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MULTIMETHOD MARBLE IDENTIFICATION FOR FIGURAL SCULPTURE IN HIPPO REGIUS (ANNABA, ALGERIA)

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Abstract

Seventeen Roman sculptures in Hippo Regius, modern Annaba, on the coast of eastern Algeria were sampled, and their stable isotopes of carbon and oxygen compared with the data base for marbles important for the international marble trade in antiquity and with our new isotopic data base for Algerian quarries of white marble. Grain size, color, and markings were determined by either macroscopic inspection or laboratory measurement and compared with databases for international marbles. When marbles appeared to be Thasian, mineralogy was determined with cathodoluminescence and/or x-ray diffraction. With this combination of laboratory techniques and empirical observations in the field, it was possible to assign fourteen of the sculptures to their quarries of origin with a high degree of confidence.

Keywords

Algerian quarries, Thasos, stable isotopes

Introduction and methodology

Hippo Regius was an important city of ancient Numidia, lying in the eastern coast of modern Algeria and within the modern city of Annaba. In Roman times it was an administrative center, a port, and a center of communication with the interior via two rivers and a major road (Blas de Roblès, Sintes 2003, 194-207; DELESTRE 2005a). Hippo owes its greatest fame to St. Augustine, who was bishop there from 395 to 430. The excavated parts of the ancient city have revealed a number of typical Roman monuments, including a theatre, a large bath building, and a forum paved with marble dated to the year 78-79 (SUMERA 2005, 96). Especially important from our point of view are the nearby quarries of Cap de Garde, which produced a streaked and spotted marble that can be considered an “atypical” variety of “greco scritto” (ATTANASIO *et al.* 2012; HERRMANN *et al.* 2012a).

The Cap de Garde quarries were the prime local

source for architectural marble (HERRMANN *et al.* 2012a; HERRMANN *et al.* 2012b), and some material may also have been taken from outcroppings at several points within the city (DELESTRE 2005b, 86-7). Most of the marble from these local sources, however, is not ideal for sculpture since it has gray markings that would have been disfiguring in human images. Some blocks of uniform light gray marble, however, can also be found on the Cap de Garde. For the purposes of sculpture, somewhat more distant, “regional” quarries should also be taken into consideration. The quarries of Mt. Mahouna about 100 km up the Seybouse River and the Oued Chert produced an onyx marble or high-quality travertine that is usually marked heavily with pink but contains areas that are more-or-less white. The most significant quarries of white and gray marble in Algeria lie to the west of Cap de Garde near the coast on Mt. Filfila, roughly 75 km by sea from Hippo (HERRMANN *et al.* 2012a; HERRMANN *et al.* 2012b). In addition, “international” marbles used for sculpture in other Mediterranean or western Mediterranean coastal cities should be considered in assessing the situation at Hippo.

We have systematically sampled the three Algerian quarries that produced white or light gray marble, and the ratios of stable isotopes of carbon and oxygen have been determined at the University of South Florida (USF). These data have been compared with the diagrams of Gorgoni *et al.* 2002 and Pike 2009. Three large but relatively distinct fields have emerged (Fig. 1). The 31 samples from Mt. Mahouna and the 47 samples from Cap de Garde have relatively limited overlapping with international marbles from northern coasts of the Mediterranean (HERRMANN *et al.* in this volume, fig. 1). The 45 samples from Mt. Filfila, however, pose much more serious problems in relation to the international marbles. The Filfila isotopic field is not only large but it also coincides with or covers the fields of most of the international marbles (HERRMANN *et al.* in this volume, fig. 1). Complicating the problem further is the fact that the marble of Filfila is highly

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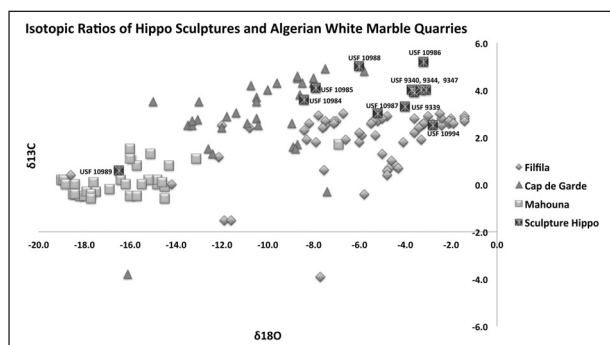


Fig. 1. Isotopic ratios of sculptures at Hippo Regius.



Fig. 2. Torso of a captive (?), Guelma Museum, USF10989, onyx marble from Mt. Mahouna.

variable in grain size and color. Furthermore, testing with paramagnetic resonance spectrometry (EPR) at the ISM-CNR, Rome proved to be unhelpful in separating Filfila from the international marbles (HERMANN *et al.* in this volume, figs. 2-3). EPR also revealed that, while generally pure calcite, Filfila has spots of pure dolomite: 3 out of the 45 samples were dolomite (Donato Attanasio, private communication).

In spite of the variability of Filfila marble, considering a combination of parameters (isotopic ratios, grain size, color, and markings) made it possible to assign a majority of the sculptures to their quarries of origin with a high degree of confidence (Table I). Maximum grain size (MGS) and color were compared with the data provided in Attanasio 2003, Van Keuren *et al.* 2009, and Van Keuren *et al.* 2012 (Table II). In select cases cathodoluminescence (CL) and/or X-ray diffraction (XRD) were used to determine mineralogy.

Analysis of test results

In a few cases isotopic results made identification relatively simple; in one case, the isotopes point unmistakably to Cap de Garde, USF10988 (Table I, Fig. 1). This non-figurative monument was a plain rectilinear sarcophagus inscribed in Greek, apparently in the fourth century, to a certain Flavia Kosmopolis. In a few other cases, two options were available and other criteria made the choice clear. A torso (apparently a captive with his arms behind his back), USF10989, had the very negative carbon and oxygen values of the onyx marble of Mt. Mahouna and some outliers from Mt. Filfila (Table I, Figs. 1-2). The layered structure of the torso's stone made it certain that it was onyx marble/travertine from Mt. Mahouna. A relief with a Maenad, USF10985 (Fig. 3), and a comic theatre mask, USF10984, had isotopic values characteristic of both Cap de Garde and Mt. Pentelicon, but their coarse grain and gray color strongly favors an assignment to Cap de Garde. All of these sculptures in the local marble can be considered reliefs; the flat cut on the backside of the torso USF10989 indicates that it was applied to a background. Relief sculpture, typically made use of local sources, even at sites where imported marble was used



Fig. 3. Relief with an ecstatic Maenad from the theatre of Hippo, Hippo Regius Museum, USF10985, marble from Cap de Garde.

USF #	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$	Grain size, optical features	museum #, bibliography or site	Description, provenance	Dolomite?	Preferred quarry & justification
9339	3.3	-4.0	Coarse grain; pure white	Inv. 953; Baratte 2005, 160	Minerva from N. Baths	Dolomite CL/XRD	<i>Tb</i> : isotopes, optical
9340	4.0	-3.7	Medium grain; pure white	Inv. 924; Baratte 2005, 164	Bacchus from N. Baths	Dolomite CL/XRD	<i>Tb</i> : isotopes, dolomite, optical
9341	1.5	-8.6	Coarse grain; pure white	Inv. 1111	Heroic male torso	Dolomite XRD	<i>Tb</i> : dolomite, optical
9342	2.4	-1.5	Fine grain: white	In situ in Hippo Forum	Lower part Pe-plophoros, in Forum		F or C: isotopes, optical
9344	3.9	-3.6	Coarse grain; spotless, brown surface	Inv. 1108; Baratte 2005, 155	Jupiter torso from Hippo	Dolomite XRD	<i>Tb</i> or Pa1: isotopes, optical
9346	-9.1	-6.8	Medium grain; pure white	Inv. 952; Baratte 2005, 159	Hercules Farnese, from N. Baths	Dolomite CL/XRD	<i>Tb</i> : dolomite, optical,
9347	4.0	-3.1	Coarse grain; pure white	Inv. 1110	Aesculapius from Hippo	No sample left	<i>Tb</i> or Pa1: isotopes, optical
9371	2.5	-4.2	Medium grain; pure white	Inv. 926; Baratte 2005, 163	Head of goddess	Dolomite XRD	<i>Tb</i> : isotopes, optical
10983	2.5	-3.8	MGS 2 mm	Baratte 2005, 160	Venus statue from N. Baths		F or PaM: isotopes, optical
10984	3.6	-8.4	Coarse grain; grayish	Baratte 2005, 159	Comic mask from Theatre		Pe, CdG: isotopes, grain size, color
10985	4.1	-7.9	MGS 1.5 mm	Bizot et al. 2005, 110.	Maenad relief from Theatre		Pe, CdG: isotopes, grain size, color
10986	5.2	-3.2	MGS 1.2; soft gray streak, translucent	Baratte 2005, 156	Lucius Caesar from Forum		Pa1: optical, isotopes
10987	3.0	-5.2	MGS 0.8 mm		Amazon sarcophagus		F, Pr, Af, or Pe: mgs, isotopes, optical
10988	5.0	-6.0	MGS 2.5 mm	From Guelma	Sarcophagus Flavia Kosmopolis		CdG: isotopes, MGS, optical
10989	0.6	-16.5	MGS 2 mm; white, strong gray bands	Baratte, 2005, 155	Relief torso with inscription		M: isotopes, optical
10994	2.5	-2.8	MGS 2 mm	In situ in Hippo Forum	lionskin		PaM, F: isotopes, optical
10995	4.0	-3.3	MGS 2 mm; faintly grayish	Forum shops; Sumera 2005, 100	Colossal togatus with U-form umbo		Pa1, Th, or Eph1: isotopes, grain size, color

Abbreviations: Af = Afyon/Dokimion; C = Carrara; CdG = Cap de Garde; Eph = Ephesus; F = Filfila; M = Mahouna; N = Naxos; Pa1 = Paros, Lychnites; PaM = Paros, Marathi; Pe = Pentelikon; Pr = Prokonnesos; Th = Thasos 3, Cape Vathy (dolomitic)

Tab. I. Sculpture at Hippo Regius: Stable C and O isotopic analysis and XRD at the Department of Anthropology, University of South Florida (USF). CL at Université Pierre et Marie Curie. Paris.

for freestanding statues, as for example, in Macedonia (PIKE *et al.* 2002, 271-273).

In some of these relatively simple cases, the isotopic ratios clearly indicate a non-Algerian origin for the marble. The combination of relatively high isotopic values for both carbon and oxygen provides a good basis for identifying non-Algerian marbles at Hippo. An Augustan portrait, perhaps Lucius Caesar, USF10986, and a colossal togatus, USF10995 (Figs. 4-5), both high-quality works and both from the forum, are well centered in the isotopic field for the Lychnites quarry on Paros, making this the probable source for their marble and excluding an Algerian origin. Their grain size is also compatible with Paros 1.

A relatively strong presence of Thasian marble was detected by a combination of macroscopic observation

and testing for the presence of dolomite by means of EPR, CL, or XRD. The sculptural marble of Thasos, which was quarried on Cape Vathy and the adjoining Saliara area on the island, was apparently the only coarse-grained dolomitic marble widely used in the ancient Mediterranean (ATTANASIO 2003, 201-2; HERRMANN, NEWMAN 2002, 215). Seven sculptures in Hippo have the look of marble from Cape Vathy on Thasos: that is, they are pure white and coarse grained and have areas of glittering flake-like grains. Six of them have proven to be dolomite, and no sample remains for testing the seventh (Table I). In general the isotopic values of these dolomitic marble sculptures fall into the field of Thasos, Cape Vathy in the diagram of Gorgoni *et al.* 2002 (Fig. 4). A Hercules of the Farnese type, USF9346, and a heroic torso, USF9341 (Fig. 6), however, have isotopic values that

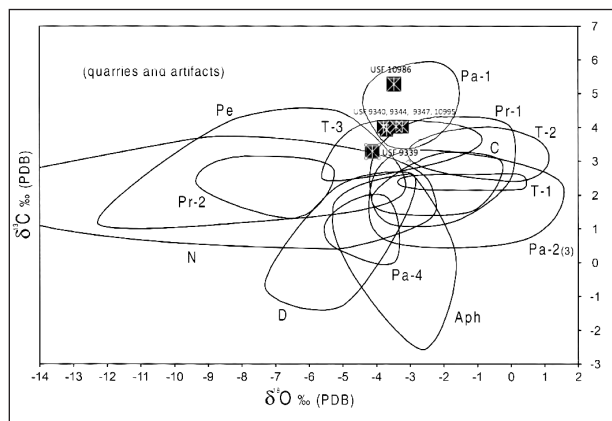


Fig. 4. Isotopic ratios for Mediterranean marbles (Gorgoni et al. 2002) and for sculptures of imported marble, Hippo Regius. Aph = Aphrodisias; C = Carrara; D = Dokimeion; Pa = Paros; Pe = Pentelikon; Pr = Prokonnesos; T3 = Thasos, Cape Vathy (dolomitic).

Quarry	$\delta^{18}\text{O}$	$\delta^{13}\text{C}$	MGS
Carrara	2.11	-1.89	0.80
Pentelicon	2.20	-7.00	0.96
Paros (Chorodaki)	1.79	-1.11	2.07
Paros (Marathi)	1.97	-2.59	2.11
Paros (lychnites)	4.27	-3.25	1.70
Proconnesos-1	2.51	-1.80	1.93
Proconnesos-2	2.64	-6.85	1.67

Tab. II. median values for relevant international quarries From Van Keuren, Attanasio et al. 2009, 353, Table I.



Fig. 5. Colossal togatus, Hippo Regius, shops of Forum, USF10995, Paros lychnites marble.

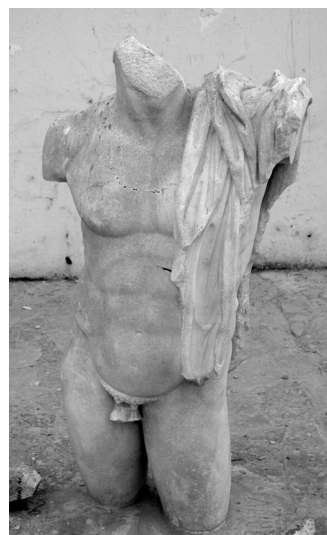


Fig. 6. Heroic torso: a god, hero, or ruler first century BCE, Hippo Regius Museum, USF9341, dolomitic marble from Thasos.



Fig. 7. Classicizing torso, Thasos Archaeological Museum, storage. Apparently Thasian marble.



Fig. 8. Torso of Jupiter, 2nd century. Hippo Regius, Museum, USF9344, Thasian marble.

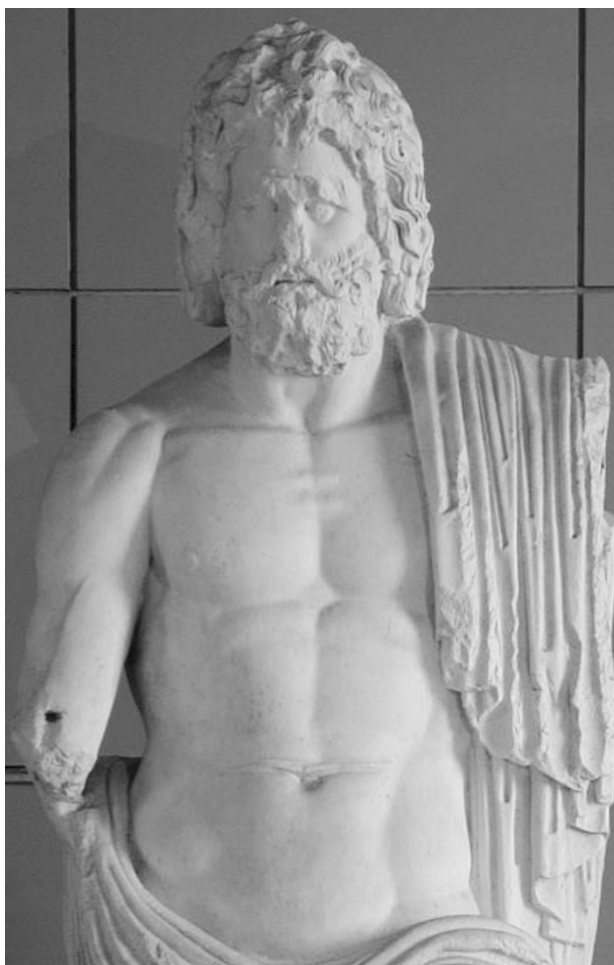


Fig. 9. Head and torso of Zeus, from Gaza, Istanbul, Archaeological Museum, dolomitic marble from Thasos.



Fig. 10. Goddess wearing a peplos ("peplophoros"), Hippo Regius, Forum, USF9342, Filfila or Carrara marble.

were far from the accepted Thasian range, but these problematic results may be due to analyzing a weathered sample or inadequate calibration for dolomite. A clumsy head of a goddess, USF9371, also had a carbon value that is somewhat low for the Gorgoni field for Thasos, but several other dolomitic, Thasian-looking sculptures elsewhere have similar, "light-carbon" isotopic ratios (HERRMANN, NEWMAN 1995, 74, table II).

The heroic torso in Thasian marble (Fig. 6) is an unusual type that could be a Hellenistic ruler; the head turned toward the upraised arm recalls the Nelidow Alexander, a bronze statuette reportedly from Macedonia (VERMEULE 1980; Harvard University Art Museums 1956.20). The statue's missing head was jointed on to the neck, suggesting a change of identity, perhaps when the ruler's head was replaced by that of a Roman emperor. The torso could well have been the product of a sculptor from Thasos; the torso has the schematic outlines of a Classicizing torso in the Thasos museum (Fig. 7), and the modeling of the cloak is comparable to that of another torso also in the Thasos museum's storage (MULLER, MULLIEZ 1982, 656, 658, fig. 10).

A torso of Jupiter in Thasian dolomite, USF9344 (Fig. 8), bears a striking resemblance to a more com-

plete statue of the same type, also in dolomitic marble from Thasos, found in Gaza and now in the Istanbul Museum (Fig. 9) (HERRMANN, NEWMAN 2002, 216). The drapery over the shoulder is particularly similar; a bare-chested Jupiter or Zeus does not normally have drapery that covers the shoulder so completely, and the technique of animating the drapery with narrow, drilled slots is another common feature. The similarities suggest that the Jupiter at Hippo could have been carved by a travelling sculptor from the East, probably from Alexandria.

Five of these sculptures in Thasian dolomite come from the North Bath at Hippo, which is dated to the time of Caracalla (211-217 CE). The best piece of the group, the overlifesize Minerva, USF9399, is inscribed in Latin as a product of the workshop of Plotius Clemens (EX OF. L – PLOT < CLEMENTIS <: *ex officina Lucii Plotii Clementis*). Clemens was probably the owner of the shop rather than the sculptor. The Minerva is an elaborate and original variation on famous types of Minerva known at Rome, especially the Minerva Giustiniani. The other sculptures in the Baths group are more stereotyped and simplified and are probably the products of less-talented assistants. A consignment of Thasian mar-



Fig. 11. Lionskin, Hippo Regius, Forum, USF10994, Filfila or Parian marble.

ble was evidently put at the disposition of the workshop of Clement for the project in the North Baths.

On a purely isotopic basis it is almost impossible to unambiguously identify calcitic marble in Algeria whose isotopic ratios of carbon fall at or below the level of 3.0. As noted earlier, Mt. Filfila has isotopic ratios that coincide with the fields of most international marbles of antiquity, spreading out in a band below the 3.1 level. Furthermore the grain size and color of Filfila marble are too variable to offer a certain basis for discrimination. Two high-quality sculptures in the Hippo forum are made of beautiful blocks of fine-grained marble of very uniform white color and texture. Isotopically, the lower part of a colossal goddess wearing a peplos, USF 9342, could be either Filfila or Carrara marble (Fig. 10). A fragmentary sculpture with a lionskin, USF 10994, might be marble from Filfila or Paros (Fig. 11). In spite of the good quality of the marble and the fact that these works are statues rather than reliefs, Filfila cannot be excluded as an option. A completely different coarse-grained, grayish marble with dark gray zones was used for a statue of Venus of the Capua type, USF 10983. It could have come from Paros or a number of quarries in Asia Minor, but Filfila is again a legitimate option in terms of color, grain size, and isotopic ratios.

As a practical matter, however, non-quantitative characteristics, such as color, markings, and texture, in some cases can provide a basis to choose between Filfila and other isotopically possible marbles. A third-century sarcophagus with an Amazonomachy, USF10987, has fine grain and isotopic ratios suitable for Filfila, Afyon, and Pentelicon (Fig. 12). Afyon is pure white and Pentelicon has foliation. The sarcophagus, however, has a somewhat dingy color and an occasional wandering crack, and these characteristics tend to exclude the former sources and make it likely that the marble comes



Fig. 12. Sarcophagus with a battle between Greeks and Amazons, Hippo Regius Museum, USF10987, probably marble from Mt. Filfila.

from Mt. Filfila. Since the style and iconography of the sarcophagus seems central Italian, the identification of the marble indicates that a workshop or sculptor trained in Italy moved to Algeria to execute the sarcophagus.

Conclusions

Of the seventeen marble sculptures we sampled at Hippo Regius (including one in onyx marble or high quality travertine), we were able to confidently identify thirteen by making use of a combination of methods, namely, isotopic ratios of carbon and oxygen, CL and XRD (to detect the presence of dolomite), petrographic determination of grain size, and macroscopic examination. Three Algerian marble sources were identified: Mt. Mahouna, Cap de Garde, and Mt. Filfila. These eastern Algerian sources were used for five relief sculptures. Marble imported from the Greek islands of Paros and Thasos, on the other hand was used for nine statues or statue fragments. In the case of the three remaining statues, we felt unable to determine not only whether or not the marble came from a specific quarry but also whether it was from a local Algerian source or imported.

In cultural terms, the identification of the marble made it clear how central Italian types of sculpture could be translated into various Algerian marbles by skilled workshops. The identification of Thasian marble at Hippo Regius produced several striking results. An early and important statue of a ruler (USF941) was probably made by a sculptor from the north Aegean, possibly Thasos itself. A Thasian torso of Jupiter (USF9344) revealed possible connections with the Alexandrian orbit. The Thasian sculptures in the Hippo "Baths of Caracalla" returned to an orientation toward Rome.

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