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INITIAL ARCHAEOMETRIC STUDIES OF THE MARMARITSA QUARRY (MARONEIA) AND TWELVE THRACIAN FUNERARY RELIEFS IN THE KOMOTINI MUSEUM (GREECE)

INTRODUCTION

Aegean Thrace, a conventional, modern designation, is the southwest and smallest section of ancient Thrace (Fig. 1), bordered by the Nestos River to the west, the Evros River to the east, Mt. Rhodope to the north and the Aegean Sea to the south.¹ Being a fruitful plain, it was inhabited already in the Neolithic period and according to the literary sources and the rapidly emerging archaeological evidence, various Thracian tribes dwelt in the area before Greek colonization and lived side-by-side with the colonists afterwards.

Before the middle of the seventh century B.C., the first Greek colonists came from Clazomenae and founded Abdera.² Around 680 B.C. Parians colonized the neighbouring island of Thasos and soon crossed over to the coast of Aegean Thrace to settle the Thracian Peraia (between the Strymon and Nestos Rivers). Before the middle of the seventh century, Chians colonized Maroneia on the shores of the land of a Thracian tribe known as the Kikones; Ainos, on the southeastern coast of Thrace, was colonized by Aeolians from Alopekonesos, Mytilene and Kyme.³ A little later, in the second quarter of the sixth century B.C., Samians colonized Samothrace.⁴ Thus, the Chians, Aeolians and Samians created a melting pot of Ionian and Aeolian influences in an area where various Thracian tribes existed since the time of Homer.

The research presented here is part of a larger, synthetic study on the inscribed and uninscribed, figured gravestones from Aegean Thrace that date from the time of the Greek settlers to the third century A.D.⁵ Of the 292 inscribed funerary monuments catalogued in the corpus of inscriptions from Aegean Thrace,⁶ only 16 are decorated with figured scenes, in other words, a mere 5.4%. To these we were able to add 47 uninscribed, sculpted monuments that provide a fuller picture of sculptural production in Aegean Thrace. From this corpus of 63 figured tombstones, the majority of which were made of marble, we selected 12 stelai of different periods, from the fourth century B.C. to the third century A.D., to undergo laboratory analysis in order to investigate the sources of the marble.

Assuming that local marbles could have been used together with imported marbles, we first conducted a search for marble quarries in the area, from Abdera to Maroneia. We visited the latter and undertook an initial sampling of the already known, but never before fully described, quarries of Marmaritsa, near the ancient town of Maroneia. Xidakis et al. have published a very general and brief account of the geology of the area and the use of the local marble but include no details as to how or when the marble was exploited, or any characterization of the marble itself.⁷ A short description of this quarry can also be found in the Corpus of Ancient Quarries by Kokkorou-Alevra et al. (2014).⁸ This paper is thus a first contribution towards a better understanding of this marble and its main minero-petrographic and isotopic features, which may be useful for implementing the ongoing database of ancient marbles⁹ and

¹ Aegean Thrace covers the modern prefectures of Evros, Rhodope and Xanthi.

² LOUKOPOULOU *et alii*, 126; SKARLATIDOU 2010, 31-32.

³ HOM. *Il.* IV, 520; HDT, VII, 58; BAŞARAN, Ainos (Enez), 19.

⁴ GRAHAM 2002, 231-260, where the author outlines all the evidence and previous interpretations for the

colonization of Samothrace.

⁵ ANDRIANOU 2016.

⁶ LOUKOPOULOU *et alii* 2005.

⁷ XIDAKIS *et alii* 1990.

⁸ KOKKOROU-ALEVRA *et alii* 2014, 82.

⁹ ANTONELLI-LAZZARINI in print.

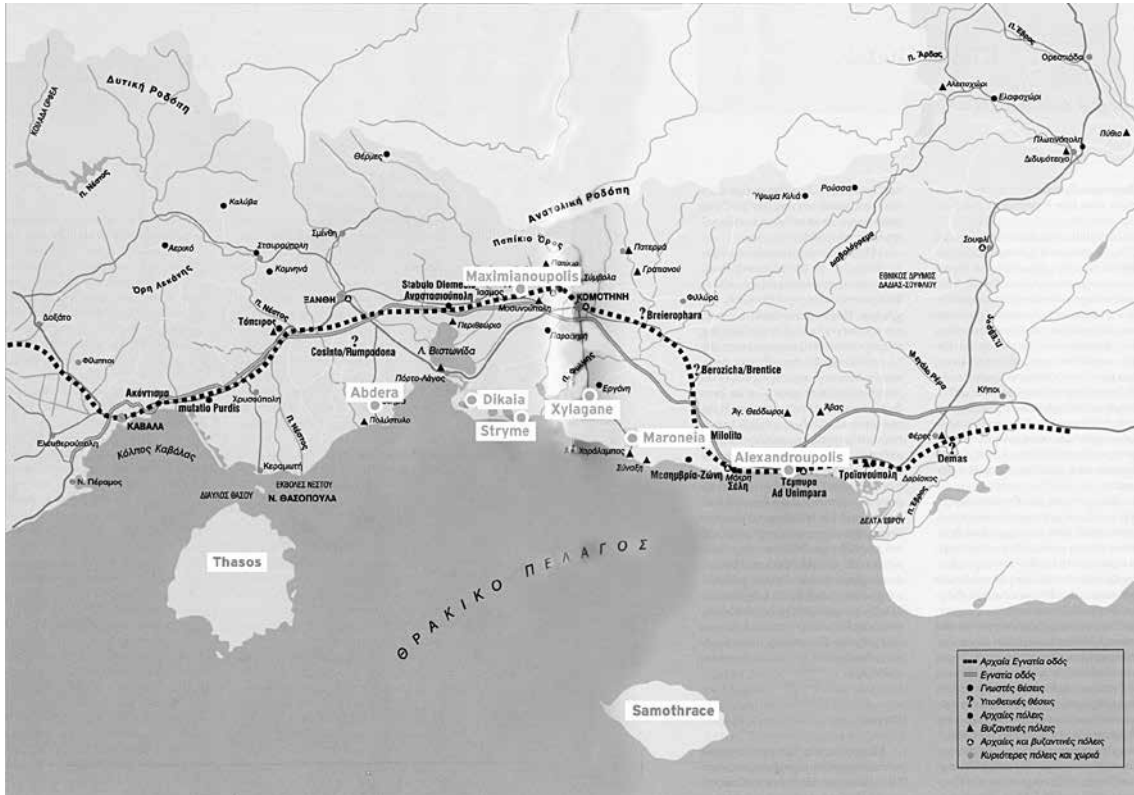


Fig. 1 - Map of ancient Thrace (TSATSOPOULOU 2005, Εγνατία Οδός: Ιστορία και διαδρομή στο χώρο της Θράκης, Athens, fig. 1 with modifications by D. Andrianou)



Fig. 2 - General view of the marble outcrop from the south, with Mount Ismaros in the back



Fig. 3 - Detail of the marble outcrop with small ridges isolated by differential karstic erosion

for solving certain archaeometric problems. Furthermore, this research presents the results of an initial provenance study of a dozen Thracian marble reliefs stored in the Archaeological Museum of Komotini.

THE ANCIENT QUARRIES OF MARMARITSA IN THE VICINITY OF ANCIENT MARONEIA

After a first exploration of the local quarrying area of Marmaritsa, it is evident that ancient quarries appear throughout quite a large area (approximately 1 square km) starting about 1,5 km east of the ruins of the theatre of Maroneia, on the southern slopes of Mount Ismaros. The marble outcrop corresponds roughly to a 2 km long, 500 m. wide ridge (Fig. 2, 3), which is rather flat and joins the mountain to the sea after a very steep scarp (Fig. 4). This ridge has been cut by a mostly dry stream into a rather deep valley full of vegetation; the best quality marble has been naturally selected by karstic erosion that isolated the less tectonised areas. In antiquity the quarries were opened in these areas, at the top of the ridge, on both sides of the valley and on the more accessible bottom areas (Fig. 5,6,7). They are all rather small (with a maximum length of 10-15 m and 5-10 m high) and generally exhibit characteristics of the typical Roman quarrying method which creates a step effect produced by cutting the marble into blocks with heavy picks



Fig. 4 - The southernmost part of the marble outcrop ending at the sea, with a small modern quarry



Fig. 5 - An ancient quarry opened in the western part of the marble outcrop, partly covered by vegetation



Fig. 6 - A small cutting area in the western part of the outcrop



Fig. 7 - A detail of Fig. 6 showing two large (Greek ?) wedge-holes

that leave deep incisions in vertical and horizontal trenches and chevron-like marks on the front of the quarried area (Fig. 8,9). These marks, however, are sometimes almost entirely erased by erosion and running water, especially in the centre of the marble outcrop (Fig. 10). Wedge-holes are numerous throughout the outcrop and outside the quarries where single blocks were extracted: they are especially frequent in the western area (Fig. 11). In most cases these wedge-holes are the same size as the Roman ones but some are larger and can be dated to the Greek period of use (Fig. 7).



Fig. 8 - Detail of a vertical cut showing marks of the Roman heavy pick



Fig. 9 - Detail of an initial horizontal cut of a quarry channel



Fig. 10 - Several small ancient quarries in the central area of the marble outcrop: some are filled with vegetation



Fig. 11 - A line of Roman wedge-holes in an ancient quarry of the eastern part of the marble outcrop



Fig. 12 - An ancient cut opened in the whitish variety of the Marmaritsa marble (central-western part of the outcrop)

Most of the quarries were opened in areas where the marble is compact, has a medium grain size and a light grey colour, and sometimes exhibits white bands. A few quarries were opened in areas with a more fine-grained and whitish marble (Fig. 12) as well as in areas containing a decidedly grey marble with a very fine grain and sometimes abundant short white stripes (Figg. 13, 14).

Outcrop of grey marble with a very coarse grain (the presence of which has been frequently noticed in the ruins of Maroneia) have not so far been found in the Marmaritsa area and should be looked for elsewhere, possibly on the NE slopes of Mount Ismaros.



Fig.13 - A small quarry opened in the grey, fine-grained variety of marble outcropping in the southernmost area of Marmaritsa



Fig. 14 - Quarry front of the grey fine-grained marble with short parallel white stripes outcropping in the southernmost area of Marmaritsa

THE MARBLES OF MARMARITSA, THEIR GEOLOGICAL SETTING AND SAMPLING

The core of the Rhodope massif is made up of sedimentary and igneous rocks formed in the Paleozoic and Mesozoic eras and metamorphosed at high temperatures into amphibolites, gneisses and marbles well before the Alpine compressions. The Mesozoic metamorphism also extended into the Serbo-Macedonian massif and the Circum-Rhodope zone, namely in the western area which produced the very coarse grey marble of Philippi,¹⁰ and in the eastern part of Aegean Thrace, including our study area. In this area, Mount Ismaros, the highest peak, corresponds to a magmatic plutonite (of monzodioritic composition with abundant clinopyroxene¹¹) that extends to the south. Considering the geological setting of the magmatic masses of Mount Ismaros and of the monzodioritic pluton, their relationships with marbles, and the great variability in grain size of the marble itself, namely its progressive diminution with the increasing distance from the pluton, it is easily inferred that the marbles have been generated by contact metamorphism. As for the marbles, the metamorphic aureole is in fact composed of a coarse-grained greyish marble in its interior section (near the mountain), a whitish/greyish marble of medium grain in the middle, and a fine-grained grey marble in the exterior section (near the sea).

A very limited number of samples have been taken in these three areas due to the difficulty of finding sound marbles in the areas quarried in antiquity where long exposure to the sun, rain water and biological attack have produced heavy weathering on the exposed surfaces. A total of eight samples were taken, along with one sample (#MT) from a block of a very coarse grey marble used to built the ancient theatre of Maroneia. An initial search in present-day stone factories for other examples from marble outcrops and quarries in the area between Maroneia to Abdera and in the vicinity of Abdera allowed us to collect information about a modern marble quarry at Stavroupolis, to the northeast of Abdera. We were told that the presence of traces of ancient exploitation could not be excluded, and we were also given a sample of a high-quality and perfectly white marble from that quarry (#SW). The quarry and the areas around Xanthi will be further investigated in the near future.

THE EXAMINED FUNERARY STELAI

The iconographic themes on the tombstones of Aegean Thrace consist of funerary banquets, following the tradition of Asia Minor; the *Heros Equitans*, a theme that became very popular in the northern part of Thrace during the Roman period; standing and seated male and female figures, with Attic and Ionian features; and a few monuments with gladiators. Interestingly enough portraits, so common on funerary reliefs from the Strymon valley and Macedonia, are not found in Aegean Thrace.

None of the tombstones under study, however, were found *in situ*; they were all either handed over to officials by villagers or found in a secondary use in the cities highlighted on the map (Fig. 1).

As mentioned earlier, the stelai under consideration range from the fourth century B.C. to the third century A.D. More specifically, four of these stelai are dated to the fourth century B.C.

The first of these reliefs (n° 134, Fig. 15), possibly in the form of a *naiskos* and depicts a female, preserved from the neck to just below the knees, seated in three-quarter view on a *diphros*



Fig. 15 - ATK 134 Seated female figure
(Photo: Christos Simatos)

¹⁰ HIGGINS-HIGGINS 1996, 114-117.

¹¹ PE-PIPER-PIPER 2002, 251-252.



Fig. 16 - AΓK 252 Seated female figure with an attendant
(Photo: Christos Simatos)



Fig. 17 - AΓK 935 Veiled female figure
(Photo: Christos Simatos)

with lathe-turned legs.¹² Dressed in a chiton with short sleeves and a himation, she rests her right hand on her thigh while her left hand, now lost, was probably bent in the *anakalypsis* gesture. The relief retains Ionic and Attic features and it may be placed in the first half of the fourth century B.C.

The second relief (n° 252, Fig. 16), also possibly in the form of a *naiskos*, comes from the peninsula of Molyvoti.¹³ It depicts a female seated on a *diphros*, facing left, towards her standing servant who offers her a folded piece of cloth (a himation or peplos). Both figures are in high relief. The iconography reminds us of Attic art and this piece of sculpture was long thought to be of Thasian marble but our investigation proved that it is Pentelic.

The third stele (n° 935, Fig. 17), from Maroneia, depicts a veiled female preserved from the head to just below the breast, with her head turned slightly to the right.¹⁴ This fragment represents only a small part of a larger relief of the fourth century made of Thasian dolomitic marble.

The fourth example (n° 12, Fig. 18), from Xylagane, is a shaft stele that depicts a male figure on the right, facing front.¹⁵ He is dressed in a short chiton and chlamys, with his right hand raised, possibly holding a spear, and is interpreted as a wayfarer or warrior. A smaller male to the left, with head bent down, either in grief or as an indication of respect, holds a cylindrical object (possibly a *deltos*) in his right hand. He is dressed in a himation that leaves the right shoulder and arm bare. This Ionian work of art with Attic influences was long thought to be of Thasian marble but our investigation proved that it is from a local source.

One relief (n° 663, Fig. 19) dated to the second or first century B.C., is part of a life-sized relief found in the coastal area of Maroneia.¹⁶ It shows a female figure standing in a frontal pose from the waist down and in a three-quarter view from the waist up. She is dressed in an Ionic chiton (high-girded and

¹² BAKALAKIS 1958, n° 9, 57-59.

¹³ PENTAZOS 1969, 194-195; TERZOPOULOU 2000, 153, fig. 11.

¹⁴ The *stèle* is unpublished. It is thoroughly discussed in ANDRIANOU 2016.

¹⁵ BAKALAKIS 1962, 197-206; TERZOPOULOU 2000, 152, fig. 10. The funerary character of this *stèle* is disputed.

¹⁶ The *stèle* is unpublished. It is thoroughly discussed in ANDRIANOU 2016.



Fig. 18 - ATK 12 Standing male figure with an attendant
(Photo: Christos Simatos)



Fig. 19 - AKM 663 Standing female figure with a servant
(Photo: Christos Simatos)

short-sleeved with buttons) and a himation. With her left hand she may be touching her himation in the *Pudicitia* motif. She is followed by a female attendant. The relief is made of local marble, from the quarry of Marmaritsa, close to the archaeological site of Maroneia.

Imported Proconnesian marble is employed on two stelai from the turn of the first century B.C. to the first century A.D.: the first (n° 131, Fig. 20) was found in 1958 in the port of ancient Ainos, modern Enez, in Turkey, and was carried to the port of Alexandroupolis.¹⁷ The *stèle* takes the shape of a *naiskos* with side pilasters, flat capitals and no bases, and has a pediment with corner acroteria and a decorative shield in the center. A cutting at the apex of the pediment is preserved for the placement of the central acroterion. Part of an inscription is visible on the epistyle and *anathyrosis* runs along all the sides of the *stèle* except the bottom. In the *naiskos* a woman, dressed in a chiton, himation and closed shoes, stands on the left holding a bird in both hands; on the right she is accompanied by a small girl who raises her right hand, holding out a fan towards the woman.

The second *stèle* made of Proconnesian marble (n° 26, Fig. 21) is another inscribed relief of the same date.¹⁸ It is especially worth noting because of the *three* figures shown reclining on a single *kline* (a “family-banquet”), something common in Kyzikos. Small weights attached to the himatia of the reclining figures create decorative fringes on the mattress of the *kline*, an artistic detail commonly seen on reliefs from late Hellenistic and early Roman Kyzikos. Based on these reliefs, examples attributed to workshop C from Miletupolis,¹⁹ and the Proconnesian marble, which has been verified through isotopic analysis, this relief may have been imported from an Eastern Greek workshop somewhere in Kyzikos or its *chora* (Miletupolis) around the sea of Manyas.

Both of these aforementioned reliefs attest to the use of Proconnesian marble before its mass

¹⁷ The *stèle* is unpublished. It is thoroughly discussed in ANDRIANOU 2016.

¹⁸ The inscription is published and the relief is briefly mentioned in LOUKOPOULOU *et alii* 2005, 600, E 491.

¹⁹ ŞAHİN 1997, 196.



Fig. 20 - AFK 131 Standing female figure with a girl (Photo: Christos Simatos)



Fig. 21 - ATK 26 Funerary banquet (Photo: Christos Simatos)

production and exportation outside Asia Minor, which was for a long time placed in the second half of the first century A.D.²⁰

Two of the *stelai* under consideration date to the first century A.D. The first relief (n° 25, Fig. 22) comes from a site possibly identified with ancient Paisoula (known as Maximianoupolis from the third century A.D. onwards) and is part of a *Stockwerkstele* that depicts a *Heros Equitans* in the lower register and what seems to be a funerary banquet, now almost entirely lost, in the upper register.²¹ The mounted *Heros* gallops over a dog and a boar; the front legs of the horse almost touch a round altar that is placed in front of a tree with a coiling snake. Next to it, on the far right of the relief, stands a female figure in the type of the Large Herculanensis. The marble is local.

The second (n° 591, Fig. 23) is an inscribed relief from Maroneia and depicts a male figure reclining on a *kline* of Roman type with S-fulcra, dressed in a *himation*.²² He holds a *skyphos* with horizontal handles and thumbrests, a type known from various Roman examples. A tripod table with legs terminating in bovine hooves is placed in front of the *kline* and part of another piece of furniture (table or shelf?) is partially sculpted next to the table. The marble is also local.

To the second century A.D. belongs another *Stockwerkstele* (n° 4, Fig. 24), that depicts a mounted *Heros* in the lower register and the feet of three possibly standing figures in the upper register.²³ Its provenance is unknown but it was once part of the Alexandroupolis collection and its marble is local.

Finally, two *stelai* of the third century A.D. comprise the latest of our samples. They both belong to ladies of Thracian origin. The first (n° 937, Fig. 25) is inscribed with the Thracian name 'Καρτουζα.²⁴ The inscription is placed in the third century A.D. but the relief itself should be dated earlier, to the late first or second century A.D. It comes from Maroneia and depicts a funerary banquet of two reclining figures resting their left arm on pillows. A rectangular table laden with food stands in front of the *kline*. A young male servant dressed in a short, girded *chiton* and sandals stands on the right side of the relief. This

²⁰ The *Propylon* of Ptolemy II in Samothrace, dated to the early third century B.C., has capitals made of Proconnesian marble. Also, Proconnesian marble is possibly attested on the Dedication of Philip III and Alexander IV (if the two eagles unearthed once served as *acroteria* for the building). According to the dedicatory inscription the building is dated to 323-317 B.C. (MANIATIS *et alii* 2009, 263-278, esp. 272-274).

²¹ LIMC, s.v. *Heros Equitans*, n° 556*; SLAWISCH 2007, Ko 1, 188, pl. 18.

²² The inscription is published and the relief is briefly mentioned in LOUKOPOULOU *et alii* 2005, 446, E 317.

²³ PENTAZOS 1973, 31. A thorough discussion of the relief in ANDRIANOU 2016.

²⁴ The inscription is published and the relief is briefly mentioned in LOUKOPOULOU *et alii* 2005, 452, E 328.



Fig. 22 - ATK 25 *Stockwerkstele* (Photo: Christos Simatos)



Fig. 23 - AKM 591 Funerary banquet (Photo: Christos Simatos)

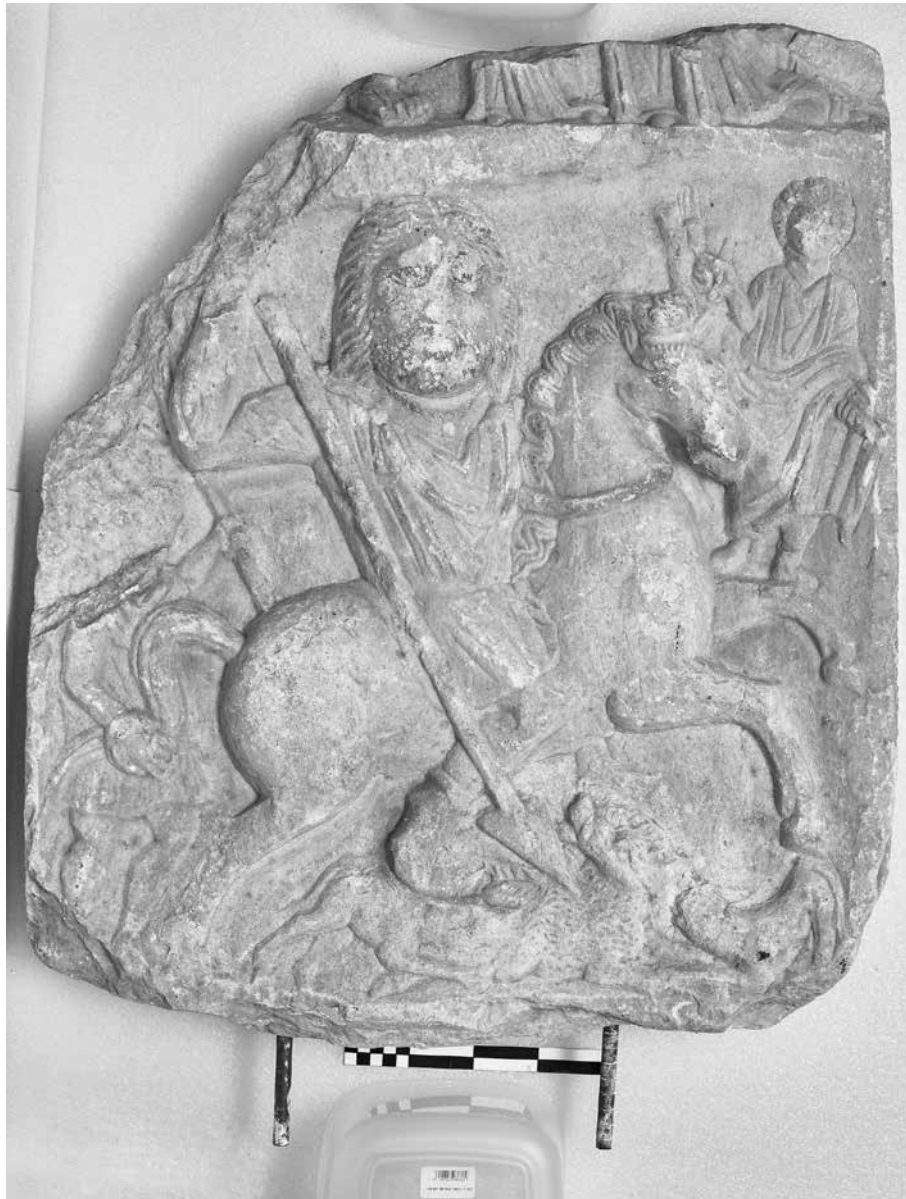


Fig. 24 - n° 4 Alexandroupolis Collection *Stockwerkstele* (Photo: Christos Simatos)



Fig. 25 - ATK 937 Funerary banquet (Photo: Christos Simatos)

exceptional relief is of local marble, from a still unknown quarry, and may be the product of a local workshop.

The final *stèle* from our sample group, n° 30 (Fig. 26), is inscribed with the Thracian name 'Bendis' and depicts a woman seated alone, next to a monopode table laden with food.²⁵ She is not dining, but depicted, in the *anakalypsis* gesture. She wears a himation tied just under her chest, closed shoes and her head is covered by a separate veil (ἐπιβλημα, καλύπτρα); this is especially popular on female figures from Thasos but also appears on a couple of reliefs from Serres (Macedonia).²⁶ She sits on a low *diphros* with an elaborate pillow that creates decorative spirals on the sides. Her feet rest on a footstool. The relief preserves traces of color and although it bears similarities to Thasian works of art, its marble is local.

EXPERIMENTAL

Minero-petrographic analyses

Minero-petrographic analysis is of fundamental importance in characterizing marbles and determining their genesis, i.e. the type of metamorphism (burial, contact, regional) and grade (low, medium, high). While a more or less complete characterization is possible for all marbles (from monuments and quarries), the petrological determination of their genesis is possible only for quarry samples and when representative sampling is undertaken by geologists who can perform accurate field studies of the marble outcrops and quarries. Such studies have not been possible for the marble of the Marmaritsa quarries for many reasons (mostly due to the limited time available for searching, documenting and sampling the outcrops and quarries), although a literature search has produced enough data to reach a first geological setting of the marble.

The characterization of the samples collected from the ancient quarrying areas has been somewhat difficult due to the heavy deterioration of the marble in the cuts: as mentioned above, only a limited number of samples could be collected and used for an initial colour determination (with a Munsell Neutral Colour Scale) and for minero-petrographic and geochemical analyses. The methods used were standard and are fully described below; the same methods were performed on the samples taken from the museum's artefacts.

All determinations were made on a single fragment (of ca. 3x5x1 cm for the quarry samples and of 1x2x0.5 cm for the artefacts). Part of each sample was finely ground and the powder subjected to diffractometric (X-radiation CuK α /Ni at 40KV, 20mA) and isotopic analysis (see below). The remaining part was used for the preparation of a thin section for the minero-petrographic study of the marble under a polarizing microscope. The purpose of this examination was to determine the fabric, accessory and secondary minerals, and the calcite (and/or dolomite) crystal-characteristics which are the principal constituents of all types of pure marble.

More specifically, the following parameters were determined:

- type of fabric (homeoblastic = with roughly isodiametric grains; heteroblastic = with grains of various dimensions), in direct relationship with the type of metamorphism (equilibrium, non equilibrium, retrograde, polymetamorphism, etc.)



Fig. 26 - ATK 30 Seated female figure
(Photo: Christos Simatos)

²⁵ The inscription is published and the relief is briefly mentioned in LOUKOPOULOU *et alii* 2005, 484-485, E 386.

²⁶ The ἐπιβλημα is common on Thasos between 150

A.D. and the end of the 3rd century A.D. I would like to thank Professor B. Holzmann for discussing this issue with me.

- boundary-shapes of the calcite/dolomite grains, also connected to the type of metamorphic event/s that generated the marble
- maximum grain size, a parameter of significant diagnostic importance since it is linked to the grade of metamorphism reached by the marble
- qualitative and semi-quantitative presence of accessory minerals, sometimes of diagnostic value.

For the petrographic description, prior specialised studies of the most significant of the ancient marbles,²⁷ in addition to other archaeometric studies of minor marbles and classical treatises on petrotectonics,²⁸ were taken into consideration.

CHEMICAL ANALYSIS

A quantitative chemical analysis of some of the accessory minerals was required to confirm their identification. This analysis was performed in polished thin sections with a scanning electron microscope (SEM) and an energy dispersive spectrometer (EDS).

ISOTOPIC ANALYSES

As is well known, isotopic characterization has proved to be very useful in identifying the marble used in ancient artefacts. Its use is becoming more and more widespread owing to its outstanding sensitivity, to the small quantity of material necessary for the analysis, and to the availability of a rapidly growing database that is often associated with other laboratory methodologies.²⁹ Such an association permits increasingly trustworthy comparisons, especially if the isotopic data are evaluated together with the minero-petrographic results from the same samples, as in the present study.

The isotopic analyses were carried out on the carbon dioxide derived from small portions (20-30 mg) of the powdered sample subjected to a chemical attack with 100% phosphoric acid at 25° in a special vacuum line, according to the procedure suggested by McCrea and Craig. The resulting CO₂ was then analysed by mass spectrometry. The instrument used is endowed with a triple collector and permits the measurement of both isotopic ratios (¹³C/¹²C and ¹⁸O/¹⁶O) at the same time.

The analytical results are conventionally expressed in δ units, in parts per thousands:

$$\delta \text{ sample} = (R_{\text{sample}} / R_{\text{std}} - 1) \times 1000$$

in which R sample and R std. represent the isotopic ratio of oxygen and carbon in the sample and in the reference standard, respectively. The standard adopted is the international PDB for both oxygen and carbon (the PDB standard is the rostrum of the *Belemnitella americana* of the Cretaceous Pee Dee Formation of South Carolina).

The identification of the provenance of the marble artefacts was obtained by comparing their minero-petrographic and isotopic data with those collected from the analysis of the quarry samples and from those published in literature.³⁰

THE RESULTS OBTAINED AND THEIR DISCUSSION

The marbles of Marmaritsa

The minero-petrographic examination of the marble of Marmaritsa has allowed us to determine the initial fundamental features of the whitish-grey marbles (Munsell N. V. S. values varying from 8.5 to 7)³¹ (Table 1). The results showed that the fabric is hetero/homeoblastic and of a mosaic type (Fig. 27, 28, 29), sometimes with lineation marked by fine-grained, slightly-oriented levels. The grain size ranges from small, to medium, to coarse (Fig. 27, 28, 29). The main component mineral is calcite (only one sample contained small amounts of dolomite) exhibiting mostly straight-to-curved boundaries (fig. 27, 28). MGS varied from 0.96 to 2.80 mm and the detected accessories are quartz, K-mica, opaque minerals (pyrite and hematite), apatite, epidote, titanite and clynopyroxene (Fig. 30), all in very small amounts.

²⁷ LAZZARINI *et alii* 1980; GORGONI *et alii* 2002.

²⁸ SPRY 1986.

²⁹ GORGONI *et alii* 2002; ATTANASIO *et alii* 2006.

³⁰ As for n. 7.

³¹ MUNSELL 1967.

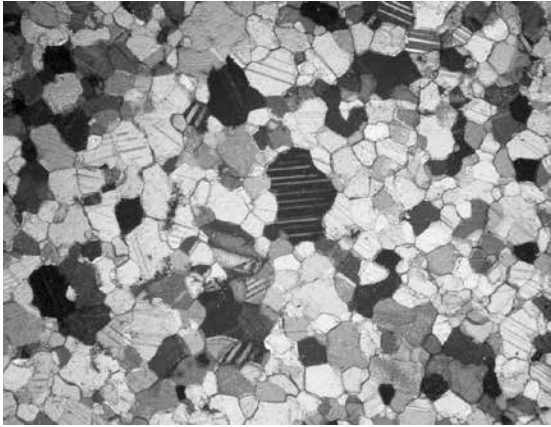


Fig. 27 - Photomicrograph of a thin section of the fine-grained variety of the Marmaritsa marble showing a slightly heteroblastic fabric formed by calcite crystals with curved boundaries, N+, long side = 2.35 mm

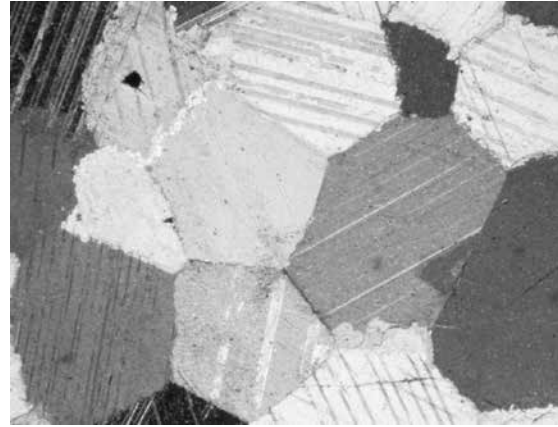


Fig. 28 - Same as fig. A, but of a medium-grained variety, showing a homeoblastic fabric composed of calcite crystals with straight boundaries and forming abundant triple points

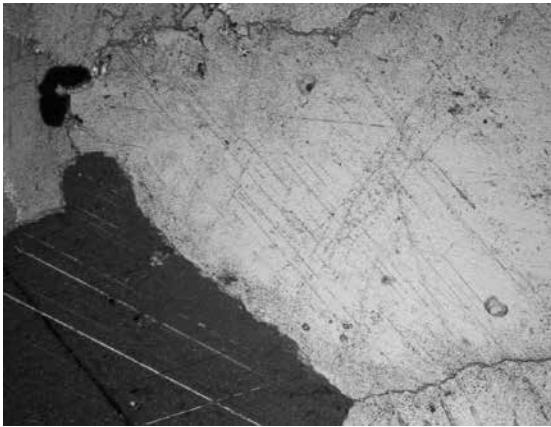


Fig. 29 - Same as fig. A, but of a coarse-grained variety with calcite showing curved-to-embayed boundaries

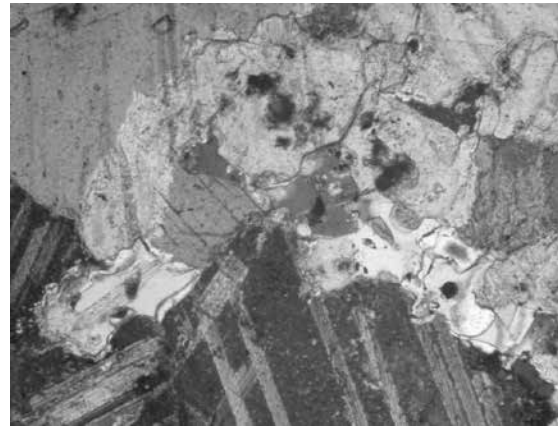


Fig. 30 - Same as fig. A, but showing diopside crystals in the centre, with quartz (right) and K-mica (left) crystals

Carbonaceous matter/graphite is more abundant and responsible for the grey hues of the marbles. Clinopyroxene is a fingerprinting mineral and has been identified chemically as diopside.

The marble sample from the theatre (#MT) was shown to be much coarser than that from the quarries, with calcite crystals reaching 9.5 mm of MGS, thus indicating that there are other ancient quarries nearby to be discovered.

The results of the isotopic analyses are also reported in table 1 and in Fig. 31. They indicate quite homogeneous $\delta^{13}\text{C}$ values, ranging from 1.90 to 2.87 (PDB), and much more variable $\delta^{18}\text{O}$ values, from 3.22 to 9.45 (PDB). Plotting the isotopic data in the reference diagram for marbles with $\text{MGS} > 2 \text{ mm}^3$ (Fig. 32) indicates that the isotopic field of the Marmaritsa marble overlaps with Naxian and Proconnesian-2 marbles as well as with small portions of Thasian-3, Aphrodisian and Parian-2 marbles. Fortunately, its petrographic features allow for a clear distinction from the first 3 marble types, while the remaining two are more difficult to separate.

THE MUSEUM ARTEFACTS

The results of the archaeometric analyses performed on the 12 reliefs from the museum of Komotini are reported in table 2 and in Figs. 33, 34, from which it is evident that some are made of local (Marmaritsa) and others of imported marbles. In particular, three items have been carved out of the Marmaritsa marbles (relief n° 962, with some uncertainty; relief n° 663; and the block from the theatre), two out of Pentelic (relief n° 134 and 252), two of Proconnesian (relief n° 131 and 26) and one of Thasian dolomitic marble

³² GORGONI *et alii* 2002.

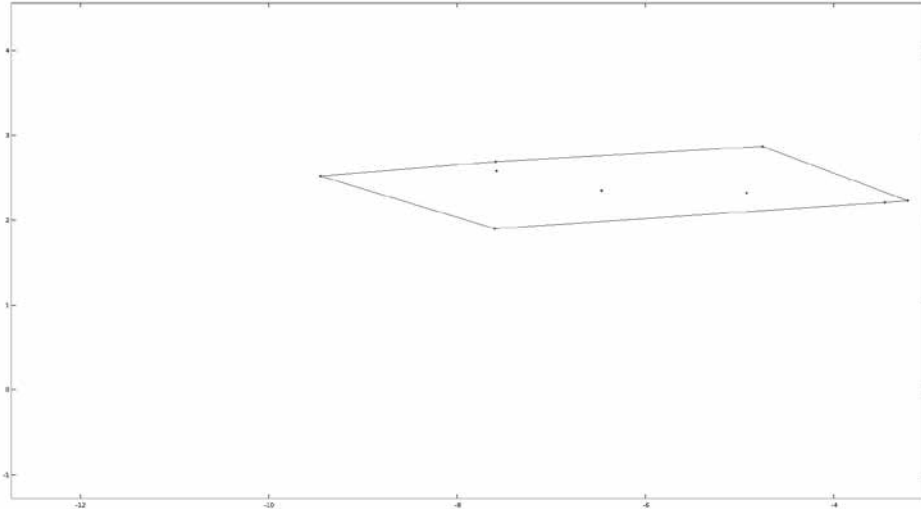


Fig. 31 - The area of the isotopic field occupied by the Marmaritsa marble

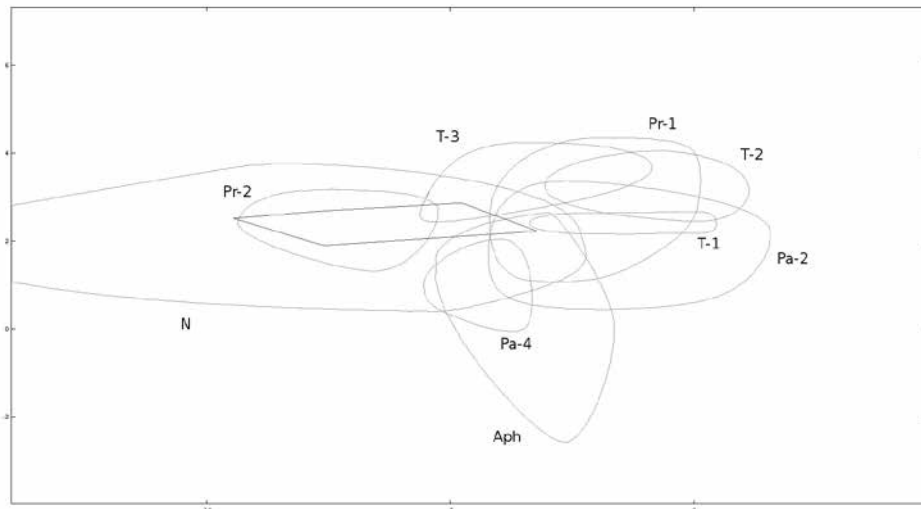


Fig. 32 - Plotting of the Marmaritsa marble in the reference coarse-grained (MGS > 2 mm) marbles used in antiquity

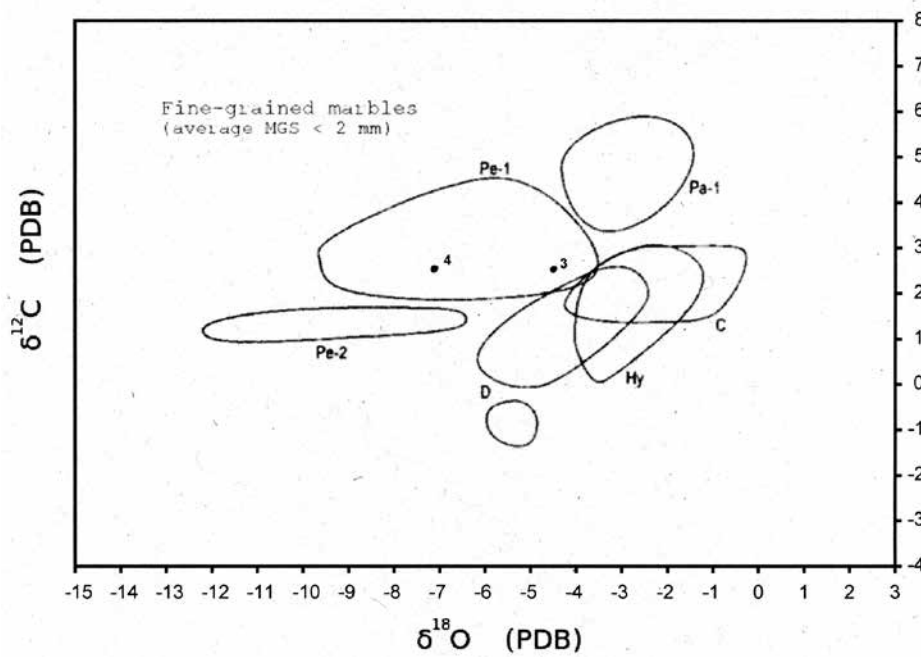


Fig. 33 - Plotting of the fine-grained marbles of the funerary reliefs in the relative reference isotopic fields

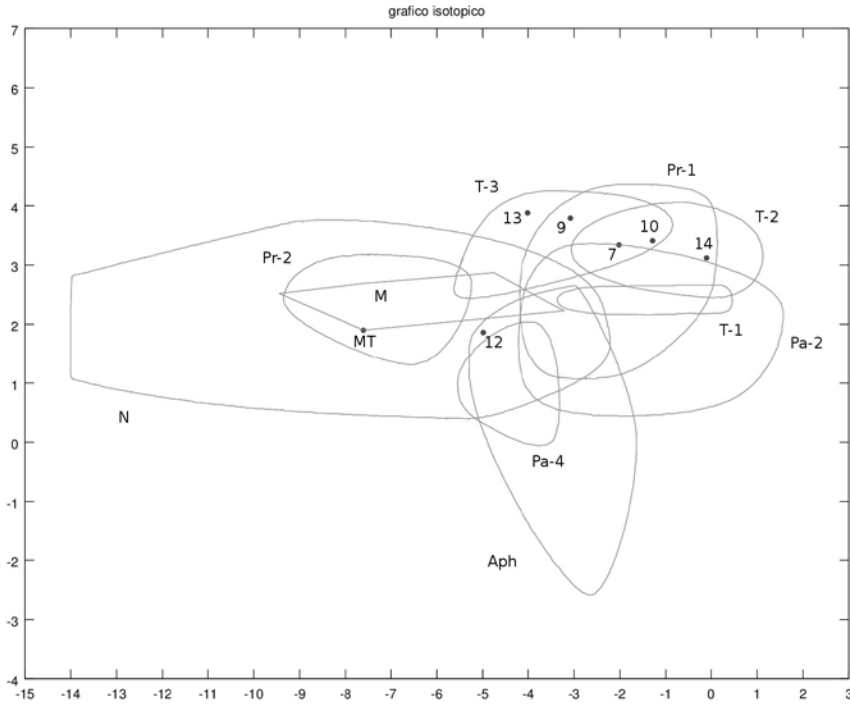


Fig. 34 - Plotting of the coarse-grained marbles of the funerary reliefs in the relative reference isotopic fields

(relief n° 935). The remaining pieces are still of unknown provenance, although it has been possible, on the basis of their petrographic features and isotopic signature, to separate them into two groups. The first group (quarry A) consists of four items (nn° 12, 30, 591, 937), and the second group (quarry B) of two items (nn° 4, 25); it is very likely that both groups are of Thracian or Macedonian origin.

CONCLUSIONS

The preliminary field survey of central Thrace, namely in the Abdera-Maroneia area in search of marble outcrops and ancient quarries, has resulted in the first examination and sampling of the marble of Marmaritsa, which was widely used in the ancient monuments of Maroneia, and has identified possible marble sources in the Xanthi province. The method of exploitation and the ancient quarrying marks found at Marmaritsa have been described and a laboratory characterization of the pertinent samples has been performed. This process included an initial round of minero-petrographic, geochemical and isotopic analyses on the Marmaritsa marble, the results of which constitute the first reference database that has proved useful for identifying the provenance of some of the 12 artefacts sampled and examined at the National Archaeological Museum of Komotini.

Although the provenance of the marble can be scientifically determined, the style of the reliefs or the style of specific workshops cannot always be determined with the same accuracy. For these reasons, and with the present evidence of a limited number of sculpted funerary reliefs, we will presently confine ourselves to the discussion of artistic influence rather than production centres. Further research on local quarries and further sampling of gravestones will certainly enable us to elaborate more fully on local production and local workshops, which most certainly operated on a small scale in Aegean Thrace.

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PRIMI STUDI ARCHEOMETRICI DELLA CAVA DI MARMARITSA (MARONEIA) E DI DODICI RILIEVI FUNERARI TRACI DEL MUSEO DI KOMOTINI (GRECIA) - Dodici stele funerarie provenienti dalla Tracia egea, parte di uno studio archeologico più ampio dei rilievi funerari della regione, hanno costituito la base per l'analisi del materiale costitutivo (marmo) e per l'individuazione della sua provenienza. Queste stele coprono uno spazio di tempo che va dal V secolo a.C. fino al I secolo d.C. e presentano tematiche iconografiche che si trovano in centri attici e ionici: figure femminili e maschili sedute o stanti, cavaliere-eroe, banchetto funebre. Da questi rilievi sono stati prelevati micro-campioni dei marmi costituenti, successivamente caratterizzati con metodi archeometrici comprendenti analisi minero-petrografiche (studio al microscopio polarizzatore di sezioni sottili, e diffrazione dei raggi X su polveri) e isotopiche (determinazione del rapporto degli isotopi stabili del Carbonio e dell'Ossigeno) mediante spettroscopia di massa. Ipotizzando sin dall'inizio che per la produzione di queste stele fosse stato usato marmo locale, si è studiato e campionato il marmo delle antiche cave di Marmaritsa (aperte sui pendii sudoccidentali del Monte Ismaros, vicino al sito archeologico di Maroneia, qui descritte in dettaglio per la prima volta), l'uniche fino ad oggi note della Tracia egea. I campioni di cava sono stati analizzati con le stesse tecniche archeometriche utilizzate per i manufatti scolpiti. Dal confronto dei risultati analitici con i campioni prelevati dalla cava locale e le più aggiornate banche dati internazionali relative ai marmi più importanti usati nell'antichità greca e romana ed è risultato che delle dodici stele analizzate due sono di marmo Pentelico, due di marmo di Proconnesio e una di marmo di Taso (Vathy), mentre delle altre 7 stele due sono di marmo da Marmaritsa e le altre da siti estrattivi non ancora individuati, ma probabilmente traci o macedoni.

ΠΡΩΤΕΣ ΑΡΧΑΙΟΜΕΤΡΙΚΕΣ ΜΕΛΕΤΕΣ ΤΟΥ ΛΑΤΟΜΕΙΟΥ ΤΗΣ ΜΑΡΜΑΡΙΤΣΑΣ (ΜΑΡΩΝΕΙΑ) ΚΑΙ ΔΩΔΕΚΑ ΘΡΑΚΙΚΩΝ ΕΠΙΤΑΦΙΩΝ ΑΝΑΓΛΥΦΩΝ ΤΟΥ ΜΟΥΣΕΙΟΥ ΤΗΣ ΚΟΜΟΤΗΝΗΣ (ΕΛΛΑΔΑ) - Δώδεκα επιτύμβιες στήλες από την Αιγιακή Θράκη, μέρος μία μεγαλύτερης συνθετικής μελέτης για τα επιτύμβια ανάγλυφα της περιοχής, αποτέλεσαν την βάση για την ανάλυση του υλικού (μάρμαρο) και τον εντοπισμό της προέλευσής του. Οι στήλες αυτές καλύπτουν μία χρονική περίοδο από τον πέμπτο αιώνα π. Χ. μέχρι τον πρώτο αιώνα μ. Χ. και παρουσιάζουν εικονογραφικά θέματα που συναντώνται σε Αττικά και Ιωνικά κέντρα (καθιστές και όρθιες γυναικείες και αντρικές μορφές, Ηρώας Ιπέας, νεκρόδειπνο). Τα δείγματα χαρακτηρίστηκαν αρχαιομετρικά μέσω ορυκτολογικών και στρωματογραφικών αναλύσεων (πολωτική μικροσκοπία λεπτών τμημάτων και περίθλαση ακτίνων X σε λειοτριβημένα δείγματα), καθώς και μέσω προσδιορισμού λόγου σταθερών ισotόπων C/O με φασματοσκοπία μάζας.

Θεωρώντας εξ αρχής ότι για την δημιουργία αυτών των στηλών χρησιμοποιήθηκε και ντόπιο μάρμαρο, πήραμε δείγματα από το τοπικό αρχαίο λατομείο της Μαρμαρίτσας (στις νοτιοδυτικές πλαγιές του Ισμάρου, κοντά στον αρχαιολογικό χώρο της Μαρώνειας), το μόνο έως σήμερα γνωστό αρχαίο λατομείο της Αιγιακής Θράκης. Τα δείγματα αυτά εξετάστηκαν με τον ίδιο αρχαιομετρικό τρόπο.

Συγκρίναμε τα αποτελέσματα της ανάλυσης με τα δείγματα από το τοπικό λατομείο και τις διεθνείς βάσεις δεδομένων των μαρμάρων της Ελληνικής και Ρωμαϊκής αρχαιότητας και κατέστη φανερό ότι από τις δώδεκα στήλες που εξετάσαμε 2 είναι από δολομιτικό μάρμαρο Πεντέλης, 2 από μάρμαρο Προκοννήσου και μία από μάρμαρο Θάσου (Βαθύ), ενώ από τις υπόλοιπες 7 στήλες μία είναι από ντόπιο μάρμαρο Μαρμαρίτσας και οι υπόλοιπες 6 από δύο ντόπιες πηγές που παραμένουν να εντοπιστούν.

MARBLE ANCIENT QUARRY of MARMARITSA (Maronia, GREECE)	Sample mm	Color index Munsell Neutral Value Scale	Fabric	Fabric Type	Calcite/Dolomite crystal boundaries	M.G.S. mm	Quartz	K-mica	Carb. matter/Graphite	Opaque Minerals	Apatite	Epidote	Titanite	CPX	Dolomite (XRD)	$\delta^{13}\text{C}$ (+)	$\delta^{18}\text{O}$ (-)
	1	8	He / Ho	Mosaic	Curved	2.24	+	++	+++	+	+	±	±	±	-	2.58	7.58
	2	8.5	Ho	Mosaic	Curved / embayed	1.28	±	±	+++	+				±	-	2.69	7.59
	3		He	Mosaic, with fine-grained areas	Embayed / sutured	1.30		±	+++		±	±		±	+	2.52	9.45
	4	7.5	He	Mosaic, with fine-grained areas	Curved / embayed	2.80	±	++	+++	++ (H, P)			±		-	2.21	3.46
	5		He	Mosaic, slightly lineated	Curved-to-embayed	2.16	±	++	++	+					-	2.23	3.22
	6	7	Ho	Mosaic	Curved	0.72	±	±	++	± (H, P)					-	2.87	4.76
	7	9	Ho	Mosaic, with fine-grained areas	Straight-to-curved	1.04		±	+++						-	2.32	4.93
	8	8.5	Ho	Mosaic	Curved	0.96		±		± (H, P)					-	2.35	6.47
Maronia, theatre, lintel of the proscenium	MT	8	He	Mosaic	Curved to sutured	9.56	±	+	+++	++ (H, P)				±		1.90	7.60
Stavroupolis, modern quarry	SW	9.5	Ho / He	Mosaic with stressed porphyroblasts	Curved, p.sutured	2.12	±	+	+++	± (H)						3.03	3.38

Table 1 - Summary of the minero-petrographic and isotopic results obtained for the quarry samples of the Marmaritsa marble (He, heteroblastic; ho, homeoblastic; He, hematite; P, pyrite; CXP, clinopyroxene; +, +, +, very abundant; ++, very abundant; +, present; ±, trace)

KOMOTINI, NAT. ARCHAEOLOGICAL MUSEUM. MARONIA, TAVANIOTIS COLLECTION OBJECT	Sample N° K	FABRIC TYPE		Calcite Crystals Boundaries	M.G.S.	Quartz	K-mica	Chlorite	Apatite	Clinopyroxene	Carbon matter/ Graphite	Op. Min.	Dolomite (XRD)	$\delta^{13}\text{C}$ PDB (+)	$\delta^{18}\text{O}$ PDB (-)	PROBABLE PROVENANCE: quarries of
		He	Ho													
Funerary relief of a man Inv. N° ATK 12	1	He	Mosaic	embayed-to-sutured	2.40	±	±		±		++		++	3.70	3.34	Unknown locality A
Funerary relief of a man Inv. N° ATK 134	2	He	Mosaic, lineated	curved	1.12	+	++	+			+++	±	-	2.75	4.62	Mount Penteli, Athens (Greece)
Funerary relief Inv. N° ATK 252	3	He	Mosaic, Lineated	curved	1.00	+	++				+++		-	2.53	4.57	Mount Penteli, Athens (Greece)
Funerary relief Inv. N° ATK 30	4	He	Mosaic	embayed-to-sutured	2.38	±	±		±		+++		++	2.61	7.12	As for sample K 1
Funerary relief of a horseman Inv. N° ATK 25	5	He	Mosaic with well interlocked crystals	sutured	2.64				±		+++	±	+	3.13	7.45	Unknown locality B
Funerary relief fr. Alexandropolis Inv. N° Alex 4	6	He	Mosaic with some large porphyroblasts	sutured	1.76		±		±		+++		±	2.80	1.62	As for sample K 5
Funerary relief Inv. N° ATK 131	7	He	Mortar	embayed	3.20	±			+		+++	±	-	3.34	2.02	Proconnesus, Island of Marmara (Turkey)
Funerary relief Inv. N° ATK 591	8	He	Mosaic, granulated	sutured	2.16		±				+++		+	3.20	4.14	As for sample K 1
Funerary relief Inv. N° ATK 935	9	He	Mosaic, granulated	sutured	2.15		+		±		+		+++	3.79	3.08	Cape Vathy, Island of Thasos (Greece)
Funerary relief Inv. N° ATK 26	10	He	Mortar	embayed	2.48		±				++		-	3.41	1.29	Proconnesus, Island of Marmara (Turkey)
Funerary relief Inv. N° ATK 937	11	He / Ho	Mosaic	Embayed-to-sutured	1.64		+				++		+	2.88	9.05	As for sample K 1
Funerary relief Inv. N° ATK 663	14	He	Mosaic, slightly strained	embayed	4.32	±			+	±	+		-	3.12	0.10	Marmaritsa, Maroneia (Greece)
Maronia, theatre, lintel of the proscenium	MT	He	Mosaic	Curved-to-sutured	9.56	±	+				+++	++		1.90	7.60	Marmaritsa, Maroneia (Greece)

Table 2 - Same as table 1, but for the museum items examined

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