

Archaeometric Analysis of the Alabaster Thresholds of Villa A, Oplontis (Torre Annunziata, Italy) and New Sr and Pb Isotopic Data for Alabastro Ghiaccione del Circeo

Barker, Simon J.; Perna, Simona; Fant, J. Clayton; Lazzarini, Lorenzo; Villa, Igor M.

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CONTENT

PRESENTATION	15
NECROLOGY: NORMAN HERZ (1923-2013) by Susan Kane	17
1. APPLICATIONS TO SPECIFIC ARCHEOLOGICAL QUESTIONS – USE OF MARBLE	
Hermaphrodites and Sleeping or Reclining Maenads: Production Centres and Quarry Marks <i>Patrizio Pensabene</i>	25
First Remarks about the Pavement of the Newly Discovered Mithraeum of the Colored Marbles at Ostia and New Investigations on Roman and Late Roman White and Colored Marbles from Insula IV, IX <i>Massimiliano David, Stefano Succi and Marcello Turci</i>	33
Alabaster. Quarrying and Trade in the Roman World: Evidence from Pompeii and Herculaneum <i>Simon J. Barker and Simona Perna</i>	45
Recent Work on the Stone at the Villa Arianna and the Villa San Marco (Castellammare di Stabia) and Their Context within the Vesuvian Area <i>Simon J. Barker and J. Clayton Fant</i>	65
Marble Wall Decorations from the Imperial Mausoleum (4 th C.) and the Basilica of San Lorenzo (5 th C.) in Milan: an Update on Colored Marbles in Late Antique Milan <i>Elisabetta Neri, Roberto Bugini and Silvia Gazzoli</i>	79
Sarcophagus Lids Sawn from their Chests <i>Dorothy H. Abramitis and John J. Herrmann</i>	89
The Re-Use of Monolithic Columns in the Invention and Persistence of Roman Architecture <i>Peter D. De Staebler</i>	95
The Trade in Small-Size Statues in the Roman Mediterranean: a Case Study from Alexandria <i>Patrizio Pensabene and Eleonora Gasparini</i>	101
The Marble Dedication of Komon, Son of Asklepiades, from Egypt: Material, Provenance, and Reinforcement of Meaning <i>Patricia A. Butz</i>	109
Multiple Reuse of Imported Marble Pedestals at Caesarea Maritima in Israel <i>Barbara Burrell</i>	117
Iasos and Iasian Marble between the Late Antique and Early Byzantine Eras <i>Diego Peirano</i>	123

Thassos, Known Inscriptions with New Data <i>Tony Kozelj and Manuela Wurch-Kozelj</i>	131
The Value of Marble in Roman <i>Hispalis</i> : Contextual, Typological and Lithological Analysis of an Assemblage of Large Architectural Elements Recovered at N° 17 Goyeneta Street (Seville, Spain) <i>Ruth Taylor, Oliva Rodríguez, Esther Ontiveros, María Luisa Loza, José Beltrán and Araceli Rodríguez</i>	143
<i>Giallo Antico</i> in Context. Distribution, Use and Commercial Actors According to New Stratigraphic Data from the Western Mediterranean (2 nd C. Bc – Late 1 st C. Ad) <i>Stefan Ardeleanu</i>	155
<i>Amethystus</i> : Ancient Properties and Iconographic Selection <i>Luigi Pedroni</i>	167
2. PROVENANCE IDENTIFICATION I: (MARBLE)	
Unraveling the Carrara – Göktepe Entanglement <i>Walter Prochaska, Donato Attanasio and Matthias Bruno</i>	175
The Marble of Roman Imperial Portraits <i>Donato Attanasio, Matthias Bruno, Walter Prochaska and Ali Bahadır Yavuz</i>	185
Tracing Alabaster (Gypsum or Anhydrite) Artwork Using Trace Element Analysis and a Multi-Isotope Approach (Sr, S, O) <i>Lise Leroux, Wolfram Kloppmann, Philippe Bromblet, Catherine Guerrot, Anthony H. Cooper, Pierre-Yves Le Pogam, Dominique Vingtain and Noel Worley</i>	195
Roman Monolithic Fountains and Thasian Marble <i>Annewies van den Hoek, Donato Attanasio and John J. Herrmann</i>	207
Archaeometric Analysis of the Alabaster Thresholds of Villa A, Oplontis (Torre Annunziata, Italy) and New Sr and Pb Isotopic Data for <i>Alabastro Ghiaccione del Circeo</i> <i>Simon J. Barker, Simona Perna, J. Clayton Fant, Lorenzo Lazzarini and Igor M. Villa</i>	215
Roman Villas of Lake Garda and the Occurrence of Coloured Marbles in the Western Part of “Regio X Venetia et Histria” (Northern Italy) <i>Roberto Bugini, Luisa Folli and Elisabetta Roffia</i>	231
Calcitic Marble from Thasos in the North Adriatic Basin: Ravenna, Aquileia, and Milan <i>John J. Herrmann, Robert H. Tykot and Annewies van den Hoek</i>	239
Characterisation of White Marble Objects from the Temple of Apollo and the House of Augustus (Palatine Hill, Rome) <i>Francesca Giustini, Mauro Brilli, Enrico Gallochio and Patrizio Pensabene</i>	247
Study and Archeometric Analysis of the Marble Elements Found in the Roman Theater at Aeclanum (Mirabella Eclano, Avellino - Italy) <i>Antonio Mesisca, Lorenzo Lazzarini, Stefano Cancelliere and Monica Salvadori</i>	255

Two Imperial Monuments in Puteoli: Use of Proconnesian Marble in the Domitianic and Trajanic Periods in Campania <i>Irene Bald Romano, Hans Rupprecht Goette, Donato Attanasio and Walter Prochaska</i>	267
Coloured Marbles in the Neapolitan Pavements (16 th And 17 th Centuries): the Church of <i>Santi Severino e Sossio</i> <i>Roberto Bugini, Luisa Folli and Martino Solito</i>	275
Roman and Early Byzantine Sarcophagi of Calcitic Marble from Thasos in Italy: Ostia and Siracusa <i>Donato Attanasio, John J. Herrmann, Robert H. Tykot and Annewies van den Hoek</i>	281
Revisiting the Origin and Destination of the Late Antique Marzamemi 'Church Wreck' Cargo <i>Justin Leidwanger, Scott H. Pike and Andrew Donnelly</i>	291
The Marbles of the Sculptures of Felix Romuliana in Serbia <i>Walter Prochaska and Maja Živić</i>	301
Calcitic Marble from Thasos and Proconnesos in Nea Anchialos (Thessaly) and Thessaloniki (Macedonia) <i>Vincent Barbin, John J. Herrmann, Aristotle Mentzos and Annewies van den Hoek</i>	311
Architectural Decoration of the Imperial Agora's Porticoes at Iasos <i>Fulvia Bianchi, Donato Attanasio and Walter Prochaska</i>	321
The Winged Victory of Samothrace - New Data on the Different Marbles Used for the Monument from the Sanctuary of the Great Gods <i>Annie Blanc, Philippe Blanc and Ludovic Laugier</i>	331
Polychrome Marbles from the Theatre of the Sanctuary of Apollo Pythios in Gortyna (Crete) <i>Jacopo Bonetto, Nicolò Mareso and Michele Bueno</i>	337
Paul the Silentiary, Hagia Sophia, Onyx, Lydia, and Breccia Corallina <i>John J. Herrmann and Annewies van den Hoek</i>	345
Incrustations from Colonia Ulpia Traiana (Near Modern Xanten, Germany) <i>Vilma Ruppiniè and Ulrich Schüssler</i>	351
Stone Objects from Vindobona (Austria) – Petrological Characterization and Provenance of Local Stone in a Historico-Economical Setting <i>Andreas Rohatsch, Michaela Kronberger, Sophie Insulander, Martin Mosser and Barbara Hodits</i>	363
Marbles Discovered on the Site of the Forum of Vaison-la-Romaine (Vaucluse, France): Preliminary Results <i>Elsa Roux, Jean-Marc Mignon, Philippe Blanc and Annie Blanc</i>	373
Updated Characterisation of White Saint-Béat Marble. Discrimination Parameters from Classical Marbles <i>Hernando Royo Plumed, Pilar Lapeunte, José Antonio Cuchí, Mauro Brillì and Marie-Claire Savin</i>	379

Grey and Greyish Banded Marbles from the Estremoz Anticline in Lusitania <i>Pilar Lapuente, Trinidad Nogales-Basarrate, Hernando Royo Plumed, Mauro Brilli and Marie-Claire Savin</i>	391
New Data on Spanish Marbles: the Case of <i>Gallaecia</i> (NW Spain) <i>Anna Gutiérrez García-M., Hernando Royo Plumed and Silvia González Soutelo</i>	401
A New Roman Imperial Relief Said to Be from Southern Spain: Problems of Style, Iconography, and Marble Type in Determining Provenance <i>John Pollini, Pilar Lapuente, Trinidad Nogales-Basarrate and Jerry Podany</i>	413
Reuse of the <i>Marmora</i> from the Late Roman Palatial Building at Carranque (Toledo, Spain) in the Visigothic Necropolis <i>Virginia García-Entero, Anna Gutiérrez García-M. and Sergio Vidal Álvarez</i>	427
Imperial Porphyry in Roman Britain <i>David F. Williams</i>	435
Recycling of Marble: Apollonia/Sozousa/Arsuf (Israel) as a Case Study <i>Moshe Fischer, Dimitris Tambakopoulos and Yannis Maniatis</i>	443
Thasian Connections Overseas: Sculpture in the Cyrene Museum (Libya) Made of Dolomitic Marble from Thasos <i>John J. Herrmann and Donato Attanasio</i>	457
Marble on Rome's Southwestern Frontier: Thamugadi and Lambaesis <i>Robert H. Tykot, Ouahiba Bouzidi, John J. Herrmann and Annewies van den Hoek</i>	467
Marble and Sculpture at Lepcis Magna (Tripolitania, Libya): a Preliminary Study Concerning Origin and Workshops <i>Luisa Musso, Laura Buccino, Matthias Bruno, Donato Attanasio and Walter Prochaska</i>	481
The Pentelic Marble in the Carnegie Museum of Art Hall of Sculpture, Pittsburgh, Pennsylvania <i>Albert D. Kollar</i>	491
Analysis of Classical Marble Sculptures in the Michael C. Carlos Museum, Emory University, Atlanta <i>Robert H. Tykot, John J. Herrmann, Renée Stein, Jasper Gaunt, Susan Blevins and Anne R. Skinner</i>	501
3. PROVENANCE IDENTIFICATION II: (OTHER STONES)	
Aphrodisias and the Regional Marble Trade. The <i>Scaenae Frons</i> of the Theatre at Nysa <i>Natalia Toma</i>	513
The Stones of Felix Romuliana (Gamzigrad, Serbia) <i>Bojan Djurić, Divna Jovanović, Stefan Pop Lazić and Walter Prochaska</i>	523
Aspects of Characterisation of Stone Monuments from Southern Pannonia <i>Branka Migotti</i>	537

The Budakalász Travertine Production <i>Bojan Djurić, Sándor Kele and Igor Rižnar</i>	545
Stone Monuments from Carnuntum and Surrounding Areas (Austria) – Petrological Characterization and Quarry Location in a Historical Context <i>Gabrielle Kremer, Isabella Kitz, Beatrix Moshhammer, Maria Heinrich and Erich Draganits</i>	557
Espejón Limestone and Conglomerate (Soria, Spain): Archaeometric Characterization, Quarrying and Use in Roman Times <i>Virginia García-Entero, Anna Gutiérrez García-M, Sergio Vidal Álvarez, María J. Peréx Agorreta and Eva Zarco Martínez</i>	567
The Use of Alcover Stone in Roman Times (<i>Tarraco, Hispania Citerior</i>). Contributions to the <i>Officina Lapidaria Tarraconensis</i> <i>Diana Gorostidi Pi, Jordi López Vilar and Anna Gutiérrez García-M.</i>	577
4. ADVANCES IN PROVENANCE TECHNIQUES, METHODOLOGIES AND DATABASES	
Grainautline – a Supervised Grain Boundary Extraction Tool Supported by Image Processing and Pattern Recognition <i>Kristóf Csorba, Lilla Barancsuk, Balázs Székely and Judit Zöldföldi</i>	587
A Database and GIS Project about Quarrying, Circulation and Use of Stone During the Roman Age in <i>Regio X - Venetia et Histria</i> . The Case Study of the Euganean Trachyte <i>Caterine Previato and Arturo Zara</i>	597
5. QUARRIES AND GEOLOGY	
The Distribution of Troad Granite Columns as Evidence for Reconstructing the Management of Their Production <i>Patrizio Pensabene, Javier Á. Domingo and Isabel Rodà</i>	613
Ancient Quarries and Stonemasonry in Northern Choria Considiana <i>Hale Güney</i>	621
Polychromy in Larisaeon Quarries and its Relation to Architectural Conception <i>Gizem Mater and Ertunç Denктаş</i>	633
Euromos of Caria: the Origin of an Hitherto Unknown Grey Veined Stepped Marble of Roman Antiquity <i>Matthias Bruno, Donato Attanasio, Walter Prochaska and Ali Bahadır Yavuz</i>	639
Unknown Painted Quarry Inscriptions from Bacakale at <i>Docimium</i> (Turkey) <i>Matthias Bruno</i>	651
The Green Schist Marble Stone of Jebel El Hairech (North West of Tunisia): a Multi-Analytical Approach and its Uses in Antiquity <i>Ameur Younès, Mohamed Gaied and Wissem Gallala</i>	659
Building Materials and the Ancient Quarries at <i>Thamugadi</i> (East of Algeria), Case Study: Sandstone and Limestone <i>Younès Rezkallah and Ramdane Marmi</i>	673

The Local Quarries of the Ancient Roman City of <i>Valeria</i> (Cuenca, Spain) <i>Javier Atienza Fuente</i>	683
The Stone and Ancient Quarries of Montjuïc Mountain (Barcelona, Spain) <i>Aureli Álvarez</i>	693
<i>Notae Lapidinarum</i> : Preliminary Considerations about the Quarry Marks from the Provincial Forum of <i>Tarraco</i> <i>Maria Serena Vinci</i>	699
The Different Steps of the Rough-Hewing on a Monumental Sculpture at the Greek Archaic Period: the Unfinished Kouros of Thasos <i>Danièle Braunstein</i>	711
A Review of Copying Techniques in Greco-Roman Sculpture <i>Séverine Moureaud</i>	717
Labour Forces at Imperial Quarries <i>Ben Russell</i>	733
Social Position of Craftsmen inside the Stone and Marble Processing Trades in the Light of Diocletian's Edict on Prices <i>Krešimir Bosnić and Branko Matulić</i>	741
6. STONE PROPERTIES, WEATHERING EFFECTS AND RESTORATION, AS RELATED TO DIAGNOSIS PROBLEMS, MATCHING OF STONE FRAGMENTS AND AUTHENTICITY	
Methods of Consolidation and Protection of Pentelic Marble <i>Maria Apostolopoulou, Elissavet Drakopoulou, Maria Karoglou and Asterios Bakolas</i>	749
7. PIGMENTS AND PAINTINGS ON MARBLE	
Painting and Sculpture Conservation in Two Gallo-Roman Temples in Picardy (France): Champlieu and Pont-Sainte-Maxence <i>Véronique Brunet-Gaston and Christophe Gaston</i>	763
The Use of Colour on Roman Marble Sarcophagi <i>Eliana Siotto</i>	773
New Evidence for Ancient Gilding and Historic Restorations on a Portrait of Antinous in the San Antonio Museum of Art <i>Jessica Powers, Mark Abbe, Michelle Bushey and Scott H. Pike</i>	783
Schists and Pigments from Ancient Swat (Khyber Pukhtunkhwa, Pakistan) <i>Francesco Mariottini, Gianluca Vignaroli, Maurizio Mariottini and Mauro Roma</i>	793
8. SPECIAL THEME SESSION: „THE USE OF MARBLE AND LIMESTONE IN THE ADRIATIC BASIN IN ANTIQUITY”	
Marble Sarcophagi of Roman Dalmatia Material – Provenance – Workmanship <i>Guntram Koch</i>	809

Funerary Monuments and Quarry Management in Middle Dalmatia <i>Nenad Cambi</i>	827
Marble Revetments of Diocletian's Palace <i>Katja Marasović and Vinka Marinković</i>	839
The Use of Limestones as Construction Materials for the Mosaics of Diocletian's Palace <i>Branko Matulić, Domagoj Mudronja and Krešimir Bosnić</i>	855
Restoration of the Peristyle of Diocletian's Palace in Split <i>Goran Nikšić</i>	863
Marble Slabs Used at the Archaeological Site of Sorna near Poreč Istria – Croatia <i>Đeni Gobić-Bravar</i>	871
Ancient Marbles from the Villa in Verige Bay, Brijuni Island, Croatia <i>Mira Pavletić and Đeni Gobić-Bravar</i>	879
Notes on Early Christian Ambos and Altars in the Light of some Fragments from the Islands of Pag and Rab <i>Mirja Jarak</i>	887
The Marbles in the Chapel of the Blessed John of Trogir in the Cathedral of St. Lawrence at Trogir <i>Đeni Gobić-Bravar and Daniela Matetić Poljak</i>	899
The Use of Limestone in the Roman Province of Dalmatia <i>Edisa Lozić and Igor Rižnar</i>	915
The Extraction and Use of Limestone in Istria in Antiquity <i>Klara Buršić-Matijašić and Robert Matijašić</i>	925
Aurisina Limestone in the Roman Age: from Karst Quarries to the Cities of the Adriatic Basin <i>Caterina Previato</i>	933
The Remains of Infrastructural Facilities of the Ancient Quarries on Zadar Islands (Croatia) <i>Mate Parica</i>	941
The Impact of Local Geomorphological and Geological Features of the Area for the Construction of the Burnum Amphitheatre <i>Miroslav Glavičić and Uroš Stepišnik</i>	951
Roman Quarry Klis Kosa near Salona <i>Ivan Alduk</i>	957
Marmore Lavdata Brattia <i>Miona Miliša and Vinka Marinković</i>	963
Quarries of the Lumbarda Archipelago <i>Ivka Lipanović and Vinka Marinković</i>	979

Island of Korčula – Importer and Exporter of Stone in Antiquity <i>Mate Parica and Igor Borzić</i>	985
Faux Marbling Motifs in Early Christian Frescoes in Central and South Dalmatia: Preliminary Report <i>Tonči Borovac, Antonija Gluhan and Nikola Radošević</i>	995
INDEX OF AUTHORS	1009

ARCHAEOLOGICAL ANALYSIS OF THE ALABASTER THRESHOLDS OF VILLA A, OPLONTIS (TORRE ANNUNZIATA, ITALY) AND NEW SR AND PB ISOTOPIC DATA FOR *ALABASTRO GHIACCIONE DEL CIRCEO*

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Abstract

A total of 13 thresholds composed of one or more blocks of alabaster (calcitic onyx alabaster) survive *in situ* at Villa A at Oplontis. The thresholds, which belong to Villa A's original phase of construction in the middle of the first century BC, arguably represent the most spectacular example of alabaster-use to survive from the villas and houses preserved by the eruption of Mt Vesuvius in AD 79. This article presents the results of the mineralogical and isotopic studies carried out on samples from these thresholds to determine their source. While a number of quarry sources can now be ruled out, the actual quarry source still remains uncertain. The results reiterate the need for a thorough investigation and re-examination of the sources of alabaster used in the Roman period in order to provide a comprehensive database of the alabaster quarries that may have been operating during Antiquity.

Keywords

Ancient calcareous alabasters, archaeometry, Villa A, Oplontis, Sr-Pb provenance fingerprinting

the Roman period, few objects or sites have been analysed and assigned to specific ancient quarries.¹ Part of the problem relates to the fact that calcitic alabaster deposits are very common throughout the Mediterranean with small outcrops that are difficult to identify for scientific study (thus many ancient sources have probably not yet been identified). We also have a very limited number of samples from individual quarries and extraction sites, which means a low representative selection, and it is possible that the quarries of the main varieties used in the Roman period could have been completely exhausted.

Thus, further identification of ancient alabaster quarries, scientific quarry data and the determination of the quarry provenance of individual objects remain a key part of understanding the origin, and therefore, distribution of and trade in alabaster. In line with this, we have attempted to determine provenance for the most important alabaster thresholds at Villa A at Oplontis (Torre Annunziata, Italy).² To this end, the article focuses on the alabaster thresholds from Villa A in their ancient context, their macroscopic characteristic, the sampling and methods used in their analysis, and the results, as well as new quarry data. This includes new Sr and Pb isotopic compositions for *alabastro*

Introduction

Although alabaster was quarried in a number of locations throughout the ancient world and was highly valued during the Roman period for ornamental uses, many aspects related to its quarrying and use remain unexplored (Fig. 1). With reference to the study of ancient alabaster-use, there are two interrelated issues: the incomplete knowledge of all the sources (and the shortage of specific studies of archaeometric characterisation) and the fact that despite the wide distribution of alabaster in

1 Despite the work of BARBIERI *et al.* 2002a and 2002b; BRUNO 2002; ÇOLAK, LAZZARINI 2002; LAZZARINI *et al.* 2012; HERRMANN Jr. *et al.* 2012, SCARDOZZI 2012, much still needs to be done (see BARKER and PERNA in this volume).

2 The authors would like to thank the Oplontis Project (directed by J. Clarke and M. Thomas of the University of Texas at Austin and in collaboration with the Soprintendenza Speciale per i Beni Archeologici di Napoli e Pompei), for permission to take a total of 7 samples for analysis.

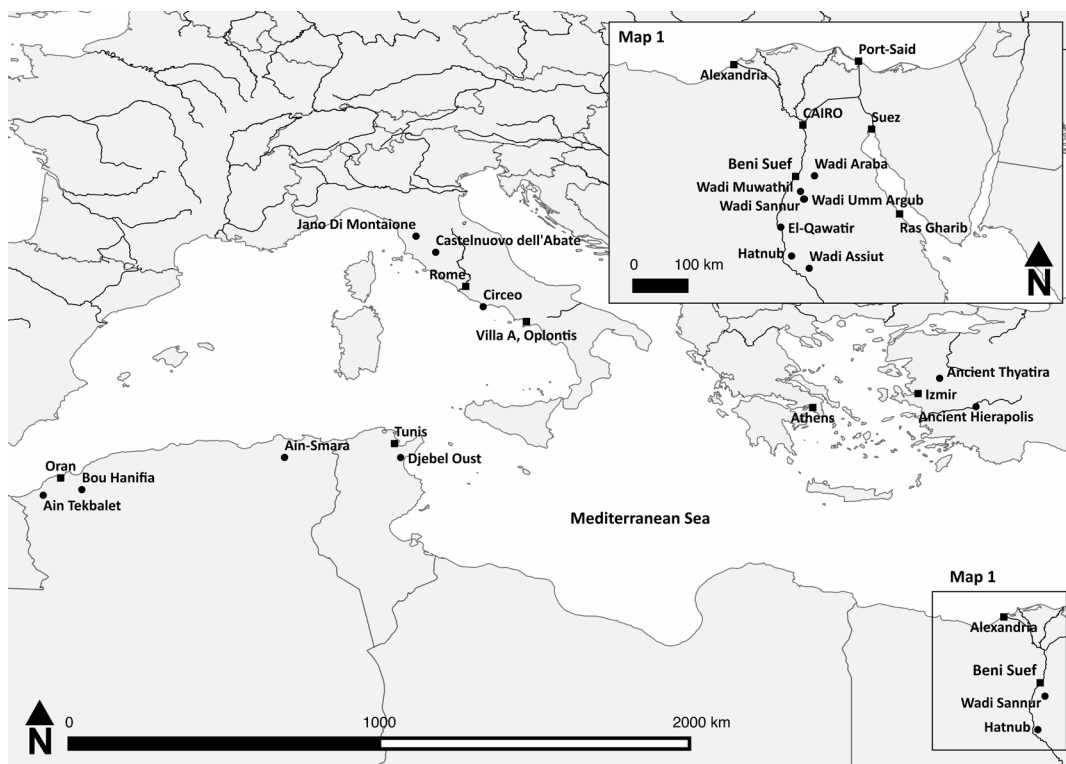


Fig. 1. Location of the ancient quarries of the most important coloured alabasters/travertines used by the Romans (drawing: S. Barker)

ghiaccione del Circeo from La Bateria,³ presented here for the first time, as well as a sample of a local *ghiaccione* alabaster from Hierapolis.⁴ This is followed by a discussion and suggestions for further research.

The alabaster thresholds of Villa A in their ancient context

Villa A (the so-called Villa of Poppaea) is one of the largest and best-documented villas in the area destroyed by the eruption of Mount Vesuvius in AD 79.⁵ An analysis of the stone decoration charted the use of stone through all phases of the Villa's history, from the initial construction of the Villa (c. 50 BC), to the renovations and additions during the Augustan period (c. AD 1-15) and finally to the east wing, constructed during the Julio-Claudian period after AD 45, and placed each phase within the

context of wider stone use in the Bay of Naples and Italy.⁶ This included an investigation of the 14 thresholds composed of one or more blocks of alabaster surviving *in situ* at Villa A that decorate the elegantly Second-Style painted rooms, such as the atrium (5), *triclinium* 14, *salone* 15 and *cubiculum* 11, as well as (surprisingly) some service areas (Fig. 2). See Table 1 for details of the alabaster thresholds sampled and Figures 3-7.

By the middle of the first century BC, the taste for imported marble was well established in Rome, but quantities remained very small, and almost none of it is known outside the most elite houses in the capital, let alone in provincial Campania. Pliny the Elder testifies to the novelty of alabaster, presumably calcareous, in mid-first-century BC Rome. According to him (following Nepos, 99-24 BC) Lentulus Spinther and Balbus, in 54 BC and 13 BC respectively, were amongst the first Romans to display alabaster items.⁷ The stone's popularity continued into the late Flavian period as we learn from Statius' *Silvae* (after AD 93) where he describes the private baths of Claudius Etruscus (AD 1-90) and the house of Violentilla, which were lavishly lined with onyx.⁸

Large quantities of alabaster in single contexts were exceptional due to the dynamics of extraction and

3 BRUNO 1998.

4 The authors are most grateful to G. Quarta of the CNR laboratory at Lecce and G. Scardozzi of the Marmora Phrygiae Project for the sample.

5 On the importance and context of Villa A, see GAZDA 2016. On the history of the excavations, see CLARKE 2014. See The Oplontis Project Website for details of the project and its publications to-date: <http://www.oplontisproject.org>.

6 See BARKER and FANT, *forthcoming*.

7 Pliny, *NH*, 36.59-60.

8 Statius, *Silvae*, I.5.1-65; I.2.149.

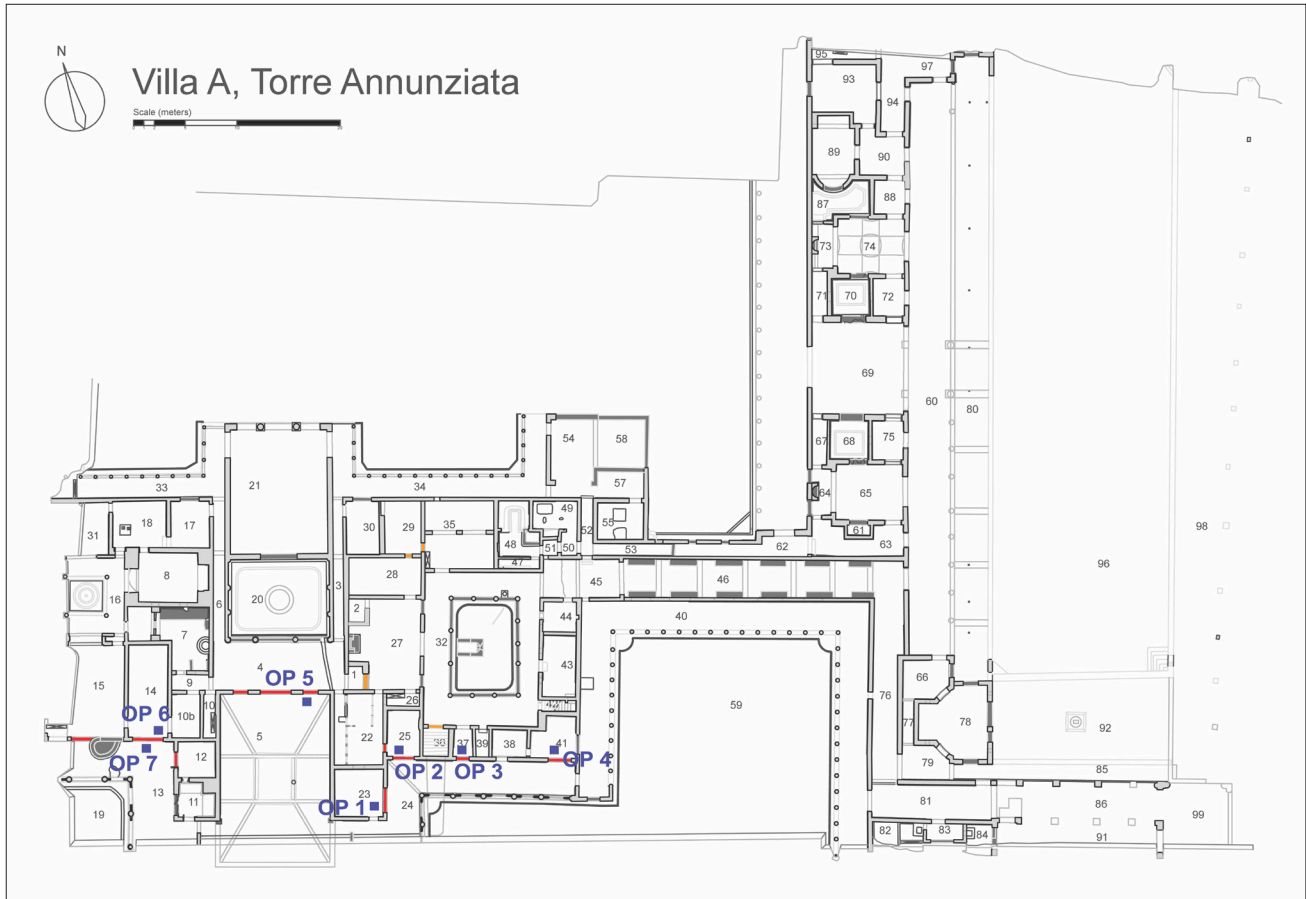


Fig. 2. Plan of Villa A, Oplontis and sample locations (photo: Oplontis Project)

Threshold Location	Sample Number	Description	Estimated Volume
23/24	OP 1	Threshold installed in three blocks. From north to south, the three blocks measure 88 x 45 cm, 81 x 45 cm, and 70 x 45 cm respectively. The total length of the threshold is 238 cm. The northern and southern blocks have square hinge sockets cut into the stone.	0.5 m ³
24/25	OP 2	Threshold installed in three blocks. From west to east, the blocks measure 70 x 37 cm, 67 x 37 cm, and 59 x 37 cm respectively. The total length of the threshold is 196 cm. The eastern and western blocks of alabaster have square hinge sockets cut into the stone.	0.35 m ³
37/24	OP 3	Solid threshold installed in one piece. The threshold measures 120 x 37 cm. There is a substantial fissure in the stone c. 32 cm west of the east wall. There are two square hinge sockets cut into the block at the east and west sides.	0.22 m ³
41/24	OP 4	Threshold, inserted in two blocks. The two blocks measure 95.5 x 38 cm and 124.0 x 38 cm. The total width is 219.5 cm. The stone is broken but complete. There are two integrated hinge sockets on the east and west sides.	0.41 m ³
5/4	OP 5	Threshold installed in three blocks. From east to west, the blocks measure 150 x 23 cm, 155 x 23 and 145 x 22 cm. The total width is 450 cm. There are two integrated hinge sockets on the east and west sides.	0.5 m ³

Table 1. Details of the alabaster thresholds sampled (table: S. Barker)



Fig. 3.
Villa A, Oplontis. Threshold
23/24, Sample OP1 (photo:
Oplontis Project)



Fig. 4.
Villa A, Oplontis. Threshold
25/24, Sample OP 2 (photo:
Oplontis Project)



Fig. 5.
Villa A, Oplontis. Threshold
37/24, Sample OP 3 (photo:
Oplontis Project)



Fig. 6.
Villa A, Oplontis.
Threshold 41/24,
Sample OP 4 (photo:
Oplontis Project)



Fig. 7.
Villa A, Oplontis.
Threshold 13/14,
Samples OP6 and
OP7 (photo:
Oplontis Project)

thus availability. Its limited distribution in comparison to the distribution of polychrome marble made the use of alabaster a clear indication of the wealth and status of the house owners. The evidence from Villa A leaves no doubt about the almost exclusive use of this stone in elite contexts, thus confirming the testimony of ancient authors on the presence of such material in the houses of the wealthy. Alabaster only began to be exploited more frequently by the Romans in the mid-first century AD,⁹ when in fact we find it more widely in houses within the Vesuvian area (see Barker and Perna this volume). Within the initial construction, the Villa's use of alabaster is therefore not only striking but it also stands out as perhaps the most

spectacular example of alabaster-use to survive from the villas and houses preserved by the eruption of Mt Vesuvius in AD 79.¹⁰ The use of alabaster for the thresholds has of course already been noted,¹¹ however the importance of the Villa's use of alabaster has only recently been recognized.¹²

In its original construction, Villa A's alabaster thresholds joined and perhaps surpassed contemporary elite houses in Rome, headlined by M. Lepidus (consul in

9 BRUNO 2002; LAZZARINI *et al.* 2009; 2012; ÇOLAK, LAZZARINI 2012; HERRMANN Jr. *et al.*, 2012.

10 All of the alabaster thresholds can be dated to the original construction during the Second-Style period, c. 50 BC, see BARKER and FANT *forthcoming*.

11 PISAPIA 1997, 559.

12 BARKER and FANT, *forthcoming*.



Fig. 8a, 8b. Casa di Umbricius Scaurus (VII, 16 (Ins. Occ.), 12-15), Pompeii. Mosaic pavement in Atrium (2), detail of the alabaster inserts (photos: S. Barker)



Fig. 9. Casa di Umbricius Scaurus (VII, 16 (Ins. Occ.), 12-15), Pompeii. Atrium (2), impluvium (photo: S. Barker)

78 BC), who first displayed a solid threshold block of *giallo antico*.¹³ The most common use of alabaster in private houses contemporary to the thresholds at Villa A was as small inserts in pavements. For example, the Second-Style mosaic pavement in room 62 (*atriolo tetrastilo*) of the Villa dei Misteri includes many inserts of alabaster that have been identified visually as *alabastro del Circeo*,¹⁴ although it is more likely that they are bleached Egyptian onyx. Inserts of alabaster macroscopically similar to the alabaster thresholds of Villa A (especially threshold 25/25, OP 02) are found in the mosaic pavement of the atrium of the Casa di Umbricius Scaurus (VII, 16 (Ins. Occ.), 12-15) at Pompeii (Fig. 8a, 8b), which also features a drain at the north end of the *impluvium* in the same type of alabaster (Fig. 9).

There are only three examples of thresholds, all at Pompeii, which feature alabaster: the Casa di Cerere (I, 9, 13)

and the Villa dei Misteri, both datable to the Second-Style period, and the Casa de "Euxinus" (I, 11,12), which is difficult to date precisely.¹⁵ The latter features a block, most likely recycled, inserted into a rough cement floor.¹⁶ The Casa di Cerere features a threshold of polychrome mosaic with a rhombus pattern motif, either side of which are small rectangular slabs of alabaster (Fig. 10), probably from Egypt or Italy.¹⁷ The threshold at the Villa dei Misteri, located in room 47 off room 62 (*atriolo tetrastilo*), features two types of alabaster, probably from Egypt (Fig. 11).

Blocks for thresholds are more typically of white marble, and even they only became common at Pompeii after the Augustan period.¹⁸ Other than the exceptional example of M. Lepidus noted above and a few examples at Pompeii,¹⁹ thresholds of marbles other than white at Pompeii and Herculaneum date to the Fourth-Style period. The owners of the Casa di N. Popidius Priscus (VII, 2, 20) at Pompeii, for example, seem to have been in the process of installing stone thresholds of green porphyry and *cipollino verde* at the time of the eruption,²⁰ and at the Casa dei Cervi in Herculaneum a slab of *alabastro a*

13 Pliny, *NH*, 36. 49.

14 CICIRELLI, GUIDOBALDI 2000, 43, fig. 57.

15 For the Casa di Cerere: *PPM* II, 219. For the house at I.11.12: *PPM* II, 582-583.

16 The block is located in *fauces* (a).

17 The threshold is located between *cubiculum* (k) and *tablinum* (j). *PPM* II, 219, fig. 72.

18 FANT 2007.

19 One possible exception is a threshold of gray marble between the *apodyterium* (v) and garden (2) in the Casa delle Nozze d'Argento (V, 2, 1) probably dated to the Second-Style period; *PPM* III, 731.

20 FANT 2007, 340. The thresholds are piled up in the corner of the house's large peristyle, but their measurements correspond to the widths of the doorways facing that courtyard.



Fig. 10. Casa di Cerere (I, 9, 13), Pompeii. *Cubiculum* K. Threshold of polychrome mosaic with a rhombus pattern motif, on either side of which are small rectangular slabs of alabaster, datable to the Second-Style period (photo: S. Barker)



Fig. 11. Villa dei Misteri, Pompeii. Alabaster threshold in room 47 off room 62 (*atriolo tetrastilo*), datable to the Second-Style period (photo: S. Barker)

pecorella was set into the Fourth-Style mosaic directly in front of the entrance into *oecus* 16. In this context, therefore, the Villa's solid threshold blocks of alabaster must have made a spectacular impression when the Villa was inaugurated in the mid-first century BC. They highlight the luxury status of the Villa within the wider context of private residences in Campania.

It is for these reasons that we decided to undertake archaeometric analysis of the Villa A thresholds, with the expectation that the results should provide further data regarding the potential sources and uses of this ornamental stone during Antiquity.

Macroscopic characterisation

Visual characteristics of the Villa A alabaster vary from dark beige to light grey with wavy patches and no

banding and coarse to very coarse compact crystalline calcite. This corresponds to a variety of alabaster known as *alabastro ghiaccione*, a calc-synter,²¹ characterized by a translucent white grey to greenish base with some brown inclusions. A number of ancient quarries could be plausible sources of *ghiaccione*: Jano di Montaione in Tuscany, Circeo in Latium, Uthina/Thuburbo Maius near present-day Djebel Oust in North Africa;²² the Hierapolis area in the Pamukkale plateau²³ of Asia Minor

21 LAZZARINI 2002, 35.

22 LAZZARINI *et. al.* 2012, 437-438.

23 There are small quantities of *alabastro fiorito* from these quarries in the floors at Pompeii and Herculaneum; BRUNO 2002, 19.

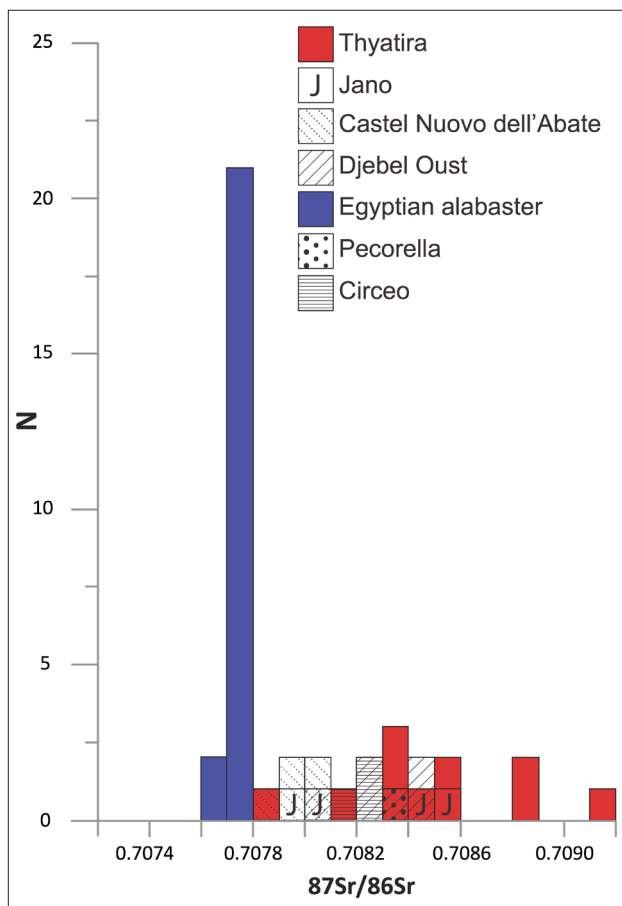


Fig. 12. Histogram with Sr isotopic ratios of possible alabaster sources for the Oplontis samples (drawing, after LAZZARINI *et al.* 2012, with additions by S. Barker)

(*marmor Hierapolitanum*). Alabasterine gypsum could derive from Fayyum (Egypt) and the island of Crete.²⁴ Due to the difficulty of positive identification via visual analysis (most of the quarries noted above could have produced white *ghiaccione* alabaster with similar macroscopic and microscopic characteristics), a total of 7 samples from 6 thresholds were subjected to archaeometric analysis with the aim of determining the source of the stone and whether several varieties were used to compose individual thresholds, particularly those of rooms 13/14 and 23/24.

Sampling and Analytical Methods

All seven samples were subjected to minero-petrographic and isotopic study. XRD (CuKα at 40 KV, 20 mA) analyses were performed at Laboratorio di Analisi dei Materiali Antichi to check the presence of calcite/aragonite and the type of Fe-oxides/hydroxides. In the light

of research suggesting the superiority of strontium isotope analysis as a method for provenancing calcite-alabaster/travertine²⁵, ⁸⁷Sr/⁸⁶Sr analyses were performed at the Institut für Geologie, Universität Bern. As an additional discriminating tool, Pb isotopic compositions were determined on the same samples used for Sr isotope analyses. At present, there are only Pb data available for the Circeo quarry, and the present analyses can only address the homogeneity of the provenance of the Villa A samples. We plan to augment the database to include Pb isotope data.

Sr and Pb were purified from the Ca matrix using miniaturized chromatographic columns and analyzed on a Nu Instruments™ multicollector plasma source mass spectrometer, following LAZZARINI *et al.* and Villa, respectively.²⁶ The results were compared with the alabasters of Jano di Montaione and Castelnuovo dell'Abate (Tuscany), Circeo, Uthina/Thuburbo Maius, Thyatira (Asia Minor), Hierapolis, and a number of Egyptian alabasters, for which Sr isotope ratios are known (Fig. 12).²⁷ In addition, two previously untested varieties of *ghiaccione* have been compared: a sample of *ghiaccione* from Hierapolis provided by G. Quarta of the CNR laboratory at Lecce, which is of local origin, and the *alabastro ghiaccione del Circeo* from la Batteria. The complete analytical data (Sr and Pb isotope ratios) for both of these varieties are presented here for the first time.

New quarry for *alabastro ghiaccione del Circeo*

The ancient quarry at La Batteria near the Circeo promontory may be reached with difficulty by ground from the face of Torre Cervia, but is more easily accessible from the sea. The quarry contains several blocks of white *ghiaccione in situ*, likely quarried in the Renaissance, and a rather wide area covered by ancient debris. Two samples, one with a fragment of the “mother limestone”, were taken and submitted to analysis. The X-Ray diffraction of both samples showed only the presence of calcite, and the thin section cut parallel to the crystal growth, showed the usual fibrous-radiated fabric typical of all alabasters. Such minero-petrographic features (composition and fabric) unfortunately proved of no use for provenance studies.

The Sr isotope analyses of the two *ghiaccione* samples, AGH-1 and AGH-2, have yielded identical results:

24 HARRELL 2012, 19 (for Egypt) and BARBIERI 2002b (for Crete).

25 ÇOLAK, LAZZARINI 2002, 38-40; LAZZARINI *et al.* 2012.

26 LAZZARINI *et al.* 2012; VILLA 2009.

27 Recent work has increased the database of microscopic characterisation of various alabasters, including those from Egypt (Eastern Desert), Algeria (Ain Tekbalet, Bou Haniffa), Tunisia (Djebel Oust), Turkey (Harmandali, Golemezli), Crete and Italy; BARBIERI *et al.* 2002a; 2002b; ÇOLAK, LAZZARINI 2002; LAZZARINI *et al.* 2006; 2012.



Fig. 13. Alabaster block with architrave and frieze. From the excavation of the southern sector of the Early Byzantine city walls at Hierapolis (Sample 185) (photo: G. Scardozi)



Fig. 14. Detail of the alabaster block with architrave and frieze. From the excavation of the southern sector of the Early Byzantine city walls at Hierapolis (Sample 185) (photo: G. Scardozi)



Fig. 15. The macroscopic aspect of the alabaster block from the southern sector of the Early Byzantine city walls at Hierapolis (Sample 185) (photo: G. Scardozi)

$^{87}\text{Sr}/^{86}\text{Sr}$ (AGH-1) = 0.708232 ± 0.000024 (2 sigma errors); $^{87}\text{Sr}/^{86}\text{Sr}$ (AGH-2) = 0.708231 ± 0.000044 . These data contrast with a previous analysis of a sample from a modern quarry of the yellow-brown Circeo alabaster.²⁸ See Table 2 for the Oplontis samples and Table 3 for the current Sr isotope database.

Data for the Hierapolis sample

The Hierapolis sample was collected during the 2013 field campaign of the Marmora Phrygiae Project (co-ordinated by G. Scardozi) and was taken from a block with architrave and frieze (Fig. 13, 14 & 15), re-used in the southern sector of the Early Byzantine city walls. The monument in which it was originally used is unknown. The architrave block can be dated to the second century BC. The main quarries of this type of stone are near Hierapolis: one is between 400 and 800 m to the west of the city, the second is about 1.8-2 km northwest of the city, and a third quarry is in the Gölemezli area, c. 13 km northwest of Hierapolis.²⁹ The Sr isotope analyses of the *ghiaccione* alabaster sample from Hierapolis (Sample 185)³⁰ have yielded the following results: $^{87}\text{Sr}/^{86}\text{Sr} = 0.707880 \pm 0.000024$ (Tables 2 and 4).

Results

Initial visual analysis suggested that the yellow-honey variety of alabaster from Oplontis could have been sourced from Egypt (*cotognino*) and the dark white and translucent blocks could have been from Italy; however, the result of pure calcite from the XRD analyses rules out a provenance from Fayyum or Crete (Fig. 16). The calcite-alabaster from Egypt and Hierapolis also can be ruled out, but the latter and Castelnuovo dell'Abate overlap with the comparatively dispersed fields of Jano di Montaione, Thyatira, and Uthina/Thuburbo Maius (Tables 2 and 3 and Fig. 17). There is some ambiguity regarding the *alabastro ghiaccione del Circeo*: the three analysed quarry samples are not compatible with most of the Oplontis thresholds, but they might be compatible with threshold 23/24, whose Sr isotopic composition is greatly different from that of the other five thresholds analysed (Fig. 18a & b). Moreover, the three quarry samples analysed suggest the same genetic heterogeneity as the larger datasets of Thyatira and Jano di Montaione. Thus, pending a more comprehensive sampling of the Circeo quarries, they cannot be conclusively excluded as potential sources.

28 LAZZARINI *et al.* 2006

29 SCARDOZZI 2012.

30 The number 185 was used during the sample's collection. Its final project ID number is H13_173.

Sample no.	⁸⁷ Sr/ ⁸⁶ Sr	2 sigma	²⁰⁶ Pb/ ²⁰⁴ Pb	2 sigma	²⁰⁷ Pb/ ²⁰⁴ Pb	2 sigma	²⁰⁸ Pb/ ²⁰⁴ Pb	2 sigma	²⁰⁸ Pb/ ²⁰⁶ Pb	2 sigma	²⁰⁷ Pb/ ²⁰⁶ Pb	2 sigma
OP 1	0.708214	0.000026	18.4941	0.0023	15.6588	0.0022	38.6530	0.0074	2.08996	0.00025	0.84668	0.00004
OP 2	0.708295	0.000035	18.5145	0.0016	15.6568	0.0019	38.6908	0.0051	2.08985	0.00017	0.84566	0.00005
OP 3	0.708314	0.000033	18.5741	0.0029	15.6646	0.0025	38.7617	0.0073	2.08693	0.00015	0.84338	0.00003
OP 4	0.708332	0.000039	18.4332	0.0085	15.6808	0.0071	38.6104	0.0166	2.09471	0.00016	0.85068	0.00005
OP 5	0.708296	0.000044	18.1912	0.0061	15.6318	0.0052	38.2648	0.0130	2.10344	0.00011	0.85931	0.00003
OP 6	0.708292	0.000036	18.5264	0.0018	15.6688	0.0021	38.7472	0.0065	2.09145	0.00019	0.84575	0.00004
OP 7	0.708305	0.000037	18.3880	0.0015	15.6516	0.0016	38.5441	0.0047	2.09614	0.00013	0.85116	0.00004
Hierapolis (#185)	0.707880	0.000024	18.6724	0.0031	15.6915	0.0028	38.8056	0.0076	2.07822	0.00017	0.84041	0.00004

Table 2. Results of the analysis of the Sr and Pb isotopic compositions for the sampled alabaster thresholds of Villa A and the Giovanni Quarta sample #185 from Hierapolis theatre analysed at the Institut für Geologie in Bern by Igor M. Villa (table: I. Villa)

Egypt						Crete						
El-Qawatir	Hatnub	Wadi Sannur	Wadi Barschawi	El-Ghurayib	Bosra-Wadi Assyuti	Anopoli	Ierani	Proph. Elias	Eleftherna Milopotamou	Kaverna-Labyrinth, Gortis	Atsipopoulo	Afrata-Kissamou
0.70770	0.70770	0.70772	0.70771	0.70771	0.70773	0.70826	0.70847	0.70880	0.708942	0.708312	0.70908	0.708951
0.70771	0.70772	0.70776	0.70774	0.70774	0.70777	0.70808	0.70845	0.70798				
0.70772	0.70772	0.70776				0.70818	0.70840	0.70850				
0.70774	0.70774	0.70780				0.70817	0.70809	0.70802				
0.70777	0.70775					0.70820	0.70803	0.70804				
0.70780	0.70777					0.70802	0.708373	0.70804				
	0.70778							0.70892				
								0.70894				
								0.70789				
								0.70880				

Table 3. Alabaster Sr isotope data-base for Egypt and Crete (after BARBIERI 2002b, Tables 2 and 3)

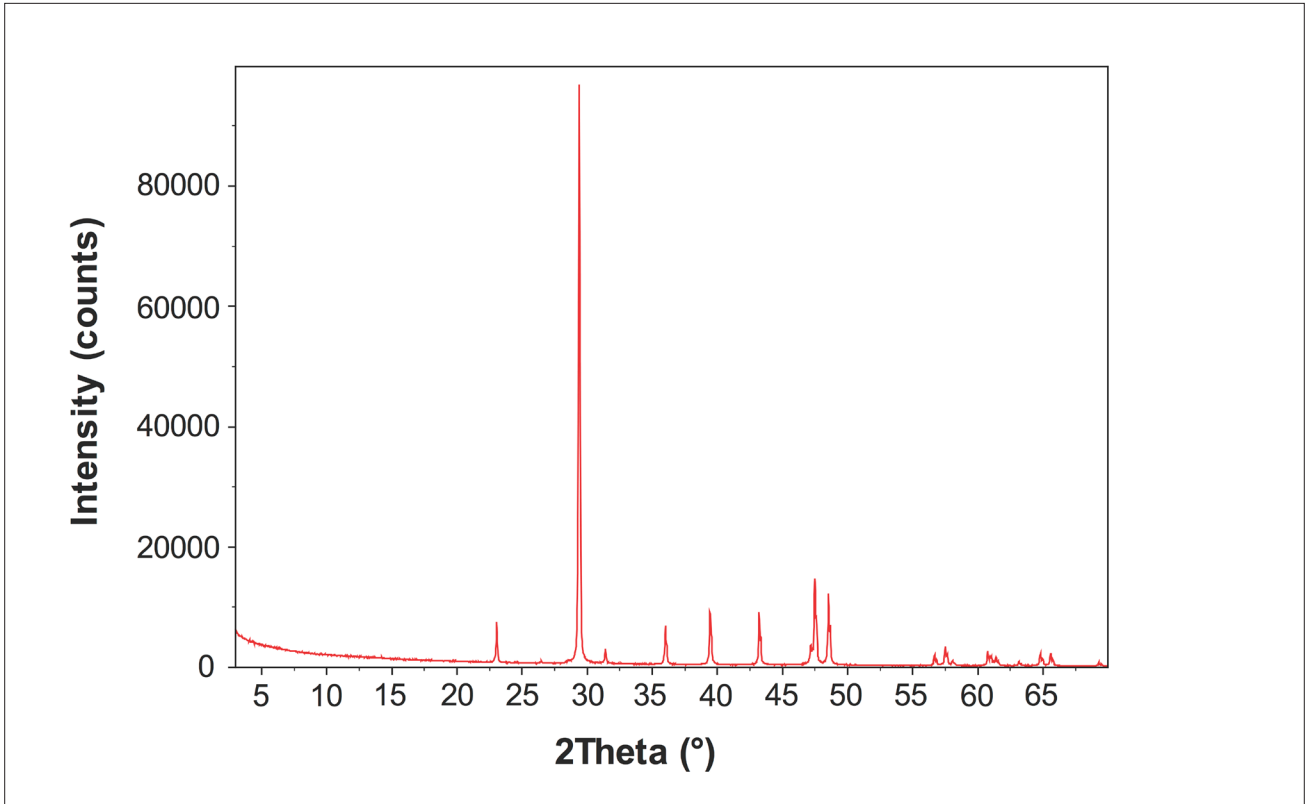


Fig. 16. X-Ray diffractogram (Cu Ka, 40 KV, 20mA) of sample 7 showing only the peaks of calcite (Ca CO₃) (drawing: L. Lazzarini)

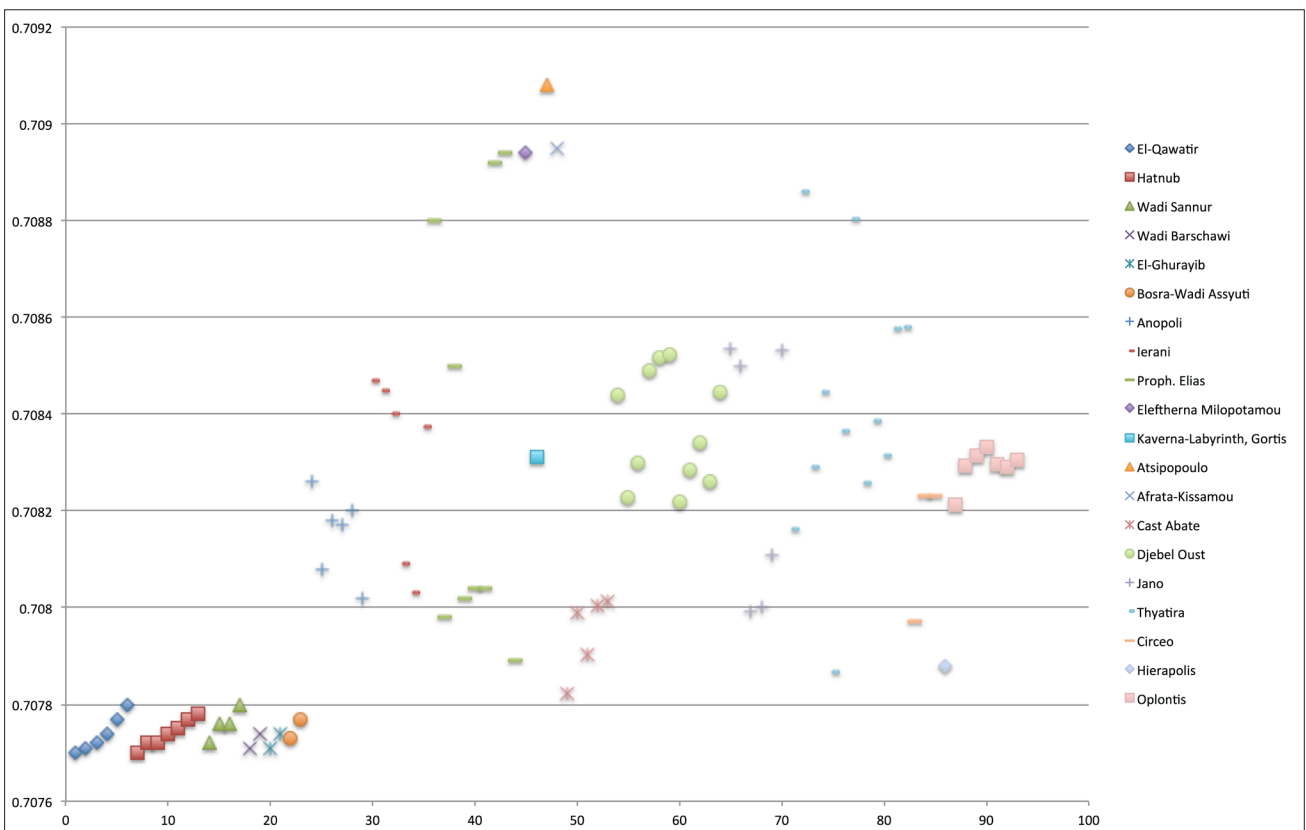


Fig. 17. Known Sr isotope results for alabaster quarries and Oplontis threshold samples. (drawing: I. Villa and S. Barker)

Italy			North Africa	Asia Minor	Artefact Samples	
Castelnuovo dell'Abate	Jano di Montatone	Circeo	Djebel Oust	Thyatira	Hierapolis Theatre	Oplontis
0.707824	0.708536	0.707973	0.708439	0.708162	0.707880	0.708214
0.707989	0.708500	0.708232	0.708229	0.708859		0.708295
0.707903	0.707994	0.708231	0.708299	0.708292		0.708314
0.708003	0.708002		0.708491	0.708446		0.708332
0.708012	0.708109		0.708517	0.707868		0.708296
	0.708533		0.708524	0.708365		0.708292
			0.708218	0.708804		0.708305
			0.708286	0.708259		
			0.708340	0.708385		
			0.708260	0.708315		
			0.708446	0.708578		

Table 4. Alabaster Sr isotope database of quarry samples and artefact samples analysed at the Institut für Geologie in Bern by Igor M. Villa (table: I. Villa)

In order to move from negative evidence (i.e. identifying the sources that *could not* have supplied the alabaster) to a positive identification it is necessary to augment the database to include trace elements, which have been a useful geochemical tool for identifying other materials.³¹ In the present work we have measured Pb isotopic compositions of the threshold samples as a supplementary discriminating tool. The dispersion of points in the $^{207}\text{Pb}/^{204}\text{Pb}$ vs $^{206}\text{Pb}/^{204}\text{Pb}$ diagram (Fig. 19) requires one or more heterogeneous sources. This can be explained in two ways: (1) the thresholds derive from different localities, which is rather implausible, given the archeologically exceptional occurrence of such large volumes of alabaster, and given the great visual similarity of the individual slabs, or (2) the geological process leading to the formation of calcareous alabaster leads naturally to a heterogeneous isotopic signature of both Sr and Pb, further to that of C and O.³² A genesis of alabaster lenses

by localized recrystallization of a pre-existing carbonate/marble protolith can easily explain the heterogeneity, as the circulating aqueous fluid did not interact completely with the protolith and left behind microscopic relicts, as attested by the variety of petrographic replacement structures.³³ Macroscopic sampling of a texturally complex mixture of replacements and relicts is expected to yield heterogeneous isotopic and elemental signatures.

The Pb isotope analyses could, at least in principle, be used to derive a model Pb-Pb age of the formation of the alabaster; however, the second genetic mechanism described above, which involves at least three separate events (the deposition of marine carbonate sediments, the metamorphism of sediments to marble, and the fluid circulation transforming marble into alabaster) implies that any alignment is more likely to represent the mixing between different fluid sources than to reflect a well-defined genesis. Indeed, the large dispersion of the points in Fig. 18b rules out an interpretation as a single-stage mineral formation event.

31 I.e. bronze sources; VILLA, 2016.

32 LAZZARINI *et al.* (2006) observed that the alabaster in Thyatira had a substantially higher and much more variable Sr isotopic composition than the surrounding marble.

33 LAZZARINI *et al.* 2006.

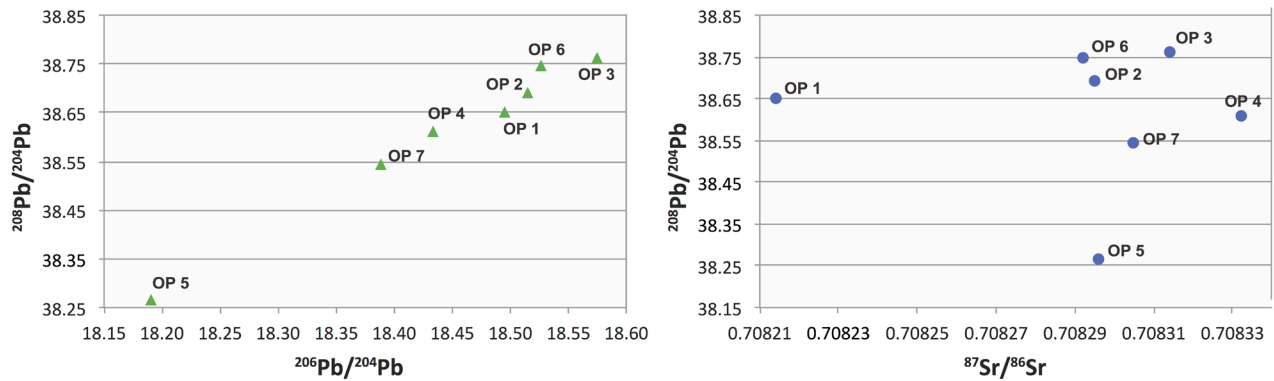


Fig. 18a, 18b. Sr and Pb isotope plots for Villa A threshold samples OP1-7 (drawing: I. Villa)

Discussion

The current results of the $^{87}\text{Sr}/^{86}\text{Sr}$ and Pb isotope ratio analyses indicate that the Oplontis samples are most compatible with a number of quarries: Thyatira, Djebel Oust and Circeo. Jano di Montaione also remains a possibility, albeit remote. It is highly probable that the Italian alabasters from Jano di Montaione (and Castelnuovo dell'Abate) were known and exploited as early as 50 BC; however, since they are quite large and deeply exploited, the evidence for quarrying activity is currently scarce.³⁴ At both Italian quarries, the mother and embedding rocks are yellowish/brownish. It is possible that an area with white/grey alabaster could have existed that is now exhausted, although this is more likely for Jano di Montaione than for Castelnuovo dell'Abate.

The quarries of ancient Thyatira are located immediately south of Harmandali and recent surveys have found debris, tool marks, and discarded architectural elements from extensive Roman quarrying at the site. The varieties from these quarries are very compact with alternating thick semi-transparent layers of pure honey-coloured calcite, and thin milky-white, opaque layers forming areas with a typical concretionary fabric (Fig. 20). Examination of the Thyatira quarries³⁵ did not identify a *ghiaccione* variety, but Thyatira must remain a serious possibility since there are light honey-colored varieties of alabaster there and we cannot exclude the continuing modern exploitation perhaps having exhausted this variety of alabaster or further deposits remaining to be discovered in this vicinity.

Two varieties are known from the Djebel Oust alabaster quarries, c. 50 km south of Tunis (Fig. 21): holotype, characterised by a regular fabric formed by thick layers of yellowish, sometimes greenish colour

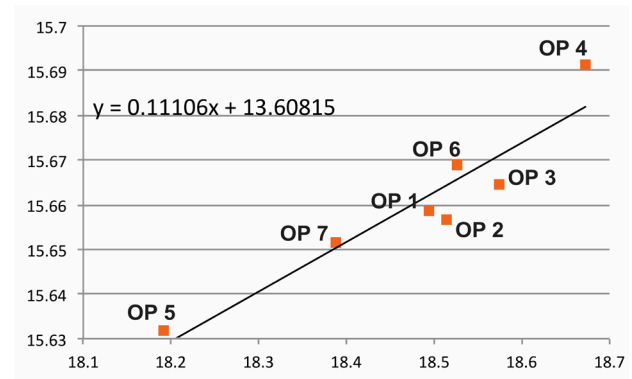


Fig. 19. Model Pb-Pb age 1.40 Ga (drawing: I. Villa)

alternating with layers of red-purplish colour, and a variety similar to Egyptian *florito*. Despite emerging from the analysis as a possible source, Djebel Oust may be sensibly excluded due to the absence of a white or light coloured *ghiaccione* variety at the quarry: the mother and embedding rocks are deeply yellow-red in colour. Moreover, the dark-red alabaster from Djebel Oust seems to have been mainly used for local and North African production of *sectilia* panels and is difficult to quantify – this may have been due to the physical conformation of the beds, which seems to have only allowed the extraction of relatively small blocks.³⁶ Moreover, the use of this stone peaked in Rome in the late Imperial period.³⁷

Circeo is geographically speaking the best candidate for the Oplontis alabaster. At least four main alabaster quarries have been identified to the southwest of the Circeo promontory in Latium.³⁸ The *ghiaccione* variety was

34 LAZZARINI *et al.* 2012.

35 ÇOLAK, LAZZARINI 2002.

36 LAZZARINI *et al.* 2012, 444.

37 GNOLI 1988, 22.

38 BRUNO 1998, 213-220; 2002, 286.



Fig. 20.
The macroscopic aspect of alabaster from the quarry of Thyatira (photo: L. Lazzarini)



Fig. 21.
Samples of the alabaster from the quarry of Djebel Oust (photo: L. Lazzarini)

sourced from a quarry site at la Batteria, but was abandoned following the exhaustion of the main yellow-brown variety. Traces of intense exploitation are still evident throughout the site. Despite quarry activity taking place here predominantly in the 18th century, exploitation during the Roman period is suggested by several architectural elements, including two columns from the Villa of Lucius Verus (second century AD). As Bruno noted, the two Circeo alabaster columns from an imperial context seem to suggest an awareness of the prestige of Italian stones.³⁹

Conclusions

The compatibility of the Oplontis samples with the quarries of Thyatira and Circeo suggest that these are the most likely sources of the threshold blocks; however, pending a more comprehensive sampling of the Circeo and Thyatira quarries, neither can be conclusively confirmed or excluded as potential sources at this stage. Circeo alabaster

would have represented a sensible choice both logistically and geographically due to the proximity of the quarries to shipping harbours and to the end destination.

These data, albeit incomplete, represent an important first step in the determination of the quarry source of Villa A's alabaster thresholds, but only a much larger database (which must include Sr, Pb and O isotope data and Ba/Mg/Sr element concentration ratios for all samples) will clarify this. The triple (or quadruple) discriminator would likely narrow down the field of candidate quarries. What is certain is that the owner of Villa A seems to have been caught up by the growing popularity of alabaster during the late Republican period. It is evident, judging by the size and location of the thresholds, that a considerable financial effort was put into acquiring the blocks in a period when alabaster was probably not immediately available in significant quantities.

39 BRUNO 1998.

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