

The Distribution of Troad Granite Columns as Evidence for Reconstructing the Management of Their Production

Pensabene, Patrizio; Domingo, Javier Á.; Rodà, Isabel

Source / Izvornik: **ASMOSIA XI, Interdisciplinary Studies on Ancient Stone, Proceedings of the XI International Conference of ASMOSIA, 2018, 613 - 620**

Conference paper / Rad u zborniku

Publication status / Verzija rada: **Published version / Objavljena verzija rada (izdavačev PDF)**

<https://doi.org/10.31534/XI.asmosia.2015/05.01>

Permanent link / Trajna poveznica: <https://urn.nsk.hr/urn:nbn:hr:123:616416>

Rights / Prava: [In copyright](#)/[Zaštićeno autorskim pravom.](#)

Download date / Datum preuzimanja: **2025-01-03**



Repository / Repozitorij:

[FCEAG Repository - Repository of the Faculty of Civil Engineering, Architecture and Geodesy, University of Split](#)



UNIVERSITY OF SPLIT

DIGITALNI AKADEMSKI ARHIVI I REPOZITORIJI



ASMOSIA XI

Interdisciplinary Studies on Ancient Stone

PROCEEDINGS

of the XI ASMOSIA Conference, Split 2015

Edited by Daniela Matetić Poljak and Katja Marasović



Interdisciplinary Studies on Ancient Stone
Proceedings of the XI ASMOSIA Conference (Split 2015)

Publishers:

ARTS ACADEMY IN SPLIT
UNIVERSITY OF SPLIT

and

UNIVERSITY OF SPLIT
FACULTY OF CIVIL ENGINEERING,
ARCHITECTURE AND GEODESY

Technical editor:
Kate Bošković

English language editor:
Graham McMaster

Computer pre-press:
Nikola Križanac

Cover design:
Mladen Čulić

Cover page:

Sigma shaped mensa of pavonazzetto marble from Diocletian's palace in Split

ISBN 978-953-6617-49-4 (Arts Academy in Split)

ISBN 978-953-6116-75-1 (Faculty of Civil Engineering, Architecture and Geodesy)

e-ISBN 978-953-6617-51-7 (Arts Academy in Split)

e-ISBN 978-953-6116-79-9 (Faculty of Civil Engineering, Architecture and Geodesy)

CIP available at the digital catalogue of the University Library in Split, no 170529005

Association for the Study of Marble & Other Stones in Antiquity

ASMOSIA XI

Interdisciplinary Studies of Ancient Stone

Proceedings of the Eleventh International Conference of ASMOSIA,
Split, 18–22 May 2015

Edited by
Daniela Matetić Poljak
Katja Marasović



Split, 2018

Nota bene

All papers are subjected to an international review.

The quality of the images relies on the quality of the originals provided by the authors.

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

THE DISTRIBUTION OF TROAD GRANITE COLUMNS AS EVIDENCE FOR RECONSTRUCTING THE MANAGEMENT OF THEIR PRODUCTION

Patrizio Pensabene¹, Javier Á. Domingo² and Isabel Rodà³

¹ Dipartimento di Scienze Archeologiche, Università La Sapienza, Rome, Italy (patrizio.pensabene@uniroma1.it)

² Dipartimento di Storia della Chiesa, Pontificia Università della Santa Croce, Rome, Italy (javdomingo78@gmail.com)

³ Department de Ciències de la Antiguitat i l'Edat Mitjana, Universitat Autònoma de Barcelona (UAB), Bellaterra, Spain / Institut Català d'Arqueologia Clàssica (ICAC), Tarragona, Spain (isabel.roda@uab.cat)

Abstract

Based on an analysis of the distribution of Troad granite shafts, as well as of who commissioned the construction projects in which they were used, we analyse the organisation of the work in the quarries where this granite was extracted and the mechanisms that explain its distribution. Troad granite was little used in Rome, but is frequently found in the provinces. In fact, it was probably used in place of *granito del Foro*, which was almost exclusively used in Rome. Moreover, the presence of Troad stone in the provinces allows us to presume that concessions and rental contracts were awarded to private citizens for the various quarry extraction sectors. At the same time, the existence in the quarries of sectors specialising in the production of colossal shafts –the district of Koçali for example– supports the hypothesis of state control of the production.

Keywords

Troad granite, shaft, quarry

Shafts made of Troad granite are found in many Mediterranean towns and cities, generally accompanied by capitals and bases of Proconnesus marble. This fact and the standard measurements seen in most of them (roughly 10, 12, 14, 16, 18, 20, 30 and 40 feet) attest the considerable productivity of the Troad quarries, the close relationship there must have been between the different marble-producing districts and, as a consequence, the complex organisation that would have been needed to ensure that the quarries and all the production processes were well run.

Here we wish to analyse the organisational aspect of the work in the Troad quarries, as well as the distribution and transportation mechanisms of the quarried blocks. The scarcity of information that could help us better understand these processes – for example we do

not know of quarry marks on the shafts – forces us to draw conclusions based solely on the analysis of the distribution of the shafts in the Mediterranean basin and on who commissioned the buildings they were used in.

We have already looked at the distribution of Troad shafts in two earlier studies¹, which is why here we will only refer to those cases that can help our understanding of how the work was organised in these quarries.

Troad granite in Rome

In Rome, Troad granite is found mainly in small- and medium-sized shafts that have been reused in the interiors of churches and other monuments (Tab. 1),

1 RODÀ, PENSABENE, DOMINGO 2012, 210-227; PENSABENE, RODÀ, DOMINGO 2015, 311-322. To the catalogue of shafts presented in these studies we can now add new examples, including two shafts currently preserved some 40 km north of Paris in the abbey of Chaalis, which was founded by Louis VI in the 12th century in Fontaine-Chaalis (Ermenonville); a reused shaft in an 18th-century gate in Soissons and another in the western portal of the abbey church of Saint-Remi in Reims. We would like to thank Annie and Philippe Le Blanc for this information. Another example is reused in the Sant Miquel funerary monument (Terrassa, Barcelona) (GARCIA, MORO, TUSET 2009, 128). We would like to thank Hernando Royo for this information. Other examples are reused at the entrance of the church of Santa Sofia and the portico of the rotunda of the Church of Saint George, both in Thessaloniki and built in the s. XIII. Another shaft, with a preserved height of 2.60 m and a diameter of 52.8 cm, appears reused in the courtyard of the "Palau del Cambrer", built in the s. XIV next to the Cathedral of Tarragona. And, finally, two fragments of shafts (40-45 cm diameter) preserved in the courtyard of the sanctuary of the *Virgen de la Cinta* (Huelva, Spain). We would like to thank Juan Campos for this information.

Building	Position	Number of shafts
Coliseum	Late-period phase of the <i>summa cavea</i> portico	1
S. Paolo f.l.m.	Archaeological promenade	2
S. Clemente	Central nave of the lower church	2 (5D and 6D)
	Upper church	1 (3D)
S. Sisto Vecchio		2 (2D and 4D)
Ss. Giovanni e Paolo	12 th -century portico	1
	Central nave	1 (6D)
S. Maria Maggiore	Atrium	1
S. Stefano Rotondo	Internal circle	5 (1I-3I, 5I and 22I)
	External circle	5 (1E-4E and 8E)
S. Agata dei Goti		7 (1D, 2S, 2D, 3S, 3D, 4D, 5S)
S. Anastasia		3 (1S, 1D, 6D)
S. Maria in Domnica		3 (5S, 6S, 7S)
Ss. Quattro Coronati	Central nave of the church of Pasquale II	3 (1S, 2S, 4S)
S. Nicola in Carcere		4
S. Crisogono		6 (3S, 3D, 8S, 8D, 10S, 10D)
S. Lorenzo f.l.m.	Portico of the convent	4
	Cloister	1
Ss. Bonifacio and Alessio	Cloister	3
Ss. Vincenzo e Anastasio at Tre Fontane	Romanesque portico	3
Villa Celimontana		1
Quirinal	Porta San Felice	1
Santi Apostoli	Entrance to the convent of the basilica	2
San Giovanni in Laterano	Prothyrum	1
	Quadriporticus	1
	Cloister	2
Santa Sabina	Narthex	4
S. Maria in Cosmedin		4
S. Gregorio al Celio	Central nave	11 (3S-8S, 3D-6D, 8D)
Galleria Doria Pamphili	Entrance	2
S. Lorenzo in Lucina	Portico	1
Palazzo Borghese	Entrance	2
	Courtyard	10
Palazzo dei Conservatori	Courtyard	1
	Museum	2
Palazzo della Cancelleria	Courtyard	7
Palazzo Farnese	Vestibule	2
S. Giovanni a Porta Latina	Portico	1
S. Maria in Trastevere		1
S. Vitale	Portico	3
	Right external side	7

Table 1. Troad granite shafts reused in Rome (Font: LAZZARINI 1987, 162; PENSABENE 2003, 167-168; PENSABENE 2015).



Fig. 1. Port of Alexandria in Troad

whereas their presence in imperially-commissioned buildings is scant and concentrated in those from the Severan period. In this respect we can mention a fragment of shaft belonging to the restoration of the stage in the theatre of Pompey. Its diameter is 1.10 m, which allows us to estimate its height at approximately 8.90 m, meaning therefore that it was part of the first order of the *scaenae frons*². Other examples are the shafts from the outer area of the Baths of Caracalla, with a height of some 20 feet³, and the reconstruction of the portico of Octavia, restored with reused material following the fire of 191 AD, at the time when shafts of this stone were placed on the side porticos⁴. We can also add a fragment of a shaft deposited in the lapidarium of the Circus Maximus. Prior to that, from the Severan period on, Troad granite is documented in the area around Rome, including in the Piazza d'Oro in the Villa Adriana and the Forum in Ostia. In the northern half of the portico of this forum, which was probably financed by the *colonia*⁵, a single fragment of Troad granite shaft with a diameter of 49 cm⁶

is preserved (the rest of the preserved shafts belong to other varieties of granite or other types of stone). In the southern half, corresponding to the eastern side of the temple of Roma and Augustus, there are 11 fragmented granite shafts, of which at least four can be identified as from Troad, one of them being preserved almost whole (lower diameter 60 cm, upper diameter 51 cm)⁷. The variety of stone types from which the portico columns in this forum were made is due to the fact that in Ostia they frequently used shafts from the warehouses in Porto that were either surplus or were stored there waiting to be used. Therefore the use of one kind or the other depended on the number and type they had in stock at a particular time.

The most frequent use of Troad granite in Rome can be seen in the Severan period, coinciding with the decrease in the production of *granito del Foro* shafts. The last epigraphic evidence of activity in the quarries of *Mons Claudianus* is an *ostrakon* with a dedication from the *Cohors II Ituraeorum* that can be dated to 222-235 AD⁸. The stone from these quarries was still used in the

2 DE NUCCIO, PENSABENE 2012, 53; MONTERROSSO 2010, 143-146.

3 PEACOCK *et al.* 1994; PENSABENE 2013, 240.

4 BRUNO, ATTANASIO 2008, 53-54.

5 PENSABENE, BRUNO 1998, 296-299.

6 PENSABENE 2007, 260, n° 2. The shafts were made from other types of granite including *bigio venato di*

Lesbo and *Hipona*.

7 PENSABENE 2004, 265.

8 Also found in the area were some coins of Aurelianus (269/70-275) and Probus (276-282 AD), PEACOCK *et al.* 1994, 229.



Fig. 2. Shaft of the baths of Antoninus in Carthage



Fig. 3. Shaft of the baths of Antoninus in Carthage

Baths of Caracalla⁹ and the Severan reconstruction of the theatre of Teano, an imperial commission¹⁰. This also coincides with a decrease in the production of coloured marble shafts from the imperial quarries of Asia Minor and Greece¹¹ and an increase in the use of large Aswan granite shafts, such as the sixteen-metre-high examples in the hall of worship in the *Forum Pacis*, which was restored after the fire of Commodus.

The use of Troad granite in Rome may have also been furthered by the fact that in the Severan period shafts made with this material had accumulated in the port warehouses of Alexandria Troas¹² (Fig. 1) and Porto. The build-up of a large number of Troad shafts in the warehouses is demonstrated by the fact that, in their late-period use, builders frequently used shafts that had never before been seen in any building, for example, in Diocletian's palace in Spalato or in Rome as late as the 6th century AD (the church of Santo Stefano Rotondo). Moreover, the existence of such warehouses is confirmed by the initials¹³ on some of the granite shafts in the church of Santo Stefano Rotondo¹⁴.

Troad granite in the provinces

In contrast to the situation documented in Rome, where it is not common, Troad granite is much more abundant in the provinces¹⁵, generally in the form of small- and medium-sized shafts between 3 and 5 m in height. It was also used to make some of the colossal shafts used in complexes we can assume were imperial commissions, such as those of the Baths of Antoninus in Carthage (40 feet high) (Figs. 2-3), those of the *Traianeum* in Italica (30 feet high), the 45 examples in Tarraco (some 15 feet high)¹⁶, the 11 examples in Astigi (Écija) with a reconstructed height of around 20 feet¹⁷, or the 52 examples in Aquileia, twelve of them 20 feet high, attributed to the *scaenae frons* of the Roman theatre¹⁸, and other provincial examples with similar measures previously published¹⁹.

The presence of Troad granite in the provinces contrasts with the complete absence of *granito del Foro*. The latter we find almost exclusively used in the imperially-commissioned architecture of Rome²⁰, to such an extent that it has been hypothesised that this type of stone was not sold commercially, except for small blocks and quarrying remains or cutting rejects that were used to make plaques and pieces for *opera sectilia*²¹. The presence

9 DELAINE 1997, 33, 58, 263.

10 BESTE 2010, 119-135.

11 DE NUCCIO, PENSABENE 2012, 52-53.

12 FEUSER 2011, 256-273.

13 PENSABENE 2015, 273-282. The marks allow us to reconstruct the figure of the intermediary in the distribution of the columns during this period.

14 At least six of these columns in Troas granite have the immoscapo and summoscapo unworked. They had obviously been taken from a store to add to those reused from other buildings to make up the number needed, BRANDENBURG 2009, 143-202; PENSABENE 2015, 240, Note 303.

15 RODÀ, PENSABENE, DOMINGO 2012, 210-227; PENSABENE, RODÀ, DOMINGO 2015, 311-322.

16 RODÀ, PENSABENE, DOMINGO 2012, 210-213.

17 FELIPE 2008, 117-128; FELIPE, MÁRQUEZ 2014, 170.

18 PENSABENE 2006, 365-421; PENSABENE 2010, 582-644.

19 RODÀ, PENSABENE, DOMINGO 2012, 210-227; PENSABENE, RODÀ, DOMINGO 2015, 311-322.

20 PEACOCK *et al.* 1994, 229; PEACOCK, MAXFIELD 1997, 334.

21 FANT 1993, 159; CORCORAN, DELAINE 1994, 272; PENSABENE 2013, 233.

of Troad granite in the provinces and in constructions not commissioned by the imperial household can also be explained by its considerable resemblance to *granito del Foro*, for which it may have been a cheaper substitute. According to Diocletian's Edict, while the cost of *granito del Foro* would have been 100 denarii per cubic foot, that from Troad, if it can be identified with the Anacasteno, perhaps because it is the only granite/marble of great diffusion not quoted in the Diocletian's Edict, would only have cost 40 denarii²², the same price as Proconnesus stone, which had a similar distribution.

An example of a possible use of this granite as a substitute for *granito del Foro* is found in the large *rotae* (203-208 cm in diameter) that probably came from the floor of the Hall of Worship in the Provincial Forum of Tarraco²³ or, even better, from the floor of the temple of Augustus that, thanks to the *Historia Augusta* we know was restored by Hadrian (*Hadr.* 12, 3). These pieces remind us of the *rotae*, also made with other coloured marbles, in the floor of the exedra in Trajan's Forum (1.89-2.35 m in diameter); in the southern portico of Caesar's Forum (2.4 m in diameter); in the temple of Venus and Roma (2.4 m in diameter); in the Pantheon (1.95-2.44 m in diameter); and finally in the Severan-period floor of the Hall of Worship in the *Forum Pacis* (2.54 m in diameter), in *granito del Foro*, *pavonazzetto* and porphyry²⁴. This last complex is structurally very similar to the Provincial Forum of Tarraco.

This theory of the use of Troad granite as a substitute is strengthened by its presence in the provinces, also in colossal columns, such as those we have already mentioned in the Baths of Antoninus in Carthage and the *Traianeum* in Italica. Meanwhile, in Rome other types of granite were used for columns of this size; for example, the colossal grey granite shafts were made exclusively of *granito del Foro*. We can mention the 50-foot-high shafts in Trajan's Forum that, judging by their size, would have belonged to the temple of Divus Ulpius, which must have been in the area of those shafts, as well as the 30-foot-high shafts of the basilica²⁵; seven of the eight frontal shafts of the Pantheon, which are 40 feet high²⁶; the more than 70

shafts with a height of just under 8 m in the large portico around the temple of Venus and Roma²⁷; several shafts from the Baths of Caracalla with a height of 40 feet²⁸, two shafts found abandoned in the quarry with a height of 60 feet, perhaps destined for the temple of Serapis that Aurelianus built in Rome²⁹; and finally, some examples in the Baths of Diocletian³⁰. Other colossal columns in Rome were made of different types of stone, such as Aswan granite, which is found in the Severan phase of the Hall of Worship in the *Forum Pacis*, with 16-metre-high (14.85 feet) shafts; the Proconnesus marble found in the shafts of the temple of Venus and Roma, with 17.76-metre-high columns, or the cipollino marble in the shafts of the Temple of Antoninus and Faustina, with a height of 11.80 m. In Rome, only in very rare cases during the Severan period was Troad granite used to make large shafts.

The Troad granite distribution system

From these data the production and distribution system for Troad granite can be better understood. As far as the shafts found in the provinces are concerned, we have to consider in most cases local and/or provincial commission, while for those in the public architecture of Rome (very few), exclusively imperial commission.

On the other hand, we know that there were many quarries in the large district of Troad; a certain number of shafts have been restored for each of them, which allows us to draw some conclusions. For example, in the district of the zone of Koçali at least twenty 40-foot-high shafts are preserved³¹, similar therefore to an example still preserved in the port warehouses of Alexandria Troas³² and those at the Baths of Antoninus in Carthage financed by Antoninus Pius.

If we take as a basis the presupposition that the Troad granite quarries did not have a diverse administration, such as that of the mines or other quarries, we have to suppose in the first place that during periods of maximum demand the shafts would have been produced in all the sectors of the quarries. Secondly, due to such a large production destined for export, the work in the quarries would probably have been organised through concessions (*redemptiones*) and rentals (*locationes*) of the various sectors. However, it remains to be clarified

22 Barresi and Lazzarini calculate a cost of 75-100 denarii for that from Troas (BARRESI 2003, 168-169; LAZZARINI 2010, 488), but this is very close to the cost of *granito del Foro* (BARRESI 2003, 168-169; GIACCHERO 1974; *Edictum of Pretiis*, XXXI). However, the fact that Troad granite was so widely used in the provinces leads us to believe that its cost would have been considerably less.

23 RODÀ, PENSABENE, DOMINGO 2012, 213.

24 FOGAGNOLO 2007, 267-278; MENEGHINI 2009, 84.

25 PENSABENE 2013, 232, 238.

26 WILSON JONES 2000, 190-212, 220.

27 PENSABENE 2013, 246.

28 DELAINE 1997, 33, 58, 263.

29 PEACOCK, MAXFIELD 1997, 214.

30 PENSABENE 2013, 240.

31 PENSABENE 2013, 398.

32 PONTI 1995, 291-320.

what kind of entity was involved and over which more or less limited sector direct state control was exercised. In fact we have to consider that the production destined for Rome in the Severan period and the examples of Italica and Carthage presuppose imperial involvement, perhaps together with the town itself. Moreover, the probable presence of a district specialising in the production of colossal shafts, as Koçali appears to have been, probably presupposes state control of its production, given the need for specialised machinery to manoeuvre the huge, extremely heavy blocks of quarried stone that only state intervention could guarantee. In fact, under the system of concessions to private individuals of some sectors of the quarries it would have been difficult to coordinate the large specialised workforce needed to undertake a project of such magnitude and complexity³³.

On the other hand, the lack of imperial marks on the shafts or the blocks stored in the quarry and the role played by the port of Alexandria Troas in the warehousing and transportation of the shafts lead us also to consider the possibility that the quarry district was in the town's *ager publicus*, which would have awarded concessions for the different granite quarrying sectors. All this would have probably taken place under the control of the imperial administration, which no doubt reserved for itself the right to exploit directly part of the district for certain monuments or for specific periods of time.

The only information we have about conditions under which the quarries were exploited comes to us by way of a regulation in the Codex Theodosianus (*Cod. Theod.*, 11.28.9): in the year 414 AD quarry workers were exempted from the payment of taxes, except those in the districts of Proconnesus, Troas and Docimium. From this law we deduce that the workers in these quarries were probably freedmen organised into specialist teams that took charge both of the extraction of the stone (*caesura*) and the initial squaring of the blocks, as well as of partially preparing the architectural and decorative elements (*officinae*). It is precisely the existence of a highly developed system of concessions that allows us to understand how they were able to meet such a high demand for architectural elements that were sent to their consignees via the trade routes and/or directly ordered by the towns and cities.

33 PENSABENE, DOMINGO 2014, 119, 128-130. As an example we can mention the Las Médulas gold mines in the Tarraconense, owned by the state from 19 BC. It is very likely that the considerable size of these mines, the complex infrastructures needed for their exploitation, and the small amounts of gold they produced would have meant they were not profitable enough to justify and/or maintain a private exploitation system (DOMERGUE 1990, 303; 2008, 201-2).

In summary, the fact that there is a lack of quarry inscriptions in the Troas quarries is another factor that indicates a production mainly carried out through concessions to private enterprises and freedmen. These would have paid a tithe or rent to the landowners³⁴, perhaps the town of Alexandria Troas. The businesses, on the other hand, would have handed over shafts to the imperial administration, at least in the periods established, to be sent to Rome and/or other localities where imperial euergetism was in play, even during the 2nd century AD.

Conclusions

As we have seen, Troas granite was used mainly in the provinces and for small- and medium-sized shafts. Only in a few cases, probably imperial commissions, was it used for colossal shafts: we recall the examples of the Baths of Antoninus in Carthage and the *Traianeum* in Italica.

This situation contrasted with that verified in Rome, where the use of Troas granite for very large shafts appears to have been very limited and reserved for imperial projects from the Severan period on. We should not forget, however, the numerous small- and medium-sized shafts reused in some of Rome's churches, although we know that some of them came directly from warehouses and therefore had never been used before.

In fact, certain indications, such as the absence of quarry marks or a regulation in the Codex Theodosianus, appear to suggest that the exploitation of these quarries was managed by free enterprises, which would explain the wider distribution of the product in the provinces and in buildings not commissioned by the imperial administration. Nevertheless, the presence from the 2nd century AD on of colossal shafts made with this stone and destined for imperially-commissioned projects in the provinces also allows us to suppose that there would have been a certain amount of state control, at least in terms of those districts specialising in the production of large shafts, Koçali for example³⁵. This state control would have allowed for the availability of the complex

34 To illustrate this fact we have the bronze tablets from the state-owned mines of Vipasca (Portugal). They refer to the payment of the *pars dimidia ad fiscum pertinens*, perhaps alluding to the payment of half of the metal mined, either in the form of metal or based on a tariff we are unaware of (DOMERGUE 1983, 124). Thus it seems that the amount paid directly in tax depended on the amount of metal mined. In other cases we know of, such as Las Médulas gold mines in the Tarraconense, the administration of the mines and the workers did not come under concessions, but directly under the state (DOMERGUE 1990, 303).

35 See n. 31.

mechanical and organisational system needed for the extraction and transport of the gigantic blocks.

However, these large shafts produced under state control were mainly destined for the provinces, while in Rome they used *granito del Foro*, a type of stone that was probably excluded from the normal trading circuits and controlled by the emperor. Only following the decrease in the extraction of *granito del Foro* and other coloured marbles from the quarries of Asia Minor and Greece does it appear that Troad granite began to be used in Rome in large imperial-type architectural projects. This coincided with an increase in the distribution of the large granite shafts from the quarries of Aswan.

Troad granite, therefore, can be considered as a replacement stone used mainly in the provinces in imitation of the growing tendency to use grey granites in the imperial architecture of Rome. While *granito del Foro* would have been almost exclusively used in grand imperial architecture, private, civic and provincial projects would have had access to Troad granite, which was very similar, but much cheaper.

Finally, it is likely that these types of stone –*granito del Foro* and Troad granite– had different distribution channels. While the large shafts of the former would have been shipped directly to Rome, probably following a well organised circuit, and would have been able to count on all the necessary machinery and specialists, the large shafts from Troad would have travelled by alternative trade routes to the main ports of the Mediterranean. There was, therefore, a specialisation in terms of the trade routes followed by each type of stone.

BIBLIOGRAPHY

- BARRESI P. 2003: *Provincie dell'Asia Minore. Costo dei marmi, architettura pubblica e committenza*, Roma.
- BESTE H.-J. 2010: "Il teatro di Teano e la sua scaena frons in età severiana", in S. F. RAMALLO (ed.): *La scaena frons en la arquitectura romana*, Murcia, 119-135.
- BRANDENBURG H. 2009: "Die Architektur und Bau- skulptur von S. Paolo f.m. Baudekoration und Nutzung von Magazinmaterial im späterem 4. Jh.", *RM* 115, 143-202.
- BRUNO M., ATTANASIO D. 2008: "Il reimpiego nel Portico di Ottavia. I marmi del Propileo Monumentale", in J.-F. BERNARD, PH. BERNARDI, D. ESPOSITO (eds.): *Il reimpiego in architettura. Recupero, Trasformazione, Uso*, Collection de l'École Française de Rome 418, Roma, 51-66.
- BUZÓN M. 2009: "El Templo Astigitano de la calle Galindo: análisis e interpretación de un puzle arqueológico", *Romula* 8, 65-123.
- COLODRERO A. M. F., MÁRQUEZ C. 2014: "Una propuesta de modulación del Foro Colonial de Astigi y la configuración de su área sacra", *AEspA* 87, 157-173.
- CORCORAN S., DELAINE J. 1994: "The Unit Measurement of Marble in Diocletian's Prices Edict", *JRA* 7, 264-273.
- DELAINE J. 1997: *The Baths of Caracalla. A Study in the Design, Construction and Economics of Large Scale Building Projects in Imperial Rome*, Ann Arbor.
- DE NUCCIO M., PENSABENE P. 2012: "Il Teatro di Marcello e la divulgazione dei marmi colorati nell'architettura teatrale romana", in V. GARCÍA-ENTERO (ed.): *El marmor en Hispania: explotación, uso y difusión en época romana*, Madrid, 49-72.
- DOMERGUE C. 1983: *La mine antique d'Aljustrel (Portugal) et les tables de bronze de Vipasca*, Paris.
- DOMERGUE C. 1990: *Les mines de la péninsule ibérique dans l'antiquité Romaine*, Roma.
- FANT J. C. 1993: "Ideology, Gift and Trade: A Distribution Model for the Roman Imperial Marbles", in W. HARRIS (ed.): *The Inscribed Economy. Production and Distribution in the Roman Empire in the Light of "instrumentum domesticum"*, Ann Arbor, 145-170.
- FELIPE A. M. 2008: "Estudio de los fustes de granito de la Colonia Augusta Firma Astigi (Écija)", *Romula* 7, 117-128.
- FELIPE A. M., MÁRQUEZ C. 2014: "Una propuesta de modulación del Foro Colonial de Astigi y la configuración de su área sacra", *AEspA* 87, 157-173.
- FEUSER S. 2011: "The Roman Harbour of Alexandria Troas, Turkey", *The International Journal of Nautical Archaeology* 40.2, 256-273.

- FOGAGNOLO S. 2007: "Rivestimenti marmorei dal tempio del Foro della Pace", Atti del XII Colloquio dell'Associazione Italiana per lo Studio e la Conservazione del Mosaico, (Padova-Brescia 2006), Roma, 267-278.
- GARCIA M. G., MORO A., TUSET F. 2009: La seu episcopal d'Ègara. Arqueologia d'un conjunt cristià del segle IV al IX, Tarragona.
- GIACCHERO M. 1974: Edictum Diocletiani et Collegarum de pretiis rerum venalium, Genova.
- LAZZARINI L. 1987: "I graniti dei monumenti italiani e i loro problemi di deterioramento", Bollettino d'Arte, Suppl. al n. 41, 157-172.
- LAZZARINI L. 2010: Considerazioni sul prezzo dei marmi bianchi e colorati in età imperiale, in S. CAMPOREALE, H. DESSALES, A. PIZZO (eds.): Arqueología de la Construcción II. Los procesos constructivos en el mundo romano: Italia y provincias orientales, (Certosa di Pontignano, Siena 2008), Madrid-Mérida, 485-490.
- MENEGHINI R. 2009: I Fori Imperiali e i Mercati di Traiano. Storia e descrizione dei monumenti alla luce degli studi e degli scavi recenti, Roma.
- PEACOCK D. P. S., WILLIAMS-THORPE O., THORPE R. S., TINDLE A. G. 1994: "Mons Claudianus and the problem of the granito del foro: a geological and geochemical approach", *Antiquity* 68, 209-230.
- PEACOCK D. P. S., MAXFIELD V. (eds.) 1997: Mons Claudianus. Survey and Excavation, Vol. I. Topography and Quarries, Il Cairo.
- PENSABENE P. 2003: "Il reimpiego a Santa Maria in Domnica", in A. ENGLÉN (ed.): *Caelius I. Santa Maria in Domnica, San Tommaso in Formis e il Clivus Scauri*, Roma, 166-196.
- PENSABENE P. 2006: "Reimpiego e interventi edilizi nell'Aquileia tardoantica", *Antichità Altoadriatiche*, 365-421.
- PENSABENE P. 2010: "Disposizione e provenienza delle colonne di reimpiego nel complesso episcopale di Aquileia", in G. CUSCITO, T. LEHMAN (eds.): *La Basilica di Aquileia. Storia, Archeologia ed Arte*, *Antichità Altoadriatiche* LXIX-II, Trieste, 551-660.
- PENSABENE P. 2007: *Ostiensium Marmorum Decus et Decor. Studi Architettonici, decorativi e archeometrici*, Roma.
- PENSABENE P. 2013: *I marmi nella Roma antica*, Roma.
- PENSABENE P., BRUNO M. 1998: "Calcolo volumetrico delle lastre di rivestimento per la definizione della committenza: due casi ostiensi", in AISCOS, *Atti del V Colloquio*, Roma, 295-306.
- PENSABENE P., RODÀ I., DOMINGO J. Á. 2015: "Production and distribution of Troad Granite, both public and private", in *ASMOSIA X*, 311-322.
- PONTI G. 1995: "Marmor Troadense. Granite Quarries in the Troad", *Studia Troica* 5, 291-320.
- RODÀ I., PENSABENE P., DOMINGO J. Á. 2012: "Columns and Rotae in Tarraco made with granite from the Troad", in *ASMOSIA IX*, 210-227.
- WILLIAMS-THORPE O., POTTS P. J. 2002: "Geochemical and Magnetic provenancing of Roman Granite Columns from Andalucía and Extremadura, Spain", *Oxford Journal of Archaeology* 21.2, 167-194.
- WILSON JONES M. 2000: *Principles of Roman Architecture*, London-New Haven.