Antonelli and co-workers, the maximum grain size varies between 2,2 and 6,7 mm, with an average of 3,65 mm⁵. In our sampling, MGS at Cap de Garde was somewhat lower, ranging from 1,5 to 4 mm (18 samples). Filfila produced both fine-grained and coarse-grained marble,

4. See the articles cited in the previous note.

5. ANTONELLI *et al.*, *Minero-petrographic and Geochemical Characterization*, cit., p. 358.

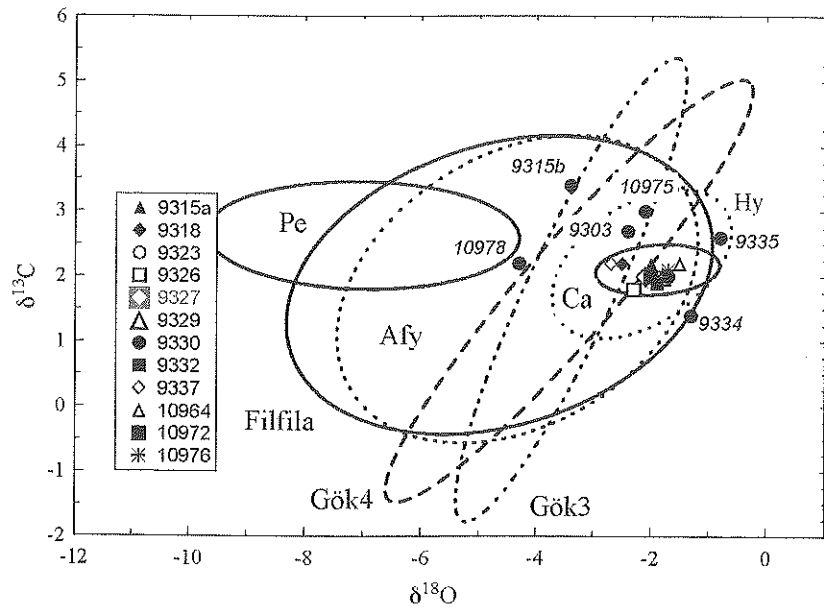


Fig. 3: Artifacts from *Caesarea* (Cherchel) plotted against fine-grained marbles.

although Antonelli and co-workers found only fine grain⁶. In our survey, MGS ranged from 0,3 mm to 15 mm (45 samples). Grain size at Mahouna is again highly variable, with MGS ranging from 0,5 mm to 8 mm (29 samples).

When the isotopic fields are compared with those of quarries elsewhere in the Mediterranean world, more ambiguities appear. Even when considering only major quarries of coarse-grained marble, the isotopic field for Filfila coincides with many others (FIG. 2). Filfila must also be juxtaposed with fine-grained marbles as well (FIG. 3). Color, markings, and historical and geographical considerations, however, can help to suggest the most probable result in many ambiguous cases.

6. ATTANASIO *et al.*, *On the White and Coloured Marbles*, cit., pp. 588, 594.

Table 1: Architectural decoration in white marble at *Caesarea* (Cherchel).

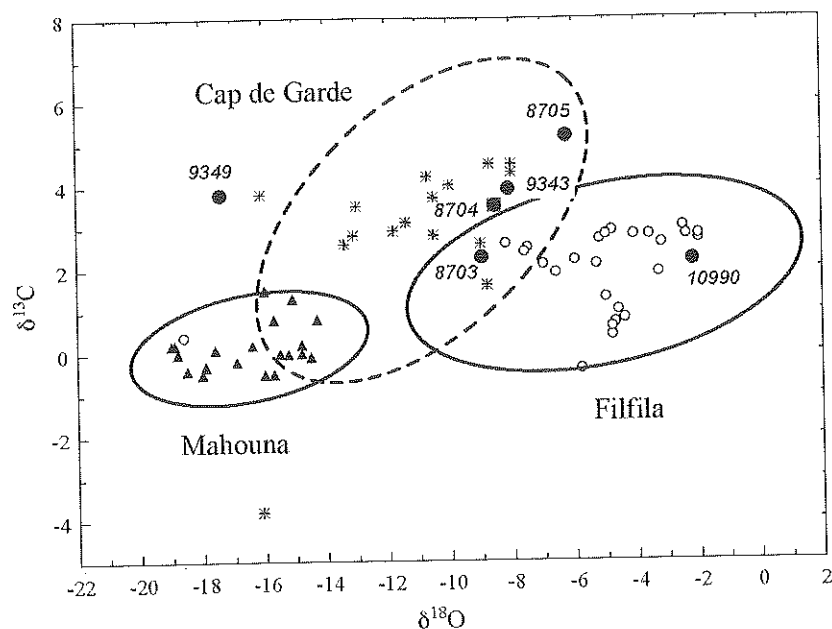
USF lab #	$\delta^{13}C$	$\delta^{18}O$	MGS	Possible quarries*	Location	Cat. or inv. #	Description
9303	2,7	-2,4		<u>E</u> , <u>Pror</u> , <u>Pa/Ch</u> , <u>Eph2</u> , <u>Th</u>	Outside Museum		Polygonal cornice from the theatre
9315a	2,2	-2,0		<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	Place des Martyrs	Pensabene 40	Corinthian capital
9315b	3,4	-3,4		<u>Afy</u> , <u>F</u> , <u>Gök3</u>	Place des Martyrs	Pensabene 40	Corinthian capital
9318	2,2	-2,5		<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>Gök3/4</u>	New Museum	Pensabene 87	Corinthian capital
9323	2,0	-1,9		<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	Museum	PL21	Vine pillar
9326	1,8	-2,3		<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	New Museum	Pensabene 33	Corinthian capital
9327	2,0	-2,1	fine	<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	Museum	CH51	Corinthian capital
9329	2,0	-1,8	fine	<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	Route Nationale/ Route Revolution	Pensabene 29	Corinthian capital
9330	2,0	-1,7		<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	Route Nationale/ Route Revolution	Pensabene 66	Corinthian capital with vine helices
9332	1,9	-1,9	fine?	<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	Place des Martyrs		Column shaft beside fountain
9334	1,4	-1,3		<u>E</u> , <u>Pa/Ch</u>	New Museum	A437	Corinthianizing pilaster capital
9335	2,6	-0,8		<u>E</u> , <u>Pror</u> , <u>Th</u>	Museum	PL01	Vine pillar
9337	2,2	-2,7	fine	<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u> , <u>Gök3/4</u>	Route Nationale/ Route Revolution Museum	Pensabene 57	Corinthian capital
10964	2,2	-1,5	1,5 mm	<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>		Pensabene 95?	Corinthianizing capital with leaf volute
10972	2,0	-2,0	1,0 mm	<u>Ca</u> , <u>Afy</u> , <u>Hy</u> , <u>F</u>	New Museum	Pensabene 96	Corinthian capital

* Abbreviations in the tables: USF = University of South Florida; MGS = maximum grain size. Possible quarries are selected from either the coarse-grained or fine-grained group. Preferred quarries are underlined.

Table 2: Architectural decoration in white marble at *Hippo Regius* (Annaba).

USF lab #	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$	MCS	Possible quarries*	Location	Museum inv. #	Description
10975	3.0	-2.1	2.0 mm	<u>ProL</u> , F, Th	West Baths, storage		Cornice with plain sima and acanthus
10976	2.0	-1.7	0.3 mm	E, Ca, Afy, Hy	West Baths, storage		Molding, h 45.2 cm Gray-streaked cornice (cavetto, roundel, sima) 107x23x25 cm
10978	2.2	-4.3	3.0 mm	E, Pro2, Nx/Mel, Eph2, H	West Baths, in situ		Revestment at NW corner of Promenoir A (north)
98703	2.3	-9.0	coarse	<u>CdG</u> , Pro2, Nx	Theatre		Acanthus pillar
8704	3.5	-8.5		<u>CdG</u> , Pro2	Theatre		Detached slab on <i>scenae frons</i>
8705	5.2	-6.2		<u>CdG</u>	Theatre		Corinthian capital
9343	3.9	-8.1	coarse	<u>CdG</u>	Museum courtyard	1032	Schematic Composite capital
9349	3.8	-7.4	coarse	<u>CdG</u>	Sea front		Block of quay
10990	2.2	-2.2	0.6 mm	E, Ca, Hy, Afy, Gök4	Outside Museum		Grayish column shaft, \varnothing 36.8 cm

* Abbreviations in the tables: USF = University of South Florida; MCS = maximum grain size. Possible quarries are selected from either the coarse-grained or fine-grained group. Preferred quarries are underlined.

Fig. 4: Artifacts from *Hippo Regius* (Annaba).

Results and discussion

During the Roman imperial period, Algerian quarries seem to have had different spheres of influence within the country, although inevitably there were intruders into those spheres. Cherchel, ancient *Caesarea*, forms the most striking regional compartment. The city was the Mauretanian royal capital up to 40 CE, and this exalted status is reflected in the quality and cosmopolitan origin of its marbles. The city is distinguished by large numbers of beautiful Augustan Corinthian capitals, datable from about 20 BCE to 20 CE. No other site in the Mediterranean outside of Rome has as many examples of the type, which were undoubtedly carved by workshops originating in Rome. Patrizio Pensabene, who has catalogued sixty-five such pieces at Cherchel, attributed their fine-grained white marble optically to the quarries of Carrara⁷, and his

7. P. PENSABENE, *Les chapiteaux de Cherchel. Étude de la décoration architectonique*, (BAA, suppl. 3), Alger 1982, cat. nos. 19-83.

opinion seems amply justified by our isotopic evidence (TAB. 1, FIG. 3). None of the nine Cherchel capitals we tested had isotopic signatures that fell outside the small Carrara field. A fluted shaft and a decorated pillar also seem to be from Carrara isotopically and visually (USF 9323, 9332). So far we have not found certain evidence of architectural decoration in Carrara marble elsewhere in Algeria, further confirming Cherchel's favored status⁸. Not all the Cherchel capitals, however, belong to the lofty Augustan group; some date from the third and fourth centuries and are provincial in workmanship (USF 9318, 10964, 10972). These late capitals might have been made of old Carrara blocks or of Filfila marble, whose isotopic signature overlaps that of Carrara.

Carrara was not the only quarry that provided white marble for architectural decoration in Cherchel. During the royal period the main alternative source probably was Djebel Filfila (TAB. 1). A beautiful pilaster capital (USF 9334), a vine pillar (USF 9335), and a cornice of early Augustan type (USF 9303)⁹ are carved of grayish, rather coarse-grained marbles. Isotopically these materials could be from Filfila or from various coarse-grained quarries, including Paros, Ephesus, and Proconnesus in the Sea of Marmara. Parian, however, was a high-status marble normally used for sculpture rather than architecture, and Proconnesian and Ephesian marbles were not much used in the West until the second century¹⁰.

In the second and third centuries Proconnesian marble did make its appearance at Cherchel. Pensabene catalogues six Corinthian capitals of Asia Minor type and of Antonine to Severan date, and on a visual basis he plausibly ascribes their marble to the Proconnesus¹¹. A cornice at Cherchel can be identified as Proconnesian on the basis of its isotopic ratios and grain size (USF 10975).

Hippo Regius, located in modern Annaba, and the nearby quarries on Cap de Garde represent another distinct regional concentration. Marble from Cap de Garde usually has very coarse grain and is usually streaked with gray bands and spots. Most of the marble for architectural decoration in *Hippo* looks as though it comes from Cap de Garde, and isotopic tests by – and – large confirm this origin (TAB. 2, FIG. 4). The pre-Roman seafront wall (USF 9349)¹² has an isotopic ratio distant from the main Cap de Garde ellipse, but it coincides rather well with one stray sample from the quarries. Cap de Garde, however, does not have a complete monopoly at *Hippo*. A column shaft (one of a pair) has isotopic ratios compatible with Mt. Filfila (USF 10990), and its fine grain and uniform light gray color also correspond to this source.

Formerly Cap de Garde was thought to be the source of a grey and white patterned marble called *greco scritto*¹³. Some plaques of classic *greco scritto*, with its convoluted veins, are set into the walls of the Cherchel museum, but otherwise it is rare or missing in Algeria. It has recently been shown that the classic *greco scritto* actually came from quarries near Ephesus¹⁴. The spotted and streaked marble of Cap de Garde was, in any case, exported to Tunisia, Libya, and Central Italy in the form of column shafts, capitals, and marble revetment plaques¹⁵. In Sardinia a column shaft in the cathedral of Santa Giusta and a doorpost of Santa Maria in Uta seem optically to be marble from Cap de Garde.

Skikda, ancient *Rusicade*, is another center with a distinct personality, and the city was closely connected with the nearby quarries on Mt. Filfila. Most of the marble for architectural decoration in the city's museums looks as though it comes from those quar-

etâ imperiale, «Marmorata. An international journal for archaeology, history and archaeometry of marbles and stones», 5, 2009, pp. 45-70.

12. X. DELESTRE, *Histoire des recherches. Techniques et matériaux de construction*, and D. LAVERGNE, *Le quartier "des villae du front de mer"*, in X. DELESTRE (éd.), *Hippone*, Aix-en-Provence 2005, pp. 63-4, 83-4, 127-38.

13. M. C. MARCHEL, *Greco scritto*, in G. BORGHINI (a cura di), *Marmi antichi*, Roma 1997, p. 237; ANTONELLI *et al.*, *Minero-petrographic and Geochemical Characterization*, cit., pp. 351-64.

14. D. ATTANASIO *et al.*, *On the Ephesian Origin of Greco Scritto Marble*, in *Proceedings of ASMOSIA IX (Tarragona 2009)*, Tarragona 2012, tab. 2, O1, O3.

15. J. HERRMANN *et al.*, *Characterization and Distribution of Marble from Cap de Garde and Mt. Filfila, Algeria*, in *Proceedings of ASMOSIA IX*, cit.; ATTANASIO *et al.*, *On the Ephesian Origin of Greco Scritto Marble*, cit., tab. 2, O1, O3.

8. Carrara was also missing at Djemila: ANTONELLI *et al.*, *On the White and Coloured Marbles*, cit., p. 594.

9. From the theatre: J.-M. BLAS DE ROBLES, C. SINTES, *Sites et monuments antiques de l'Algérie*, Aix-en-Provence 2003, p. 281.

10. D. ATTANASIO, M. BRILLI, M. BRUNO, *The Properties and Identification of Marble from Proconnesos (Marmara Island, Turkey): A New Database Including Isotopic, EPR and Petrographic Data*, «Archaeometry», 50, 5, 2008, pp. 747-74.

11. PENSABENE, *Les chapiteaux de Cherchel*, cit., cat. nos. 88-93. For the chronology, compare more recent works, such as M. FISHER, *Das korinthische Kapitell im Alten Israel in der hellenistischen und römischen Periode*, Mainz am Rhein 1990; F. BIANCHI, *Su alcuni aspetti della decorazione architettonica in marmo a Leptis Magna in*

Table 3: Architectural decoration in white marble at *Rusicade* (Skikda).

USF lab #	$\delta^{13}C$	$\delta^{18}O$	MGS	Possible quarries*	Location	Museum inv. #	Description
9352	3,7	-4,7	coarse	<u>CdG</u>	Theatre		Column shaft with wavy stripes
10918	2,7	-4,3	1,0 mm	E, Pro2, H, Eph1-2	Museum	Ch Sk.051	Composite capital
10938	2,8	-5,0	2,0 mm	E, Pro2, H, Eph1	Theatre	C.16	Schematic Composite capital
10939	2,6	-5,3	2,0 mm	E, Pro2, H, Eph1	Theatre	C.28	Schematic Composite capital
10940	2,8	-5,0	2,5 mm	E, Afy, Pe, Pro2	Theatre	C.29	Asiatic Corinthian pier capital
10941	3,1	-6,6	2,0 mm	F, CdG, Pro2, Eph1	Theatre	C.31	Schematic Composite capital
10942	2,3	-5,5	2,5 mm	E, Pro2, H, Eph1	Theatre	C.47	Schematic Composite capital
10943	3,3	-6,5	8,0 mm	F, CdG, Pro2, Eph1	Theatre	C.56	Corinthian capital
10944a	2,4	-13,1	0,5 mm	E, CdG	Theatre	C.66	Corinthian capital with decorated abacus
10944b	2,4	-13,0	0,5 mm	E, CdG	Theatre	C.66	Corinthian capital with decorated abacus
10945	2,7	-5,4	2,0 mm	E, Pro2, H, Eph1	Theatre	C.73	Schematic Corinthian capital
10946	2,5	-8,2	1,1 mm	E, CdG, Pe	Theatre	C.22	Schematic Corinthian capital
10947	0,8	-6,7	2,0 mm	E, Afy	Theatre		Composite capital with decorated abacus
10950	3,3	-13,3	2,0 mm	<u>CdG</u>	Theatre	Col.51	Column shaft
10951	2,8	-7,6	1,5 mm	E, CdG, Pe	Theatre	Col.67bis	Giant column shaft

* Possible quarries are selected from either the fine-grained or their coarse-grained group. Preferred quarries are underlined.

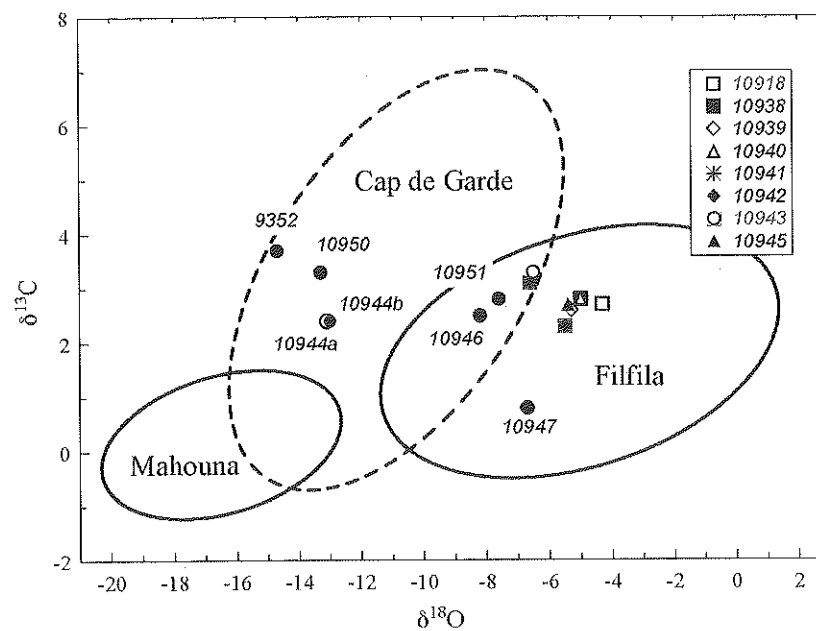
Fig. 5: Artifacts from *Rusicade* (Skikda).

Fig. 6: Corinthian pier capital of Proconnesian type, marble probably from Filfila, at Skikda theater (USF 10940).

Table 4: Architectural decoration in white marble at Calama (Guelma) and Thibilis (Announa).

USF lab #	$\delta^{13}C$	$\delta^{18}O$	MGS	Possible quarries*	Location	Museum inv. #	Description
8702	1,8	-15,5	coarse	<u>CdG</u>	Guelma, Jardin Archéologique	Col.JAG 001	Column shaft with dark gray diagonal bands
9385	1,9	-15,9	coarse	<u>CdG</u> , Nx	Guelma, Jardin Archéologique	Col.JAG 001	Column shaft with dark gray diagonal bands
9388	0,2	-18,6		<u>M</u>	Guelma, Museum	Col.guel.001	Tuscan column, Altar of Anstitti, Announa, travertine
9389	0,7	-14,1		<u>M</u>	Guelma, Museum, Ch.003	Pacht.pl.8.2	Corinthian capital with red marks
9390	0,5	-15,9		<u>M</u>	Guelma, Museum	IL.007	Altar of Fruendus, reddish
9403	0,5	-14,9		<u>M</u>	Guelma, Museum	Th.462	Altar of the Anstitti, Announa, front, banded travertine
9404	0,5	-19,3		<u>M</u>	Guelma, Museum	Th.462	Altar of the Anstitti, Announa, back, banded travertine
9454	0,5	-19,0	coarse	<u>M</u>	Announa, Market of Livius Felix		Altar with garland, patera, jug, layered travertine
9455	-1,1	-17,2	coarse	<u>M</u>	Announa, arch at forum entry		Corinthian pier capital, red and white, layering/foliation
9456	0,0	-17,9	coarse	<u>CdG2</u> , M, unknown?	Announa, South Church		Column shaft with dark gray diagonal stripes
9457	3,5	-15,5	coarse	<u>CdG</u>	Announa, below South Church		Column shaft with dark gray diagonal bands
10836	0,3	-8,7	0,8 mm	<u>F</u>	Guelma, in front of Museum		Corinthian capital with leaf and stem to abacus flower
10838	2,3	-3,1	7,0 mm	<u>E</u> , Proz., Pa/Ch, Ephz, H, Nx	Guelma, stairs behind Museum		Lower part of capital, two rings of schematic leaves

* Possible quarries are selected from either the fine-grained or the coarse-grained group. Preferred quarries are underlined.

(continued on next page)

Table 4 (continued)

USF lab #	$\delta^{13}C$	$\delta^{18}O$	MGS	Possible quarries*	Location	Museum inv. #	Description
10839	-1,2	1,2	mm	<u>E</u> , Ca, Hy, Afy	Guelma, stairs behind Museum		Schematic Corinthian capital with abacus
10855a	-17,1	5,0	mm	<u>M</u>	Guelma, Jardin Archéologique	Pacht.pl.8.3	Corinthianizing capital on inscription LIBERO.AVG
10855b	-17,3	5,0	mm	<u>M</u>	Guelma, Jardin Archéologique	"	Corinthianizing capital on inscription LIBERO.AVG
10857a	-17,1	5,0	mm	<u>M</u>	Guelma, Jardin Archéologique		Schematic Corinth. capital on inscription SAECVLOBAEATIS
10857b	-17,3	5,0	mm	<u>M</u>	Guelma, Jardin Archéologique		Schematic Corinth. capital on inscription SAECVLOBAEATIS
10858	3,8	-11,4	3,0 mm	<u>CdG</u>	Guelma, Jardin Archéologique		Corinthian capital with stem to abacus flower
10860	2,1	-6,5	2,0 mm	<u>E</u> , Proz., Nx/Mel, H	Announa, West Church		Column base, h 26 cm; upper \varnothing 52 cm
10861	0,8	-3,6	0,6 mm	<u>F</u> , Afy, Gökz, error?	Announa, Market of Livius Felix	Resample of 9454	
10862	3,7	-0,7	0,6 mm	<u>MP</u> , unknown?	Announa, Market of Livius Felix		Altar of Livius Felix, banded travertine with red layers

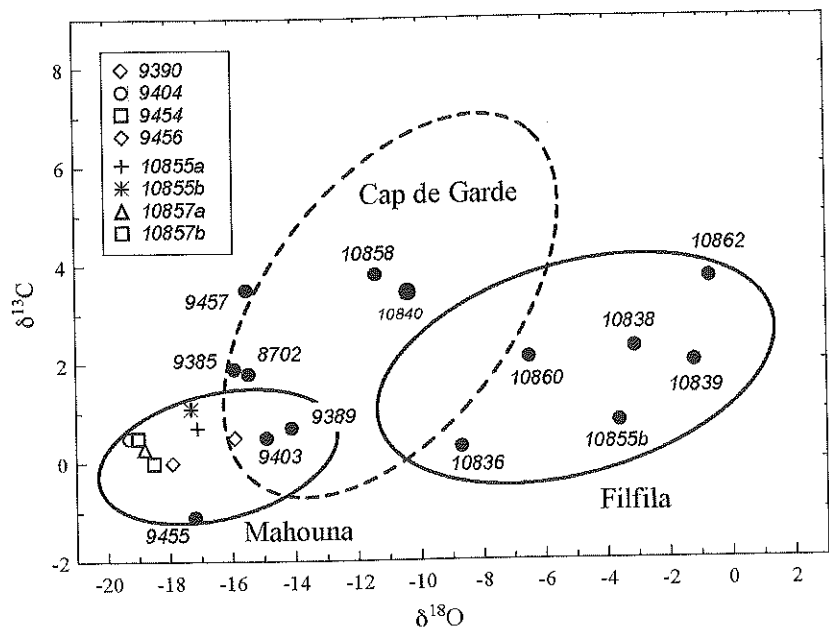


Fig. 7: Artifacts from *Thibilis* (Announa) and *Calama* (Guelma).

ries, and isotopic testing confirms this impression (TAB. 3, FIG. 5). Two Corinthian capitals had isotopic values for Cap de Garde (USF 10944, 10946), but their very fine grain indicates that they are more likely to be from Filfila. The marble of Mt. Filfila was exported to Carthage and Central Italy in the form of column shafts and capitals¹⁶.

Marble from Cap de Garde was able to make some inroads in the market at *Rusicade*. Two coarse-grained column shafts with diagonal bands, streaks, and spots not only appear to be from Cap de Garde but also had isotopic values compatible with this origin (USF 9352, 10950).

Several Corinthian capitals at Skikda reproduce designs seen in the Proconnesus (C14, 29, 40). One of them, C14, has coarse grain and was probably imported fully finished from the Proconnesian quarries. The other two (C40, C29, USF 10940, FIG. 6) have generally fine grain and a rather uniform light-gray color that indicate they are Filfila marble. The abacus of C29 (USF 10940, FIG. 6)

¹⁶ HERRMANN *et al.*, *Characterization and Distribution of Marble*, cit.



Fig. 8: Corinthian capital, third century, marble from Mahouana. Guelma, Museum (USF 9389).

is decorated with a palmette, a detail not seen in the East¹⁷, and the capital could be either a careful copy of an Eastern import or the work of a travelling sculptor from Asia Minor.

Inland almost equidistant from Mt. Filfila and Cap de Garde are the Roman cities of *Calama* and *Thibilis*, modern Guelma and Announa. Isotopic evidence makes it clear that the dominant marble for architectural decoration in this region came from the nearby quarry of Mahouana (TAB. 4, FIG. 7). An assignment to Mahouana is frequently supported by the appearance of a layered structure or by pink or red spots, veins or bands, as in two capitals in Guelma (USF 9389, FIG. 8; USF 10855)¹⁸. A minority of the architectural decoration in Guelma and Announa did not come from Mahouana. The alternate sources include Cap de Garde (USF 8702/9385, 9456, 9457, 10858), Djebel Filfila (USF 10836, 10838, 10839, 10860), and an unknown quarry, which produced a travertine visually indistinguishable from that of Mahouana (USF 10862).

¹⁷ Pointed out by Fulvia Bianchi, personal communication.

¹⁸ F.-G. DE PACITIÈRE, *Musée de Guelma (Musées et collections archéologiques de l'Algérie et de la Tunisie)*, Paris 1909, pl. VIII, fig. 2 (USF 9389), pl. VIII, fig. 3 (USF 10855).

Conclusion

The combination of scientific methods (isotopic analysis and grain size measurements) and optical analysis illuminates the interaction of local and imported white and gray marbles in North Eastern Algeria. Each of the three Algerian sources for architectural marble dominated the market in their immediate neighborhood. Marble from Mt. Filfila and Cap de Garde was able to penetrate their neighbors' home territories to some degree, while travertine from Mahouna apparently remained more local. Cherchel in the royal period had access to the best products of Rome and the Carrara quarries, but some architectural elements were made of Filfila marble. In the late second century Proconnesian marble was imported to Algeria, and Proconnesian designs were reproduced in the marble of Mt. Filfila.

John J. Herrmann Jr., Donato Attanasio, Robert H. Tykot, Annewies van den Hoek Aspects of the Trade in Colored Marbles in Algeria

Quarries and artifacts of colored marble in Algeria have been sampled and their stable isotopes of carbon and oxygen analyzed. These laboratory data have been supplemented by macroscopic observations of color and structure. In many cases it has been possible to attribute the marble of artifacts to quarries in Greece, Turkey, Tunisia, and Algeria itself. In some cases macroscopic and isotopic data contradict one another, and in others it seems possible that the marble came from currently unknown quarries.

Keywords: quarries, stable, isotopes, Mahouna, Aïn Smara, *alabastro a pe-corella*.

Background and methodology

In the nineteenth century Algeria was celebrated for its quarries of colorful marble, and these quarries have continued in use under the management of Enamarbre, the Algerian national marble company. The team of Antonelli, Lazzarini, Cancelliere, and Dessandier has provided scientific data on some of the quarries and has identified artifacts made of their marble at Djemila¹. We have also undertaken surveys of the Enamarbre quarries, which in geological terms produce true marble, calcite-alabaster, and travertine, and have sampled artifacts in many archaeological sites and museums. Analysis of the samples is underway at the University of South Florida (USF) and the Istituto di Struttura della Materia of the Centro Nazionale di Ricerche (CNR) at Rome. The ratios of stable

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1. F. ANTONELLI *et al.*, *On the White and Coloured Marbles of the Roman Town of Cuicul (Djemila, Algeria)*, «Archaeometry», 52, 2009, pp. 575-96.

L'Africa romana XIX, Sassari 2010, Roma 2012, pp. 1331-1342.