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GÖKTEPE MARBLE IDENTIFICATION IN THE HADRIAN PORTRAIT OF LOS TORREJONES (YECLA, MURCIA) AND SOME CONSIDERATIONS ON THE PRESENCE OF THIS MARBLE IN HISPANIA

Identificación del mármol de Göktepe en el retrato de Adriano de Los Torrejones (Yecla, Murcia) y algunas consideraciones sobre el uso de este mármol en Hispania

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Abstract: This work characterises the high-quality white marble used in the bust of Emperor Hadrian found in the Roman villa of Los Torrejones (Yecla, Murcia). The analytical results, compared with the databases pertaining to Hispanic and Mediterranean quarry marbles, reveal its source in the quarries of Göktepe, in Muğla province, Western Turkey. The historical implications of the presence in the villa of an imperial portrait of such quality are discussed. The results also emphasise the importance of undertaking future complete archaeometric analysis of marble materials used in the sculptures of Hispania, only way to certify the provenance of the stone and, in this case, to better understand the distribution reached by the varieties of Göktepe marble in the Iberian Peninsula.

Key words: Archaeometry; Göktepe Marble; Roman Imperial Portraits; *Rollockenfrisur*; Hispania; Roman Villa.

Resumen: En este trabajo se presenta la caracterización del mármol blanco de excelente calidad utilizado en la elaboración del busto con retrato del emperador Adriano hallado en la villa romana de Los Torrejones (Yecla, Murcia). Los resultados analíticos contrastados con las bases de datos de los mármoles hispanos y clásicos son acordes con su procedencia de las canteras de Göktepe, en la provincia de Muğla, Turquía Occidental. La presencia en la *villa* de un retrato imperial de tan elevada calidad tiene implicaciones históricas que son objeto de discusión. Además, el resultado obtenido permite realizar una nueva llamada de atención sobre la

necesidad y la importancia de acometer futuros análisis arqueométricos completos del material marmóreo en que se realizaron las esculturas romanas de Hispania. Solo así podrán certificarse de forma segura las canteras de origen del material y, en el caso que nos ocupa, conocer mejor el rango de difusión que alcanzaron las variedades de mármoles de Göktepe en la Península Ibérica.

Palabras clave: arqueometría; mármol de Göktepe; retratos imperiales romanos; *Rollockenfrisur*; Hispania; villa romana.

1. Introduction

This paper reports the results of the archaeometric study of the fine-grained marble used in the spectacular Roman portrait of the Emperor Hadrian (*vide infra* Fig. 1), found in the Roman villa of Los Torrejones (Yecla, province of Murcia; Hispania Citerior; conventus Carthaginiensis). The study is part of several research projects[1] that aim to investigate the origin of the marble used in the elaboration of emblematic Hispanic pieces and monuments and their respective historical contexts. Other Hispanic imperial portraits have been the subject of recent archaeometric study, highlighting the need to apply a set of contrasted analytical techniques to pieces that a few decades ago were analysed by petrographic methods (Lapuente *et al*., 2024).

Databases of combined mineralogical, as well as chemical and physical parameters, aim to help discriminate between ancient quarrying areas. During more than three decades we have compiled an extensive analytical database with the identification parameters of a wide collection of lithological reference samples. Most of them belong to the main Hispanic quarry districts (Lapuente *et al*., 2000, 2014; Gutiérrez García-M. *et al*., 2016, 2018), but also includes the French and Spanish sides of the Pyrenees (Lapuente, 2022 and references therein). Finally, within the framework of some multidisciplinary international projects, we have applied the same analytical methodology to a wide collection of marbles from quarries in the eastern Mediterranean, including those of the ancient Phrygia and Caria, and in particular those of the recently discovered Göktepe marble (Brilli *et al*., 2018; Blanc *et al*., 2020).

This line of research is of growing interest in recent years in the Iberian Peninsula[2] since the identification of the quarry origin offers keys to understand the history of past societies, providing evidence for the study of their social organisation and economic activities; in particular, in the case of Roman sculpture, they are of great interest to establish economic and commercial circuits and to learn more about those who commissioned those works and the activity of the sculpture workshops that made them.

2. The Roman portrait of Emperor Hadrian

The bust of Emperor Hadrian[3] was found during the excavation season of 2014 in the villa of

[1] This work has been carried out in the framework of research projects: MINECO/FEDER PGC2018-099851-A-I00: "El mensaje del mármol: prestigio, simbolismo y materiales locales en las provincias occidentales del imperio romano"; PID2019-106967GB-I00 "*Sulcato marmore ferro*. Canteras, talleres, artesanos y comitentes de las producciones artísticas en piedra en la *Hispania Tarraconensis*", and MICINN *"Vivere in urbe*. Arquitectura residencial y espacio urbano en *Carthago Nova*, *Lucentum* y *Valentia*. Investigación y socialización" (PID2019105376GB-C41/MCIN/AEI/10.13039/501100011033). The archaeometric analyses of Hadrian's portrait have been financed by the Museo Arqueológico Municipal 'Cayetano de Mergelina' of Yecla (Murcia).

[2] *Cf*., for example, the progressive increase of Iberian contributions made at the last congresses of ASMOSIA (Association for the Study of Marble and Other Stones in Antiquity).

[3] Imperial busts and other sculptures presented different attires to represent the various roles assumed by the emperors during their rule; *cf*. Goette, H.-R.: "Fragment of a newly discovered portrait of Hadrian, in Classical Antiquities. Museum of Fine Arts, Budapest" (http://antik.szepmuveszeti.hu/antik_gyujtemeny/blog/?p=3007) (consulted on 06/11/2023).

Fig. 1. *Portrait of Hadrian from Los Torrejones, Yecla (photographs: J. García-Conde).*

Los Torrejones (Fig. 1). It is held in the Museo Arqueológico Municipal 'Cayetano de Mergelina', Yecla, with inventory number v.rom3/to2014/cii-a3/0001. The bust is 55 cm high, 26 cm wide, and 27.5 cm deep. The head is slightly over life-size. The chin-skull line measures 25.5 cm and the neck 7.5 cm. Only a small part of the bust remains, 8.5-9 cm high on the front and 24 cm on the back. The portrait has been published extensively, so here only the most significant aspects will be described (Noguera and Ruiz, 2018; Noguera, 2019: 268-269, no. 47 [Noguera, Ruiz]).

The head carefully expresses the gesture, factions, beard, and hair style of Emperor Hadrian, especially the nine curls that frame the forehead. These link the portrait with the *Rollockenfrisur* type, defined based on the *Leitstück* of Hadrian's head in Museo Nazionale Romano (Inv. no. 8618) (Giuliano, 1979: 18-19, no. 21; 1983: 207-208, no. 90; Wegner, 1984: p. 132; Fittschen and Zanker, 1985: 50-51, no. 49, replica 8 [Fittschen]; Evers, 1994: 164-165, no. 106), which originally comprised fifteen copies, later expanded to 27 by K. Fittschen (Fittschen and Zanker, 1985: 50-51, no. 1-22 [Fittschen]) and Evers (1994: 233-234; about the type: 233-240, fig. 5)[4].

The head turns resolutely to the left and bends slightly to the front, giving the portrait a meditative and melancholy aspect, which is characteristic of the best specimens of the type. As is typical in the *Rollockenfrisur* type, some of the facial features are especially realistic, in contrast with the standardised factions that define other imperial portraits, which is an important chronological marker (Evers, 1994: 238). Like in the model of the type, two creases run across the forehead, and the labial-nasal folds are emphasised. The eyes are marked by wide wrinkled eyebrows, which trace two small vertical strokes that spring from the nose. The eyeballs are underscored by heavy eyelids ending in two horizontal strokes on their external angles. As in most specimens of the type, the iris was not incised (Evers, 1994: 239). Also characteristic of the type is the importance

[4] In general, for Hadrian's portraiture see Wegner, 1956; Fittschen and Zanker, 1985: 44-58, no. 46-54, plates 49-60 (K. Fittschen); Evers, 1994; Calandra, 2014. See also Ahrens, 1964; Wegner, 1984: 137-153; Vout, 2003; Cadario, 2014.

given to the emperor's gaze, which underlines the psychological effect.

The highly-characteristic beard is carefully reproduced, but without affectation, with small pointy locks of hair that point towards the chin –in sideburns, cheeks, neck and the chin itself–, as well as in the lower lip and the moustache, which is parted in half.

The hair is typically combed towards the forehead in an unnatural way. It is divided into nine curly, voluminous, and highly plastic locks to the left. They frame the face rhythmically with three curls over the right sideburn, two thick ones over the outer end and axis of the right eye –separated by a trepan groove–, a thick central curl that points upwards over the nose, two over the axis and outer end of the left eye, and finally two more over the left sideburn. As in most portraits in the type, the central curl –Evers's E– is larger than the rest.

The right and left sides of the hair are also typical of the type. The ends of each curl point up in the right side and down in the left side. The curls on the left side undulate, while on the right side are shaped like hooks. The type rarely present special hair features on the parietal and occipital regions, but this example perfectly reproduces the short and curvy curls of the occipital area, whereas in the parietal zone the hair of the *coma in gradus* are less pronounced.

The scarce remains of the bust, barely a fragment of tunic and breastplate decorated with a Gorgon, point to a typical Hadrian-period model, in which the emperor is portrayed wearing a breastplate, out of whose top end the folds of the tunic or *colobium* and *paludamentum* held over the left shoulder by a ring fibula, from which an oval fold falls at the back, are visible. The centre of the breastplate was decorated with a Hellenistic-style *gorgoneion*, of

Fig. 2. *Reconstruction of the bust of Hadrian's portrait from Los Torrejones (Yecla), based on a model from the Musei Capitolini in Rome (reconstruction: J. G. Gómez after Fittschen, Zanker, 1985: 45, no. 46 [Fittschen]; and photographs: J. García-Conde).*

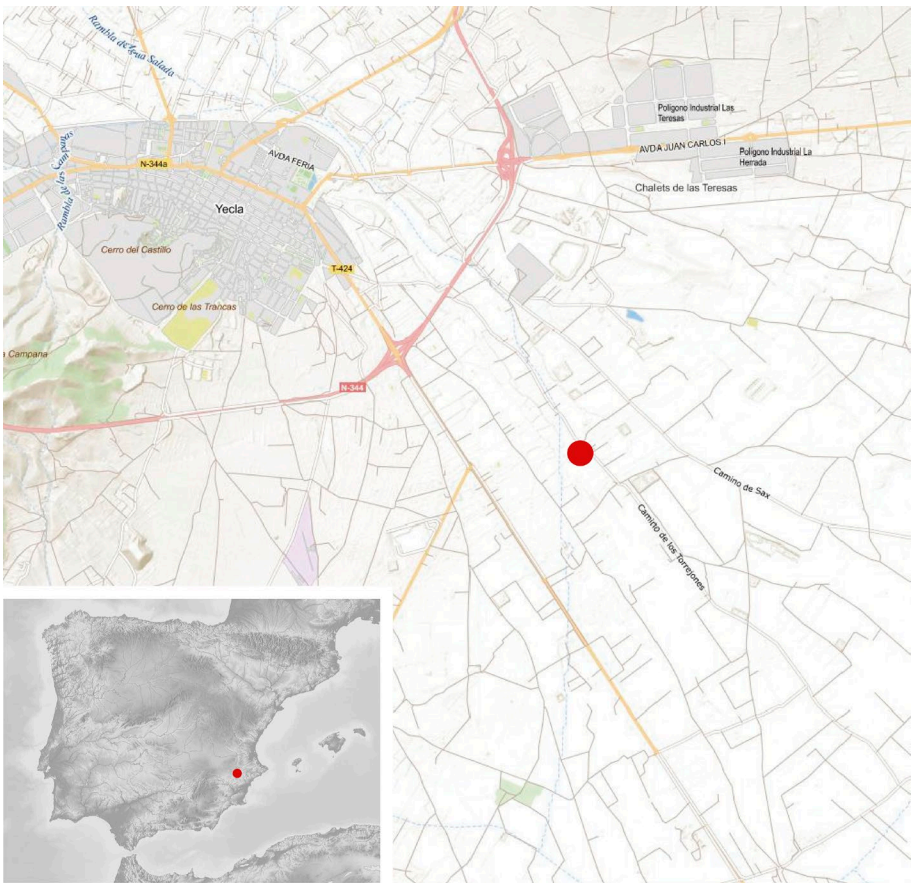

Fig. 3. *Location of the Roman villa of Los Torrejones, in the municipality of Yecla, Murcia (map: L. Suárez).*

which only the beginning of the wings is preserved (Wegner, 1956: 70; Fittschen and Zanker, 1985: 45, no. 46 [Fittschen]; Evers, 1994: 220) (Fig. 2).

The bust reproduces to perfection the emperor's anatomy and displays a high degree of formal purism. The portrait can be assigned to Evers's 'Roman workshop c' and dated to the 130s (Noguera and Ruiz, 2018: 305).

3. The archaeological context of the portrait: the Roman villa of Los Torrejones

The portrait was found in the Roman villa of Los Torrejones, near the city of Yecla (Fig. 3) and the old *via Herculea* –or *Hannibal's Road*–, which ran between *mansio Ad Palem* –Cerro de los Santos, Montealegre del Castillo, in Albacete province– and *Aras* –between Almansa, Albacete, and Mogente, in Valencia province–. This region, which was densely populated and rich in mines and grazing areas in antiquity –1st-4th centuries AD–, was an important crossroads connecting the Spanish Levante and inland Andalusia and the Mediterranean coast and the interior (Ruiz, 1988: 568; Abascal *et al.*, 2017a: 205-208). The villa is part of an important site with five phases of occupation spanning the 1st and mid-12th centuries AD (Ruiz, 2011: 157-170; Fernández, 2009: 63-71; Noguera, 2019: 120-125 [Ruiz, Noguera], for the characteristics and historiography of the site and the results of the excavation campaigns to date).

Although the first news to isolated finds in the villa date back to the 16th century (Noguera, 2019: 120-125 [Ruiz, Noguera]), the first excavations did not take place until 1842 and 1879 (of which no record survives, Ruiz *et al.*, 1989: 55). Regular excavations began in 1959, although they did not apply the archaeological methodology systematically until the 1980s. It was then that the site was defined as a *villa rustica* with buildings related to productive tasks and a *pars urbana* with remarkable mosaic (Ramallo, 1985: 147-152, no. 118-120, fig. 29, pl. LXXIV-LXXVIII), pictorial (Fernández, 1999: 57-86),

and sculptural decoration[5], as well as a *balneum* (García-Entero, 2001: 182-184, no. c.106). The associated ceramics defined an early phase for the villa in the 1st-3rd centuries and an expansion of the complex during the 4th-5th centuries, when a long, perhaps porticoed, corridor and a hexagonal tower were added to the south corner –and perhaps another tower to the west–.

In 2014, the Museo Arqueológico Municipal de Yecla resumed the excavations within the framework of a broader research project that includes important restoration tasks at the site. These works have led to a much better understanding of the chrono-architectural features of the villa, which in the 2nd and 3rd centuries stood as a rectangular complex (Fig. 4), over 3000 m² in size, organised around a porticoed peristyle –36 m x 18 m– with a central cistern and a drain channel around the perimeter. The axis of the complex ran from SE to NW, and the southern end was dominated by a rectangular exedra, flanked to the SW by eight quadrangular and rectangular rooms in two rows of four. This arrangement is seemingly repeated on the opposite side. The disposition of the area to the NW of the axis and around the peristyle is still unknown, although the presence of more rooms can be safely assumed. The ceramic contexts associated with the structures and the quality of the sculptural, pictorial, and, especially, marble decorations, which are reminiscent of those found in Villa Adriana in Tivoli (Lazio) (Noguera *et al.*, 2020), suggest a construction date in the first half of the 2nd century AD. The period of maximum splendour of the villa lasted at least until the 3rd or 4th century AD.

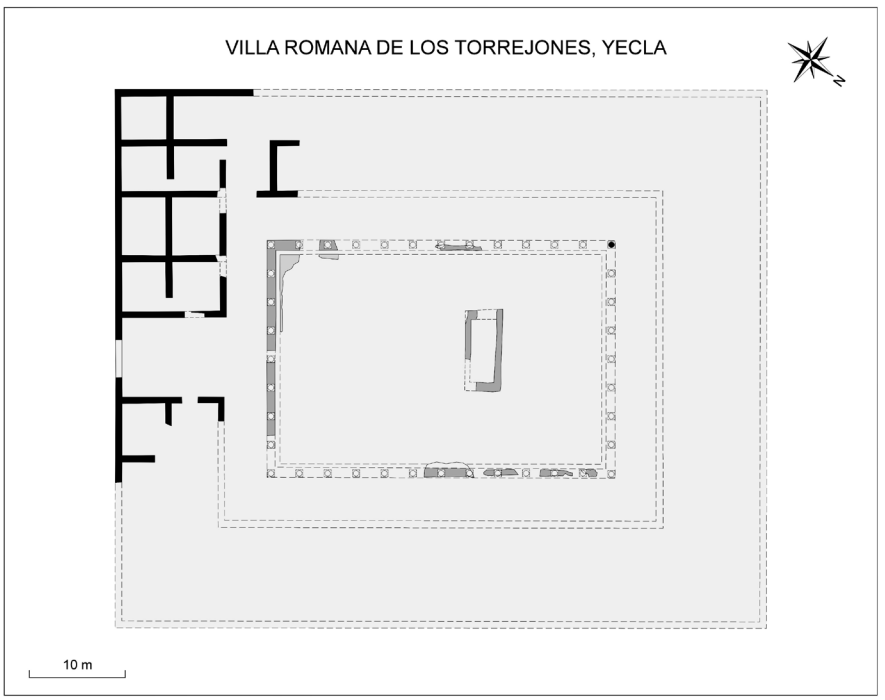

FIG. 4. *Hypothetical reconstruction of the plan of the villa in the 2nd century AD (plan: J.-G. Gómez; scientific advisors: J. M. Noguera and L. Ruiz).*

The dimensions and plan of the complex, and especially the 2nd century peristyle and the costly marble decoration force a comparison with other aulic villae built in Hispania and other provinces in the 2nd, and, especially, the 3rd and 4th centuries AD. The origin of this phenomenon seems to lie in Villa Adriana, whose monumental plan was the prototype of these luxurious villae, defined by their rich decoration and their architectural variety (Neudecker, 2014: 135-154). The model was widely adopted by the provincial elites linked to the emperor and his close political circle, among which Hispanic elites played a prominent role (Caballos, 2013: 21-75; for the social promotion of Hispanic elites during Hadrian's rule see also González-Conde, 2019: 153-225). Some examples of this sort of aulic residence can be found in the villa of Herodes Atticus in Kephisia, Marathon, and in the Loukou in Greece

[5] See Noguera, J. M.: *La escultura romana del sector meridional del* conventus Carthaginiensis *(provincias de Albacete, Alicante y Murcia)*. Unpublished doctoral thesis presented in 1993 in the Univ. of Murcia.

(Spyropoulos, 1996; Calandra and Adembri, 2014: 56-57 [Calandra]; 58-63 [Saporiti] and 64-70 [Gorrini]), and the villa of Haccourt (Belgium) (Boe, 1975, 1976; Tromme *et al.*, 2006), to which we may now add the one at Los Torrejones.

Hadrian's portrait was found in a secondary context dated to the 4th-5th centuries, in the area between the south-eastern exedra and the peristyle –Room 1, UE 104–. It was found within a dump of construction material largely formed by highly-fragmented marble pieces, including 166 architectural –cornices, mouldings, cladding and capitals– and sculptural fragments.

The area where the sculpture was originally displayed cannot be established, although it can safely be assumed that it was in one of the ends of the building's main axis. Who commissioned this rich building in the interior of Hispania's southwest is also unknown. A partially-preserved, probably honorary, inscription found in the villa mentions an unknown character that held the municipal positions of *duunvirus* and *flamen augustalis* (Abascal *et al.*, 2017a: 255-218; 2017b: 299-301). The inscription is carved in *marmor Numidicum* from Chemtou, in Tunisia, which from the Augustan period was often used for imperial inscriptions and was gradually adopted by local elites, represented by local and provincial magistrates and priests (Mayer, 2007: 176, 180). The inscription reopens the debate about the existence in the area of a possible privileged local community, probably a *municipium*, which can be tentatively identified with Pliny's Egelasta (*Nat. Hist.* 3, 4, 25).

This magistrate may have been the villa's *dominus* or a relative, and he probably set up this exceptional portrait of Hadrian as a show of loyalty to the emperor –like Herodes Atticus in his Greek villa of Loukou–. Perhaps during his time as *augustalis*, and following an unknown link with the sovereign, he obtained permission from the imperial chancellery to display a hypothetical gallery of portraits that included the reigning emperor and members of his household, alongside the villa owners and their heirs, with epigraphic *elogia.* Alongside the emperor's portrait, there may have been one of Vibia Sabina, as suggested by a fine female portrait dated to the mid-2nd century AD, also superbly carved in a fine white marble, probably Göktepe marble (Noguera, 2019: 270, no. 48 [Ruiz, Noguera]). This sculptural assemblage may have been displayed in an exedra conceived as a 'political *sacrarium*' and space for self-representation, similar to that attested in the villa of the *Volusii Saturnini* in *Lucius Feroniae*, whose interior was decorated during the 1st century by a gallery of portraits of the villa's owners[6].

4. Multi-analytical approach

Several analytical techniques were applied following a usual sequential approach (Lapuente, 2014) to identify the marble provenance. They combine first, the results of three techniques: Polarized-light optical microscopy –OM–, Cathodoluminescence microscopy – CL-Optical– and Isotope ratio mass spectrometry –IRMS– to determine C and O isotopic fractionations. Then, to confirm the probable identification, two additional analyses were carried out, Inductively coupled plasma atomic emission spectroscopy –ICP-AES– to obtain the concentration of Sr and Mn trace elements (ppm) and Thermal ionization mass spectrometry –TIMS– to measure the Sr isotope ratios ($^{87}Sr/^{86}Sr$ data).

The results of the first group of analyses were compared to those obtained, using the same methodology, in a wide collection of quarry marbles, either from the Estremoz Anticline –EA–, the Hispanic marble most extensively used in Roman times, but also in imported marbles. Nowadays, the most appreciated classical marbles exploited and traded during imperial times, especially for statuary, are recognized to be Paros-*lychnites*, Afyon *(Docimium)*, Pentelicon, Carrara and Göktepe (Antonelli and Lazzarini, 2015; Attanasio *et al.*, 2006,

[6] See Cristilli, A.: *La statuaria in marmo da lucus feroniae: cronologie, tecniche, contesti e società*. Unpublished doctoral thesis presented in 2019 at the Univ. degli Studi di Roma Tor Vergata.

2015, 2019; Blanc *et al.*, 2020; Poretti *et al.*, 2017; Wielgosz-Rondolino *et al.*, 2020).

After the relatively recent discovery (Attanasio *et al.*, 2009; Yavuz *et al.*, 2009), of the ancient marble quarries near Göktepe, in the Muğla province, Western Turkey, close to Aphrodisias, the panorama of the most prized sculptural marbles used in Roman antiquity has deeply changed (Attanasio *et al.*, 2019, 2021, 2023; Brands and Goette, 2023). This is because the identification of Carrara marble, often recognized exclusively by visual and microscopic petrography, must be considered cautiously. This was already noticed in our archaeometric studies carried out on imperial sculptural elements of Villa Adriana (Lapuente *et al.*, 2012; Lapuente, 2018). Those papers showed the complexity of identifying certain fine-grained white varieties found in the imperial Villa, since the parameters usually applied in provenance studies, Petrography by OM and C and O isotopes, do not properly discriminate certain white Göktepe from Luni-Carrara marble. Consequently, it is very likely that countless pieces carved with this Turkish material might have been mistaken for Carrara marble in many previous studies.

However, the complementary technique of CL used in combination to the petrographic parameters and C and O isotopes, following the above-mentioned protocol, makes possible the Göktepe/Carrara discrimination. Furthermore, it is now well known that Göktepe and Carrara marbles can be distinguished on the basis of other complementary attributes, concerning primarily the presence and concentration of the strontium and manganese impurities (Attanasio *et al.*, 2015; Poretti *et al.*, 2017; Brilli *et al.*, 2018; Prochaska *et al.*, 2018). The range of concentration of both elements is quite different in both marble sources, which in case of manganese also affects to the cathodoluminescent behavior (Blanc *et al.*, 2020). In addition, the use of other more sophisticated techniques have been successfully applied to the Göktepe/Carrara discrimination, such as among others, $^{87}Sr/^{86}Sr$ isotopes (Wielgosz-Rondolino *et al.*, 2020), XRD with refinement unit cell parameters (Antonelli and Nestola, 2021) and Nuclear magnetic resonance –NMR– spectroscopy (Gutiérrez García-M. *et al.*, 2019). Therefore, in this study, to the usual analytical protocol, which includes CL parameters directly related to the Mn concentration, results from two additional techniques are also reported for an unequivocal identification.

5. Methodology

One thin section was made from a small millimetric sample chip –YCL-1107– discretely chiseled off and, before powdering, its weathered surface was previously abraded to avoid possible contamination. OM was used to examine the mineralogy, fabric, texture, grain boundary shape –GBS– and to determine the maximum grain size –MGS–. This parameter was obtained by the direct measurement of the coarser calcite crystal visualized in the thin section under the microscope. Additionally, the most frequent size –MFS– was estimated following the same method explain in Brilli *et al.* (2018) for quarry samples. Combined with other analytical results, these petrographic parameters have a particular diagnostic significance for discriminating the provenance of many ancient marbles, since they are related to their respective metamorphic history.

CL technique is, on the other hand, a very useful tool to better discriminate Göktepe and Carrara (Lapuente and Royo, 2016), always used in combination with other parameters, since the CL characteristics of carbonates are related to their chemical impurities and in particular to the Mn concentration. The CL behaviour was observed with CL8200MK5-1 cold equipment coupled to a NIKON Eclipse 50iPOL OM. The electron energy was 15-20 kV, and the beam current was operated at 250-300 mA. The luminescent colours, their intensity and distribution in the sample were recorded with an automatic digital NIKON COOLPIX5400 camera. The CL images taken were automatically controlled –29 mm focal length, f/4.6 aperture, 1 s exposure, ISO-200– to obtain comparative images to be checked with those available from several classical quarrying areas (Blanc *et al.*, 2020).

Sample	Visual Size	MGS	MFS	Fabric	Texture		GBS	CI intensity
		mm						
YCL-1107	Fine	0.9	≤ 0.4	Isotropic	Granoblastic Homeoblastic Sligthly Heteroblastic	Polygonal (triple points)	Straight, curved	Homogeneous Very low

Fig. 5. *Petrographic and Optical-CL properties and mineralogical composition of sample under study.*

Oxygen and Carbon isotopic ratios were determined by IRMS[7] with Finnigan MAT 252 equipment. A Finnigan MAT Kiel II automatic preparation device was previously used for phosphoric acid digestion at 72 °C and CO^2 purification. The results were expressed in terms of usual delta notation ($\delta^{13}C$ and $\delta^{18}O$) in parts per 1000 relative to the international reference standard V-PDB. Analytical precision was better than 0.1 ‰ for both isotopic determinations. The isotopic signatures of the marble pieces were compared with those of the main classical and Hispanic marbles.

A *Varian Vista-PRO*, ICP-AES, belongs to the Earth Science Department of La Sapienza Univ. of Rome, Italy, was used for trace element determination. Sample aliquots were dissolved in solutions of HCl (3 %) to measure Sr and Mn elemental concentrations (ppm). Deionized water (resistivity 18 Mδ cm^{-e}) obtained from a Milli-Q purification system was used to prepare all standard and sample solutions. Internal standards and the precision of the method are explained elsewhere (Brilli *et al.*, 2018, 2020).

Sr isotopes were analyzed at the Scientific Instrumentation Center of Granada Univ., Spain, by Thermal ionization mass spectrometry –TIMS– in a Spectromat Tl-Box spectrometer after chromatographic separation with ion-exchange resins. Normalization values were $^{86}Sr/^{88}Sr$ = 0.1194. Blanks were 0.6 nanograms for Sr. The external precision (2σ), estimated from the results of the last 10 replicates of the standard WS-E (Govindaraju *et al.*, 1994), which is routinely analysed each 10 unknown samples, was better than 0.0013 % for $^{87}Sr/^{86}Sr$. The internal precision was estimated on the average of the standards NIST-987 with a mean $^{87}Sr/^{86}Sr$ = 0.710249 ± 0.0003%. In order to compare the results with the existing $^{87}Sr/^{86}Sr$ data of Göktepe/Carrara quarry marbles, two samples of Göktepe were reanalyzed at the Granada Laboratory, obtaining very small difference –between 0.000067 and 0.000073– which does not affect the range of concentrations for the Göktepe/Carrara discrimination.

6. Results and archaeometric discussion

The results of the mineralogical-petrographic examination and the main CL characteristics are summarized in Fig. 5. The analyzed sample is a pure calcitic marble –positive reaction to s-Alizarin Red– with isotropic fabric and GBS from straight to curved, in a polygonal granoblastic texture –mosaic–, with evident triple points due to almost stable conditions reached over long periods of metamorphism (Fig. 6 a-b). Accessory minerals are absent at the optical microscope observation scale. Its homeoblastic texture shows scarce individual crystals with larger size developing a partly heteroblastic texture which reaches up to 0.9 mm of MGS, but its MFS is ≤ 0.4 mm (Fig. 7). These measurements are plotted in the general diagram for the main fined-grained white marbles (Fig. 8) where sample YCL-1107 exhibits very similar MGS value than Carrara, Pentelicon, Afyon and Göktepe. However, the MFS and the microstructure of the marble under consideration are only compatible with Carrara and Göktepe.

The CL-pattern (Fig. 6c) with homogeneous very low intensity is typical for many white Göktepe quarry samples (Brilli *et al.*, 2018; Lapuente and Royo, 2016) and serves to decline not only Pentelicon and Afyon provenance, as they show a high CL

[7] The authors would like to express their gratitude to Dr. M. Brilli for his help in the isotopic and trace elements measurements.

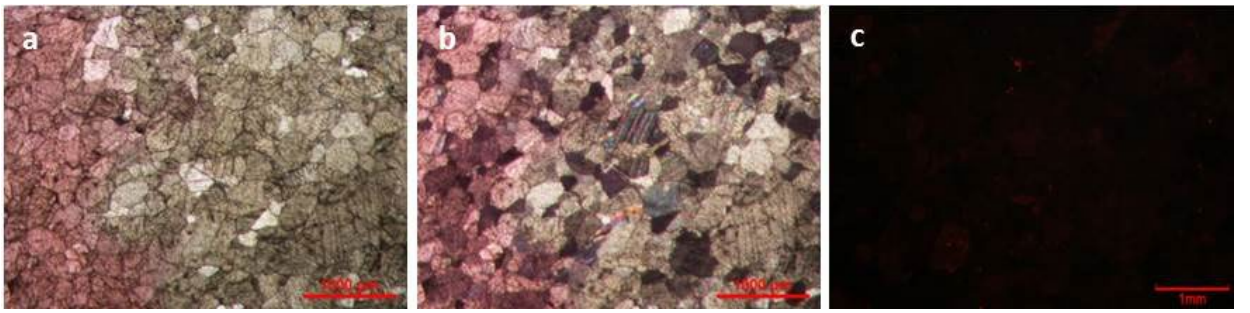

Fig. 6. *Photomicrographs of sample* YCL-*1107, all with the same scale: a) in parallel polarized light; b) in crossed polarized light; c)* CL *image.*

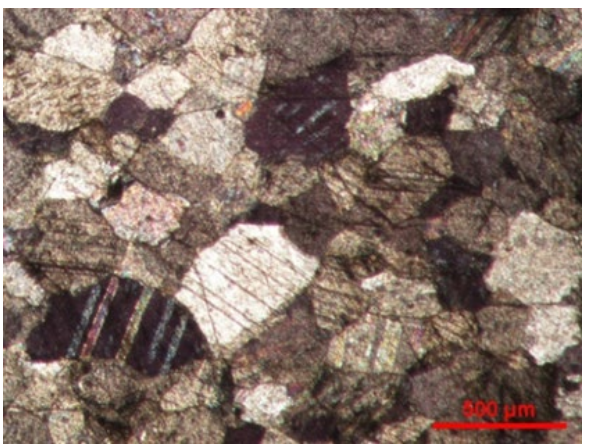

Fig. 7. *Detail of the texture, showing the* GBS *(straight to curved) and the* MFS *(≤ 0.4 mm). Photomicrograph in crossed polarized light.*

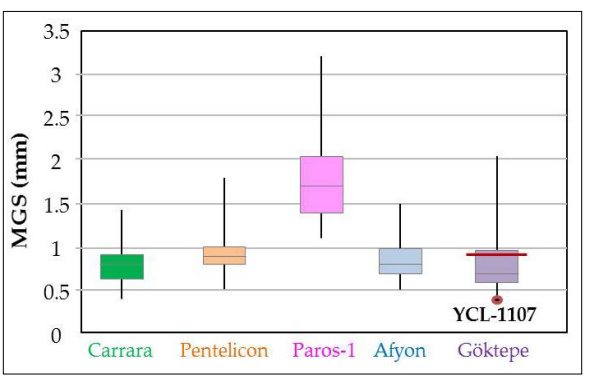

Fig. 8. *Maximum Grain Size of the white fine-grained marble; the dashed red line is the* MGS *of sample* YCL-*1107 (0.9 mm); the red point is the* MFS *(≤ 0.4 mm).*

intensity with very heterogeneous distribution, but also serves to rule out Carrara as this usually shows a medium to high intensity. Therefore, after the sequential approach, the sample under study points to be Göktepe marble. This particular very low CL intensity had served to identify a variety of white Göktepe in many sculptures of Villa Adriana (Brilli *et al.*, 2018; Lapuente, 2018). Furthermore, to reaffirm the Göktepe identification, the same pieces of Villa Adriana were also analyzed with other methodologies (Wielgosz-Rondolino e*t al.*, 2021; Antonelli and Nestola, 2021).

In Fig. 9 results from the C and O isotopic signature, Sr and Mn concentrations and $^{87}Sr/^{86}Sr$ isotopic ratio are displayed. They have been plotted in the general $\delta^{13}C$ and $\delta^{18}O$ diagram for the fine-grained marbles after different databases (Fig. 10). In Fig. 10a, YCL-1107 sample falls inside the overlapping area of Carrara and Göktepe isotopic fields in the diagram based on Gorgoni *et al.* (2002) with data from Lapuente *et al.* (2014) for the Estremoz Anticline –EA– marble and from Attanasio *et al.* (2015); Brilli *et al.* (2018) and Wielgosz-Rondolino *et al.* (2020) for Göktepe marble. This diagram, useful to discard the EA marble provenance, does

Sample	Sr (ppm)	Mn (ppm)	$\delta^{18}O$	$\delta^{13}C$	$^{87}Sr/^{86}Sr$
YCL-1107	223	1.6	-2.51	2.88	0.707383

Fig. 9. *Parameters of sample* YCL-*1107 by conventional* C *and* O *isotopes, Sr and Mn concentration and* $^{87}Sr/^{86}Sr$ *ratio.*

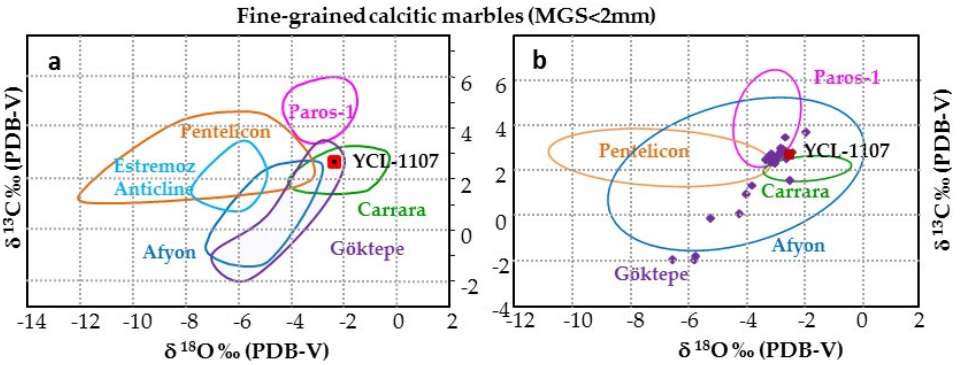

Fig. 10. *Isotopic C and O signature of the archaeological sample YCL-1107 (red and black square) plotted on two different diagrams for classical fine grained marbles: a) Isotopic diagram adapted from Gorgoni* et al. *(2002) with data from Lapuente* et al. *(2014), Brilli* et al. *(2018) and Wielgosz-Rondolino* et al. *(2020); b) Scatterplot of the C and O isotope compositions of the Göktepe white marble adapted from Brilli* et al. *(2018), with the probability distribution (90 %) of isotope data represented by ellipses adapted from Attanasio* et al. *(2006).*

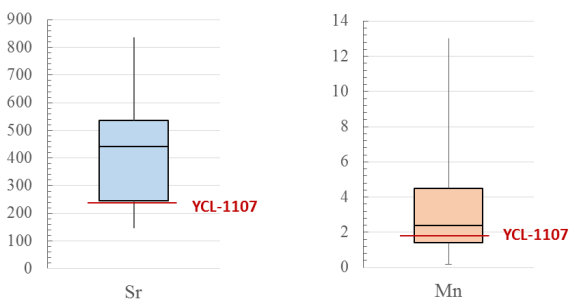

Fig. 11. *Box and whisker plots of Mn and Sr log-transformed concentration data from fine-grained marbles and the representation of the archaeological sample YCL-1107 (red line), adapted from Poretti* et al. *(2017).*

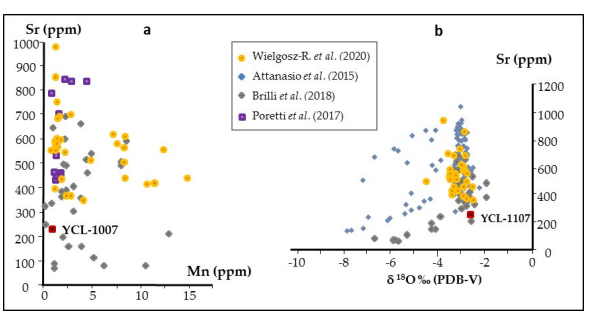

Fig. 12. *Comparative diagrams of the Sr and Mn elemental concentration of the YCL-1107 sample under study on the respective statistical diagram of both elements obtained from white Göktepe quarry samples using the same ICP-AES analytical protocol (Brilli* et al.*, 2018).*

not provide a clear discrimination for the classical marbles under consideration. However, in Fig. 10b, its projection follows the main cluster of the Göktepe marble, in a narrow area approximately between -3 and -2 ‰ of $\delta^{18}O$ and +2 and +3.5 ‰ of $\delta^{13}C$ and falls outside the probabilistic ellipse of Carrara isotopic field. Therefore, these isotopic values point to be Göktepe with very high probability, but in combination with the previous sequential characterization support the Göktepe identification. It is worthy of mention that these isotopic values are quite similar to those obtained for the sculptural programme of Quinta das Longas villa in Lusitania, which were clearly identified as the best quality white Göktepe in the very-fine-grained marble variety (Lapuente *et al.*, 2021).

Concerning the Sr and Mn concentration, the values of the YCL-1107 sample have been compared with the data provided in literature. It must be taken into account, beforehand, that the range of concentrations possible in Göktepe quarries varies slightly depending on the followed technique or even on the analytical protocol for the acid attack (Attanasio *et al.*, 2020; Brilli *et al.*, 2020). In Fig. 11, the diagram is based on data provided by Poretti *et al.* (2017) using Laser ablation-inductively coupled plasma-mass spectrometry –LA-ICP-MS–. This

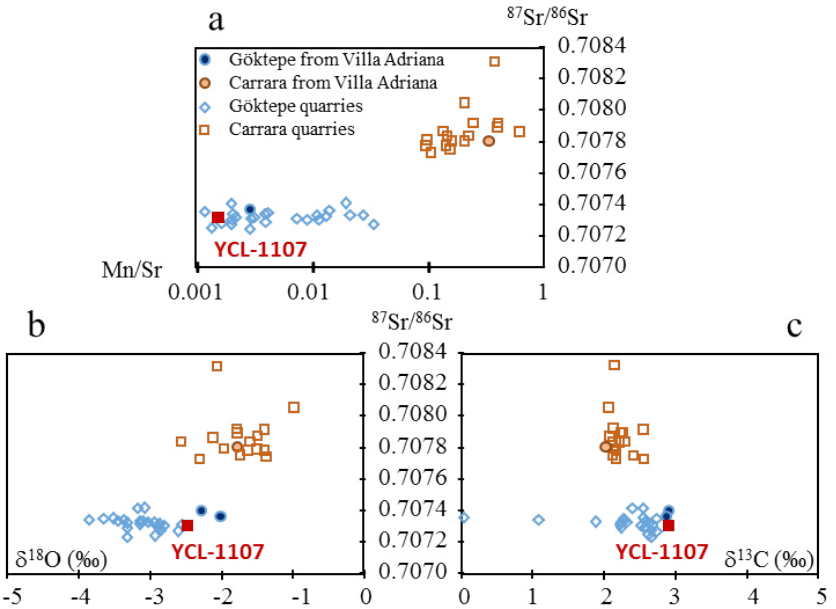

Fig. 13. *Scatterplot diagrams of the Sr isotope composition vs. Mn/Sr (a), $\delta^{18}O$ (b) and $\delta^{13}C$ (c) obtained for sample* YCL-1107 *under study (based on Wielgosz-Rondolino* et al.*, 2020: fig. 8). In them, unequivocal discrimination between Göktepe and Carrara white marbles is shown, both quarry samples and artefacts from Villa Adriana previously identified by the usual sequential protocol in Lapuente* et al.*, 2012. The remarkable low Sr isotopic ratio of sample* YCL-1107 *certainly evidences the Göktepe identification.*

is a very high-precision technique that measures the concentration of elements in specific points of each calcite crystal. As can be seen, Mn concentration falls within the range expressed by the log-transformed data, of the 25th and 75th percentiles for Göktepe marble, in line with the very low CL intensity observed in the sample under study.

Regarding the concentration of Sr, the value of 223 ppm obtained in YCL-1107 sample using ICP-AES, is below the values measured for Göktepe quarry samples by LA-ICP-MS (Poretti *et al.*, 2017). Nevertheless, the concentration of both elements are within the range of variation measured on Göktepe quarry samples using the same ICP-AES analytical protocol (Brilli *et al.*, 2018), as can be seen in Fig. 12.

In any case, to reinforce this identification, the complementary data of $^{87}Sr/^{86}Sr$ is used to definitely identify Göktepe marble. The obtained ratio of 0.707383, is within the range –0.70724 to 0.70741– for Göktepe, in contrast to the range for Carrara –0.70771 to 0.70831–, after Wielgosz-Rondolino *et al.*, 2020). Furthermore, the isotopic ratio of the sample –YCL-1107– projected in different scatterplot diagrams (Fig. 13) evidences, once again, the Göktepe identification.

7. Archaeological considerations: Göktepe marble and the productions of Aphrodisias in Hispania

The archaeometric characterisation of the marble certifies the Göktepe quarries, and this allows us to briefly consider the presence and dissemination of this high-quality material in Hispania. First, we must take into account the materials used in Hadrian's busts, especially in Hispania. The prototype of imperial portraits –*Urbild*– was generally carved by an official sculptor in Rome under the close supervision of the imperial chancellery. After this, metropolitan and provincial workshops produced

copies to supply public and private local demand. Portraits were mechanically copied, 'translating points', so they were all based on the same prototype. This helps to explain the uniformity in the details within each type, as illustrated by the bust found in Yecla and the *Rollockenfrisur*, a type found across the empire (Balty, 1995: 278). This fixation of the type was the best way to ensure the ideological impact of the image and also to avoid adaptations and changes of the prototype –*Angleichung*–, as well as, occasionally, a good marker to date a given portrait based on its *Zeitgesicht*.

In addition to qualitative and stylistic considerations, the analytical characterisation of the material can be useful to identify the workshops in which these pieces were produced. The portrait found in Yecla is technically and stylistically superb, to the point that it has been assigned to one of the metropolitan workshops that operated under the direct orders of the chancellery, perhaps Evers's 'workshop c' (Noguera and Ruiz, 2018: 305). This hypothesis is supported by the archaeometric data that links the marble with the quarries of Göktepe in Muğla province, Western Turkey, approximately 50 km south of Aphrodisias, in western Asia Minor. Two high-quality marbles, white and black in colour, were extracted from these quarries (Attanasio and Bruno, 2008; Attanasio *et al.*, 2009). Recent archaeometric studies are revealing that the best works of art produced in Rome in the 2nd century AD and also in Late Antiquity –4th-5th centuries; *cf. infra* n. 9–, were produced by a workshop –or workshops– situated in Aphrodisias, until it was relocated to the *Urbs* owing to the fame accrued by its productions. Using the marble from their native region, which was taken to Rome, Aphrodisian sculptors, whose names are known because they sometimes signed their works (Rodríguez, 2021: 35-38), specialised in statues and sculptures of the wealthy Roman elite, especially the imperial court.

Portraits carved in Göktepe marble present a specific historical problem. Recent works by D. Attanasio's team show that production began during Trajan's reign and peaked during Hadrian's, and that this type of marble remained the most popular in portraiture during the Antoninian, Severan, and Late Antique periods (Attanasio *et al.*, 2018); as many as 261 imperial and private urban portraits –from the mid-1st century BC to the early 6th century AD– were found to have been carved in Göktepe marble. The predominance of the Göktepe quarries during Hadrian's rule was such that twelve of the twenty imperial portraits analysed –61.1 % of the total–, including all seven portraits of the emperor himself, were carved in this type of marble –Luni-Carrara marble barely accounts for 16.7 % of the total– (Attanasio *et al.*, 2019: 188-196).

Many of the Aphrodisian works analysed come from Rome and suburban villae belonging to the emperor and his household. Yecla's portrait is part of those elite dynamics, which also extended to the provinces, in this case Hispania. However, the bust from Yecla is to date a *unicum* among Hispanic imperial portraits, which makes it even more significant. Of the eight known portraits of Hadrian from Hispania[8] –including Yecla's–, only two have been attributed a foreign origin, although this should remain subject to future complete archaeometric provenance analyses. The first one is Hadrian's portrait found in Italica, whose marble was identified by the LEMLA of Barcelona as Pentelic (Rodà, 1997: 179). This, alongside its extraordinary quality suggests a foreign origin (García y Bellido, 1949: 33-34, no. 22; Evers, 1994: 182-183, 132; León, 1995: 80-83, no. 22; 2001: 306-307, no. 93; Garriguet, 2006: 174), although the arrival in the city of an exceptional team of foreign artists, many of whom came from the eastern Mediterranean, in relation to the monumentalisation of the *Nova Urbs* in the 2nd century AD (León, 1995: 27-28) makes it plausible that the sculpture was carved in Italica, perhaps using marble imported from Greece. There is also

[8] One was found in 2019 by the Guardia Civil in Écija (Seville) and is still unpublished as it is part of a judicial process (available in https://www.elmundo.es/andalucia/sevilla/2019/07/15/5d2c6497fc6c83b5498b46bf.html; accessed on 07/13/2023). To these we might add another one from Tarragona, of which only the bust with breastplate and *paludamentum*, representing the same type as Yecla's, is preserved (Koppel, 1985: 52-53, no. 76, pl. 25, 1-2).

the portrait found in the Roman villa of Milreu, in Estoi, Portugal (Fittschen, 1984: 197-207; Souza, 1990: 43-44, no. 124; Garriguet, 2006: 172-173; Gonçalves, 2007: 100-103, no. 15; Noguera, 2019: 212-213, no. 1 [Teixeira]), also of high quality, and whose bust and plinth led C. Evers to interpret it as a production of 'metropolitan workshop E' (Evers, 1994: 110-111, no. 39). However, the Italica and Milreu examples are still lacking complete archaeometric characterisation, which could result in different conclusions.

Something similar happens with another four portraits of Hadrian from Córdoba (Garriguet, 2018: 579-595), Tarragona (García y Bellido, 1949: 34, no. 23; Koppel, 1985: 94-95, no. 126; Fittschen, 1984: 206; Fittschen and Zanker, 1985: 57-58, no. 54; Evers, 1994: 186, no. 137; Garriguet, 2006: 179, pl. XVII), Mérida (Ayerbe, 2001: 351-360; Garriguet, 2006: 180), and Borriol, in Castellón (Evers, 1994: 100-101, no. 27; Arasa, 1998: 319-320, pl. III; 2000: 156-157, no. 4; Garriguet, 2006: 179-180, pl. XVIII), which, based on technical and stylistic features, have been interpreted as the productions of local workshops and artists. The marble used in the Córdoba and Borriol examples has not been analysed archaeometrically, while that from Mérida was identified by the LEMLA as Estremoz marble, in Portugal (Ayerbe, 2001: 357-358), the most popular type in the city's architectural and sculptural programmes; this should be confirmed using isotope analysis. The recent analytical study of the portrait from Tarraco – alongside that of another possible portrait of Hadrian (*cf. supra* n. 8)– has provenanced the marble in Luni-Carrara and Paros-lychnites respectively (Lapuente *et al.*, 2024). In consequence, stylistic and technical quality criteria are insufficient to establish the origin of the marble in which these pieces were carved; only future archaeometric studies can clarify this point.

On the other hand, barely eight years ago it was thought that marble from Aphrodisias, specifically from Göktepe, was not represented in Hispania (Bruno *et al.*, 2015: fig. 1). However, the several campaigns of archaeometric characterisation of sculptural marbles undertaken by the ICAC and the Univ. of Zaragoza are changing the picture. Apart from Hadrian's bust from Los Torrejones, the other examples of Aphrodisias marble attested in Hispania include the portraits of Trajan and Marcus Aurelius found in Tarragona (Koppel, 1985: 92-93, no. 124, pl. 53, 3-6; 33-34, no. 46, pl. 13; Meyers, 2019: 142-143, fig. 12), in white Göktepe marble (Lapuente *et al.*, 2024), and several small sculptural cycles from the villae of Quinta das Longas, Valdetorres de Jarama, and Noheda. The latter cases of villae are technically, thematically, and stylistically homogeneous, and are dated to the 4th and first half of the 5th centuries (Attanasio and Prochaska, 2023: 12; Beckmann, 2023: 176), for which reason they can be regarded to represent the link between Constantinian and Theodosian sculpture, and the perpetuation and re-elaboration of Classical models, ideal paradigms, and traditions in the workshops of Asia Minor during this period (Hannestad, 1994, 2007; Stirling, 2014)[9]. The archaeometric characterisation of the marble has confirmed the connection of this sculptures with the Aphrodisian workshops. The assemblage from Quinta das Longas is carved in a fine-grained, high-quality marble that allowed extremely well finished products with a glossy, almost crystalline shine, and analyses have confirmed that the marble came from Göktepe (Nogales, *et al.*, 2015: 258; Lapuente *et al.*, 2021; Nogales 2022: 237-247). The sculptures from Valdetorres were carved in different varieties of black and white marble[10], which have also been analytically provenanced in Göktepe[11]. In this assemblage, dark pieces, Faustino Corsi's (1845) *nero antico*,

[9] B. Kiilerich's works on Silahtarağa's Gigantomachy, originally dated to the Antonine period, suggested a date in the Late Roman period (Kiilerich, 1993; Kiilerich and Torp, 1994; Hannestad, 1994; Fleischer *et al.*, 2001), and M. Bergmann's later work on the Chiragan cycles and their relation to Aphrodisias and the circle of Constantinople confirmed this chronology (Bergmann, 1999; for his part, J.-Ch. Balty dated the assemblage to the late 3rd century AD; *cf.* recently Balty, 2015; Brands and Goette, 2018).

[10] The initial petrological analysis failed to identify the source quarries (Mingarro *et al.*, 1987).

[11] Lapuente, M. P. and Nogales-Basarrate, T.: "Statuary qualities of white and black Göktepe marble identified

and grey hues –*bigio antico* and *bigio morato*–, predominate over white –Aesculapius's sculpture, pedestals, and other small-format pieces–. Among the dark colours, dark grey with fairer veins was used to produce half of the assemblage, notably the Niobid, Archer 1, Giant 2, Archer 2, a satyr with a wineskin, and other sculptures that are harder to interpret; the marble used to carve the Nubian slave is in part almost completely black. The use of different varieties allowed chromatic effects that resemble those found in Silahtarağa's Gigantomachy, where six giants carved in dark grey marble were positioned on white marble pedestals.

In Noheda, some of whose white marbles are very similar to those from Quinta das Longas, microscopic and isotopic analysis undertaken on several marble samples –with priority to sculptural material– in 2016, yielded unconclusive, but sufficiently significant for the research questions at the time, results (and advance in Valero *et al.*, 2015; Valero and Valverde, 2021)[12]. Of the eight samples, a head with a Phrygian cap could be Paros-2(3) marble, which, along other varieties from the same island and Thasian and Pentelic marbles, was highly appreciated in Rome for decorative sculptures. A fragment of clothing seems to be Luni-Carrara marble. The other six samples present features that are compatible with both Carrara and Göktepe marbles, but the techniques used in this study could not distinguish between them. For this reason, the cathodoluminescence and geochemical analysis of these marbles, including trace analysis of such elements as strontium (Sr) and manganese (Mn), are currently under way (Attanasio *et al.*, 2015; Blanc *et al.*, 2020).

It is possible that the sculptures of Quinta das Longas, Valdetorres, and Noheda are not unique in Hispania, and that the future study of the sculptural cycles found in other late villae –e.g. Churriana and La Estación in Malaga, Los Robles in Jaén, El Salar in Granada (Beltrán and Rodríguez, 2016: 464-465, 471-475, figs. 3, 16, 19-22 and 24), and Camino Viejo de las Sepulturas in Albacete (Noguera, 2017: 165-188), to mention a few significant examples– reveals that the productions of Aphrodisias workshops and their associated quarries were more common in Hispania than held to date. In any case, only the full archaeometric characterisation of these sculptures can close the issue, as was the case with the use in some of these cycles of Paros marble (e.g. Noheda and El Salar). Based on the isotopic and elemental analyses undertaken on the Chiragan cycles, in which idealised sculptures and private and imperial portraits were dominated by a few marble varieties –Göktepe, Afyon, Paros 2, and *lychnites*, from Paros, Carrara and Saint Béat, in Pyrenees– this should not come as a surprise[13].

8. Conclusions

Using a well-established multi-method approach, with Optical microscopy –OM–, qualitative cathodoluminescence –CL-Optical–, stable C and O isotopic signature –IRMS– and complementary analyses of trace element by ICP-AES, to obtain Sr and Mn concentrations, and $^{87}Sr/^{86}Sr$ isotopic ratio by Thermal ionization mass spectrometry –TIMS– the marble of the Hadrian portrait of Los Torrejones has been unequivocally identified. Although petrographically this marble is quite similar to Carrara statuary, the combination of the obtained results certainly certifies this marble as white Göktepe marble.

This study has highlighted the importance of carrying out the analysis of the marble provenance using the same methodology and even the same analytical protocol of acid attack in the

in the Hispanic Valdetorres de Jarama marble collection", *Minerals* (under review).

[12] "Análisis de doce muestras líticas tomadas a un conjunto de piezas halladas en el yacimiento romano de la villa de Noheda (Villar de Domingo García, Cuenca)". Report deposited at the ICAC, Tarragona, in 2016.

[13] Attanasio *et al.*, 2016; Capus, 2020: 122; *cf.* earlier Bergmann, 1995. The identification of the cycles of Herakles, *tondi* with gods, mythological figures, and some portraits, as local Saint Béat marble, suggests that they were carved in a local workshop in the late 4th or early 5th century (Beckmann, 2020).

archaeological samples, in order to have reliability in the comparative study with the quarry samples.

The identification of Göktepe marble as the raw material used in this Hadrian portrait is not surprising since recent analyses emphasized the high demand of Göktepe marble in Hadrian age. These results highlight the need to undertake full archaeometric analysis, where the usual combination of petrography and cathodoluminescence is joined by C and O stable isotopes analysis, Sr and Mn geochemical concentration analysis, and even $^{87}Sr/^{86}Sr$ isotope analysis in doubtful cases. Only in this way will we be able to establish the real presence of imported Göktepe marble in Hispania. For example, it will be interesting to analyse Hadrian's portraits from Italica and Milreu and the female bust from Los Torrejones –perhaps a portrait of Vibia Sabina–, the external appearance of which is very similar to that of the emperor's portrait. Other late cycles that demand this type of studies include those from Churriana, La Estación, Los Robles, and Camino Viejo de las Sepulturas. The material sculpture from Noheda, one of the most significant assemblages from an archaeological point of view, is another obvious candidate. In this way, we shall be able to incorporate the Iberian Peninsula to the distribution map of Aphrodisian productions that already include other regions of the Empire.

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