

The Marbles of the Sculptures of Felix Romuliana in Serbia

Prochaska, Walter; Živić, Maja

Source / Izvornik: **ASMOSIA XI, Interdisciplinary Studies on Ancient Stone, Proceedings of the XI International Conference of ASMOSIA, 2018, 301 - 310**

Conference paper / Rad u zborniku

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

<https://doi.org/10.31534/XI.asmosia.2015/02.14>

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:123:359298>

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

Download date / Datum preuzimanja: **2025-03-14**



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 Bahadir 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>Marmorata</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 MARBLES OF THE SCULPTURES OF FELIX ROMULIANA IN SERBIA

Walter Prochaska¹ and Maja Živić²

¹Department of Applied Geological Sciences and Geophysics,
University of Leoben, Leoben, Austria (walter.prochaska@unileoben.ac.at)

²National Museum Zaječar, Zaječar, Serbia (majazivicnika@yahoo.com)

Abstract

Twenty four statues and other sculptures from the sculptural decoration of the palace of emperor Galerius in Felix Romuliana/Serbia were investigated. Provenance analyses revealed that the fine-grained marbles originate from the Pentelic quarries near Athens, and a second group clearly comes from the imperial quarries of Afyon/Docimium in Asia Minor. The very narrow spread in their composition suggests that the sculptures were made for a single commission.

Two sculptures investigated within the course of this work are exhibited in the museum in Zaječar. The “Boar-hunt” shows a match with marbles from the area of Berkovitsa in the NW-Balkan Mountains, where the pink plates and veneers from Felix Romuliana also come from. No precise provenance of the “Ariadne” can be presented so far. One possibility is an origin from medium-grained varieties of Alpine marbles.

Two fragments of a gigantic statue are composed of a coarse-grained marble that probably comes from the Bachern-Pohorje mountains in Slovenia.

Keywords

Felix Romuliana, sculptural inventory, marble provenance analysis

1. Introduction

Located south of the River Danube (Fig. 1) near the city of Zaječar, in the vicinity of the village Gamzigrad, the palace of Emperor Galerius is one of the most important Late Roman imperial sites in SE Europe. C. Galerius Valerius Maximianus was Caesar from 293 to 305 and Augustus and successor of Diocletian from 305 to 311. The location is considered to be the birthplace of the emperor, who built the palace as retirement residence at the end of the 3rd/beginning of 4th century during his reign as Augustus. The operating life of the palace was relatively short thus giving good information on the chronology of the usage of the investigated marble artefacts. Starting in

2004 the palace was investigated in different campaigns within the course of a German/Serbian project¹.

Within the course of a campaign in 2012 a series of marble sculptures was sampled in order to determine the provenance of the marbles, and to elucidate the marble production centres and trading relations of this period. This work focuses on the sculptural decoration of the palace. The general use of stones in the architecture of Felix Romuliana was recently investigated by DJURIĆ *et al.* in this volume².

Among the fragments of sculptures we selected for analysis, several are of particular interest and will be described in detail below. These fragments belong to one or two giant figures of a monumental sculpture representing the armoured emperor Galerius or maybe two emperors – Galerius and Diocletian (Fig. 2). According to the dimensions of the fragments of the foot (feet) as well as fragments of legs, arms and torsos, the sculptures were over 4 m high. Knowing the architectural complex of Galerius' Palace in Gamzigrad, we could assume that such colossal statues could have been placed only in the temple of Jupiter or in the forum in front of the temple.

A fragmented sculptural group depicting the hunting of a wild boar was found in 2011 during the Serbian-German excavation campaign in the area north of the northern ramparts of the earlier fortification of Romuliana (Fig. 3). The sculpture was reused as spolia in the wall of one Late Roman building. It probably came from the civil settlement that preceded the construction of the Galerius Palace, which probably was the birthplace of Galerius. Most probably this settlement can be dated to the time of the rule of emperor Aurelian. The horseman is missing, and only in the lower part are the hind legs of the horse preserved. The figures of a dog and the wild boar are completely preserved. The sculptural group depicting the hunting of a wild boar was very carefully modelled, with attention to every individual detail. On the basis of stylistic features, we dated the sculpture to

1 VON BÜLOW *et al.*, 2009.

2 DJURIĆ, JOVANOVIĆ, LAZIĆ, PROCHASKA this volume.



Fig. 1. The geographic position of Felix Romuliana



Fig. 2. Fragment (pedestal with toes) of a gigantic figure made of coarse-grained marble (sample FRM/12/18)



Fig. 3. Imperial (?) boar-hunt found in 2011 and now displayed in the museum of Zaječar

the second half of the 3rd century. Representations of the hunt were genre scenes, popular in various branches of Roman art. The essence of the symbolism of these scenes is the aspiration for visualization of the power and virtue (virtus) of the emperor, in which hunting is a paradigm for spiritual hunting, which is a manifestation of the emperor's divine nature.

A wall relief depicting the sleeping Ariadne (Fig. 4) is also made of the same marble of medium grain-size as the sculptural group depicting the hunting of the wild boar. This monument was for the most part modelled as a deep relief while only a small part of the composition was designed as a free-standing sculpture. The reverse side of the relief was rounded and carelessly worked. Accordingly we can assume that the relief was originally made to stand in a niche. During the excavations three fragments of the relief were found in the area southeast of baths in

the south-eastern tract of Romuliana. Evidently it was in a secondary position, in ruins of agricultural buildings from the 6th century, where the fragments were used as building materials (*spolia*). For this reason, there is no indication whatsoever in which building of Romuliana this monument was originally located. Possible locations for the original display of the relief are the nearby baths but also a room in the palace. The sleeping Ariadne was made after the model of the Hellenistic sculpture, but compared to the Hellenic model, certain deviations can be noticed (the face is rounded and much softer modelled, the head of the young woman is resting on a pillow, unlike the model where it is resting on her left hand). Based on the way of modelling of the head as well as the hairstyle, this monument can be dated to the last decade of the 3rd or the early 4th century. The dating is supported by the representation of one piece of a necklace with a lunated pendant.



Fig. 4. “Ariadne” – a restored relief displayed in the museum of Zaječar

2. Sampling and methods applied

The marbles investigated in this study include most of the sculptures and decorative artefacts available on the excavation site of Felix Romuliana and in the Museum of Zaječar. No preselecting or grouping was performed. All the samples are listed in Table 1.

For the provenance analysis of white marbles, in most cases no single method, such as stable isotope investigation, is sufficient, and a combination of different methods has to be applied. We refer here to previously published papers where this problem is discussed³. The obvious consequence from the complexity of the characteristics of marbles and their overlap is to apply a combination of analytical methods followed by a statistical evaluation of the results. Below only a summary of the methodology is presented.

Sampling: Microsamples were taken from broken, non-worked surfaces of bottom parts of the sculptural fragments and analyzed for their petrographic and chemical characteristics. Beside the standard petrographic analysis with the petrographic microscope, stable isotopes, trace element, and the chemical composition of microinclusions were performed. The samples taken were small chips of some mm in size. Before grinding or polishing, as required to carry out the experimental measurements, external traces of weathering, black crusts and patinas were carefully removed mechanically.

The samples were then reduced to fine powders and used for isotopic, trace element, and inclusion fluid analyses following procedures reported in detail e.g. in PROCHASKA, ATTANASIO, 2012 or in PROCHASKA, GRILLO, 2010⁴.

Powder samples cannot be used for the crush-leach method because the inclusions are already opened and the metal drill bits usually chemically contaminate the powder. It cannot be cleaned any more as can samples obtained with diamond tipped drills or simply with solid chips.

Petrographic methods: In general a sound investigation of the microfabric of the investigated marbles is desirable. While these investigations can easily be done on quarry samples, the tininess of many samples available from artefacts prevents a sound petrographic investigation. According to petrographic standards for grain-size measurement, a few hundred mineral grains should be counted. A widely used parameter is maximum grain size (MGS), which is either determined by petrographic microscopy or by a hand magnifier on polished surfaces.

Isotope analysis: This method is the state of the art and the most widely used approach in marble provenance analysis. A considerable advantage of this method is the very small amount of sample required. It has to be kept in mind, however, that extremely small samples in the order of some mg taken from weathered or partly weathered surfaces of ancient artefacts involve the risk of wrong results. Furthermore, only in rare cases will the exclusive use of the stable isotope analysis without

3 PROCHASKA, GRILLO 2010; PROCHASKA, ATTANASIO 2012.

4 PROCHASKA, GRILLO 2010; PROCHASKA, ATTANASIO 2012.

sample	DS	MgCO ₃	Fe ppm	Mn ppm	Sr ppm	Li/Na	Cl/Na	K/Na	Br/Na	I/Na	SO ₄ /Na	¹⁸ O ‰ _(PDB)	¹³ C ‰ _(PDB)
fine-grained (Afyon/Docimium)													
FRM/12/3	1490	0,45	117	35	65	0,209	1558	497	14,9	5,0	171,1	-4,30	1,12
FRM/12/10	3123	0,30	113	33	48	0,170	2179	949	5,9	2,2	90,8	-4,54	1,38
FRM/12/12	5498	0,96	448	110	155	8,888	944	1169	3,4	2,9	190,0	-3,67	2,58
FRM/12/13	2919	0,50	147	37	60	0,528	2040	529	22,1	6,7	231,4	-3,88	1,45
FRM/12/15	2644	1,60	128	37	67	0,162	353	958	18,5	0,8	35,8	-4,18	0,70
FRM/12/16	1999	0,34	155	35	62	0,323	1591	539	13,6	5,7	143,7	-3,80	1,51
FRM/12/19	2032	0,33	85	28	60	0,263	957	736	9,9	2,8	86,0	-4,10	1,46
FRM/12/20	2169	0,42	207	45	57	0,291	1583	586	22,3	14,9	157,4	-3,91	2,05
FRM/12/21	1562	0,46	77	32	65	0,366	1556	504	20,5	5,8	581,6	-3,90	1,57
FRM/12/22	2287	0,45	74	25	64	0,452	1957	701	13,6	5,7	132,8	-3,99	1,27
fine-grained (Pentelikon)													
FRM/12/4	5134	1,20	265	95	180	0,878	2105	199	10,4	4,1	176,7	-3,74	2,77
FRM/12/5	10809	1,01	198	135	158	0,746	1978	317	7,2	2,1	46,0	-7,74	2,52
FRM/12/6	7421	1,14	203	95	163	0,732	2093	106	7,3	3,1	69,7	-7,66	2,59
FRM/12/7	12450	1,15	198	113	158	0,850	2075	132	8,0	2,6	41,0	-7,78	2,57
FRM/12/8	4692	1,23	172	72	162	0,814	1927	238	12,4	4,8	344,6	-7,69	2,75
FRM/12/9	11866	1,34	281	141	156	1,323	2283	123	9,3	3,6	103,1	-7,88	2,77
FRM/12/11	21258	1,50	571	149	171	1,068	2352	170	7,3	2,4	74,3	-4,56	2,64
FRM/12/14	9825	1,53	314	130	150	0,853	2118	181	9,2	2,9	147,2	-7,69	2,91
Torso Emperor	8995	1,13	168	80	153	0,824	1926	216	8,2	6,5	69,4	-7,79	2,78
Herkules Statue	8821	2,03	359	123	136	0,739	1564	524	9,4	6,6	834,1	-8,01	2,76
medium-grained (Berkovitsa and Alpine marble?)													
Museum Boarhunt	2662	0,37	833	79	117	0,090	916	907	9,1	2,0	58,6	-10,85	1,27
Museum Ariadne	5809	0,58	588	40	151	1,105	2741	532	16,8	2,1	183,3	-10,82	0,48
coarse-grained (unknown origin, possibly Alpine)													
FRM/12/17	4829	1,24	467	40	150	7,191	1978	352	20,4	0,9	156,1	-6,57	1,18
FRM/12/18	5375	2,28	1740	115	241	2,850	1311	463	24,2	0,9	88,9	-13,59	0,69

Table 1. The analytical data of the investigated sculptures

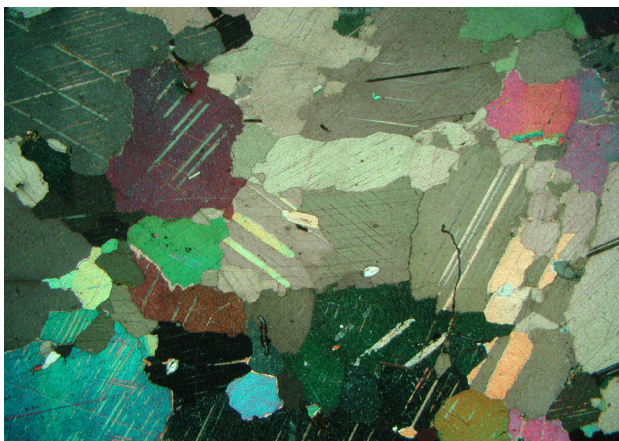


Fig. 5. Microphoto of sample FRM/12/18 showing the very coarse-grained texture of the rock with small inclusions of silicate minerals in the calcite crystals (polarized light, length of image is 6 mm)

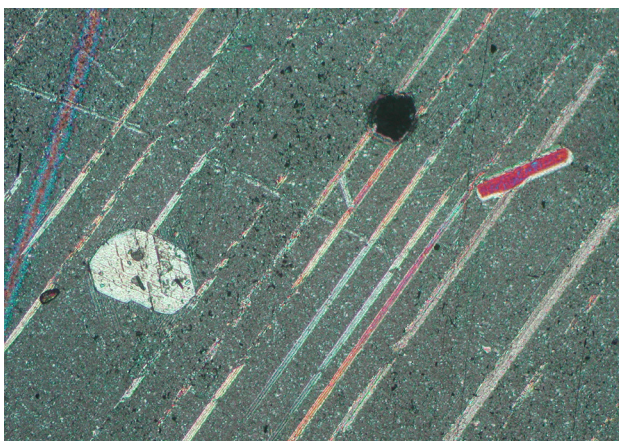


Fig. 6. Microphoto of sample FRM/12/18 with a poikilitic inclusion of amphibole in the calcite (polarized light, length of image is 1,4 mm)

combination with other methodological approaches account for satisfactory results.

Trace element chemistry: Additional variables can be obtained by chemical analysis of the marbles.

In this context it is important to mention that those elements that are incorporated into the carbonate lattice (Mg, Fe, Mn, Sr, and Zn) exhibit a fairly homogeneous and consistent distribution and can advantageously be used to discriminate different types of white marbles.

Analysis of the fluid inclusions: This technique for characterizing marbles was developed to acquire further variables to distinguish between different marble quarries when the usually applied methods like isotope analysis fail to provide a satisfying discrimination. These data can be used in concert with the established methods when applying statistical evaluation. The results from fluid inclusion investigations of carbonate rocks show that the fluid phase is usually relatively uniform with

respect to its chemical composition. A series of chemical parameters (cations as well as anions) can be detected simultaneously by means of ion chromatography⁵. To eliminate the effects of the possible irregular distribution of the amount of inclusions, and also because of possible scattering of the efficiency of the crushing and extraction of the fluids, the results are normalized to Na x 1000.

Evaluation of the data: The large number of data obtained by the different analytical methods applied requires multivariate discrimination analysis for data evaluation. The compositional fields of the marbles from a quarry or a given marble-producing site are usually presented as statistical ellipses (90 % ellipses, that means that 90 % of the samples of this population is within the ellipse). The resulting big number of variables requires a multivariate statistical analysis in combination with our databank of ancient marble quarries in the Roman Empire.

3. The analytical results

3.1. The petrographic features

The *medium- to coarse-grained marbles* exhibit different textural features. The samples FRM/12/17 and FRM/12/18 were taken from two fragments originally belonging to one or two gigantic sculptures. The white to slightly greyish marble is of exceptionally large grain-size (MGS up to 5 mm) and is characterized by silicatic impurities. Figs. 5 and 6 display the microimages of these marbles. The calcite crystals exhibit uneven and inter-meshing grain-boundaries and poikilitic inclusions of quartz, mica, and amphibole minerals (Fig. 6) testifying to the amphibolite facies metamorphism of this rock.

For the petrographic investigation of the medium-grained marbles one sample suitable for preparing a thin section was available (“Boar-hunt”). The marble is of homoeoblastic texture without noteworthy impurities. The twin lamellae of the calcites are deformed and toothed grain boundaries are ubiquitous. As can be seen in Fig. 7, the textural features of this marble exactly match those of the marbles found in the NW Balkan Mountains near the village of Berkovitsa.

Most of the analyzed *fine-grained marbles* are of high quality. The petrographic investigations clearly show the occurrence of Pentelic marbles as well as of marbles from the imperial quarries of Docimium in Asia Minor (Fig. 8). The photo on the right hand side in Fig. 8 shows Pentelic marble with slight schistosity and silicate impurities. The microphoto on the left hand side is from Docimean marble with a typical heteroblastic texture, sutured grain boundaries and slight post crystalline tectonic deformation.

5 PROCHASKA, GRILLO 2010; PROCHASKA 2013.

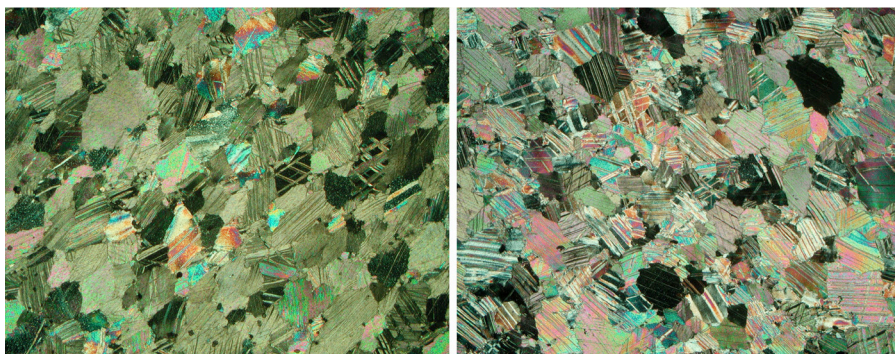


Fig. 7. Microphoto of the marble of the “Boar-hunt” with the characteristic tectonically deformed texture and slight schistosity on the left hand side, which very much resembles the white marble from Berkovitsa on the right hand side (polarized light, length of images is 6 mm)

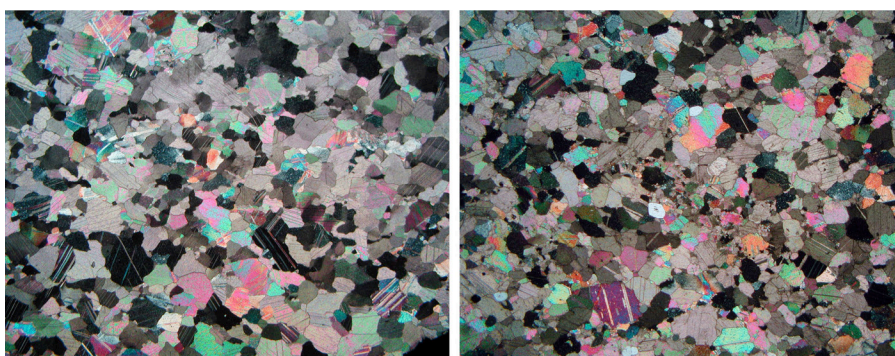


Fig. 8. The fine-grained marbles of the sculptures of Felix Romuliana. Pentelic marble on the right hand side exhibits minor deformation and traces of quartz. Docimian marble on the left hand side is very pure and characterized by a heteroblastic texture and sutured grain boundaries (polarized light, length of images is in both cases 6 mm)

3.2. The isotopic composition

The analytical data of the stable isotope investigation and the chemical analyses are displayed in Table 1.

Fine-grained marbles: In Fig. 9 the results of the isotope analyses of the fine-grained marbles are graphically shown. Reference data for a comparison of the isotope analyses were taken from our databank. These are the compositional fields for the isotopic composition of the quarries of Pentelikon near Athens, Carrara and for the imperial quarries of Afyon/Docimium. They are displayed as 90 % probability ellipses. For reasons of their macroscopic characteristics and of their general isotopic composition the fine-grained marbles from Göktepe and the Lychnites from the island of Paros were excluded a priori from further considerations. In the isotope diagram the projection points of the samples cluster clearly in two distinct groups. One sample cluster is located in a very central position of the ellipse of the Pentelic marbles with a very narrow scattering. The second sample cluster is situated within the rather large ellipse of the marbles from Afyon/Docimium. For the sake of clarity the total databank sample set for the Docimian marbles was used and no sub-site ellipses were displayed.

Medium- and coarse-grained marbles: From the investigated samples, only four exhibit a grain-size > 1.5 mm and are treated separately (“medium- to coarse-grained marbles”). The isotope results for this group are displayed in Fig. 10. Because of their special importance and popularity, two samples exhibited in the museum of

Zaječar are highlighted in the diagram (“Boarhunt” and “Ariadne”). The other two samples are fragments (foot and toe) of one or two gigantic sculptures. Because of their isotopic and petrographic features, the medium- to coarse-grained marbles from Proconnesos, Thasos, Ephesos and Paros II were not taken into further consideration and are not shown in the diagram. To compare the measured isotopic results with corresponding marbles from our databank we looked for coarse-grained marbles with very light O-isotope composition especially in Dacia and Thracia. Consequently, reference data were chosen (displayed as statistical 90 % ellipses) from the following locations: Asenovgrad near today’s Plovdiv, Bulgaria, from two locations north of the River Danube in Romania where Roman quarries are known in Bucova and Rușchița, from white and pink marbles in the NW-Balkans near Berkovitsa in Bulgaria and from Alpine marbles in Gummern and Pohorje/Bachern. The marbles of the architecture of Sarmizegetusa (the Roman Ulpia Traiana Augusta Dacica Sarmizegetusa) originate from the Roman quarries of Bucova and are displayed for comparison in Figs. 10 and 12.

The C-isotope composition of the four samples is in the range of 1 to 2 ‰, while the O-isotopes scatter appreciably but generally exhibit very light O-isotope values. They correspond roughly with the very large data-field from Asenovgrad, but do not match at all the isotopic composition of the Romanian marbles from Bucova and Rușchița.

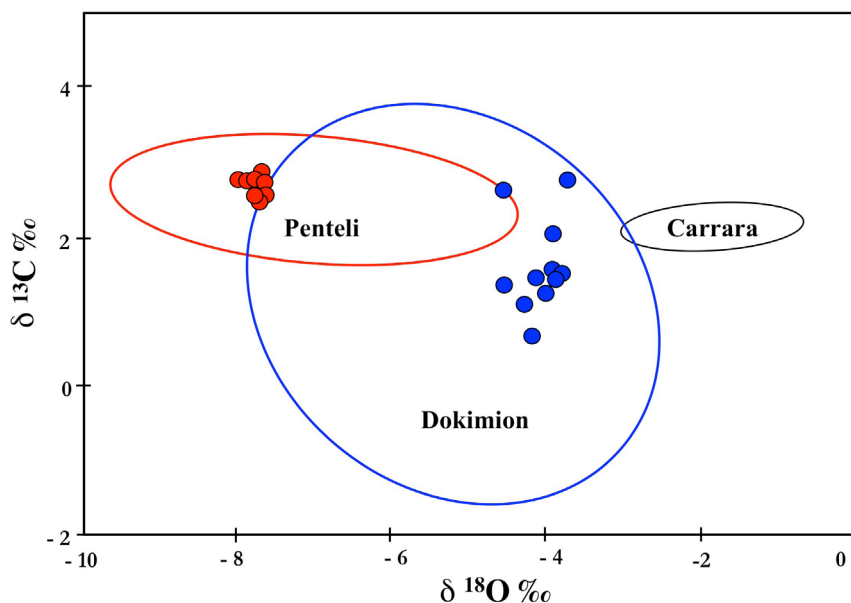


Fig. 9. Isotope diagram of the fine-grained marbles clearly showing that two distinct groups of marbles were used

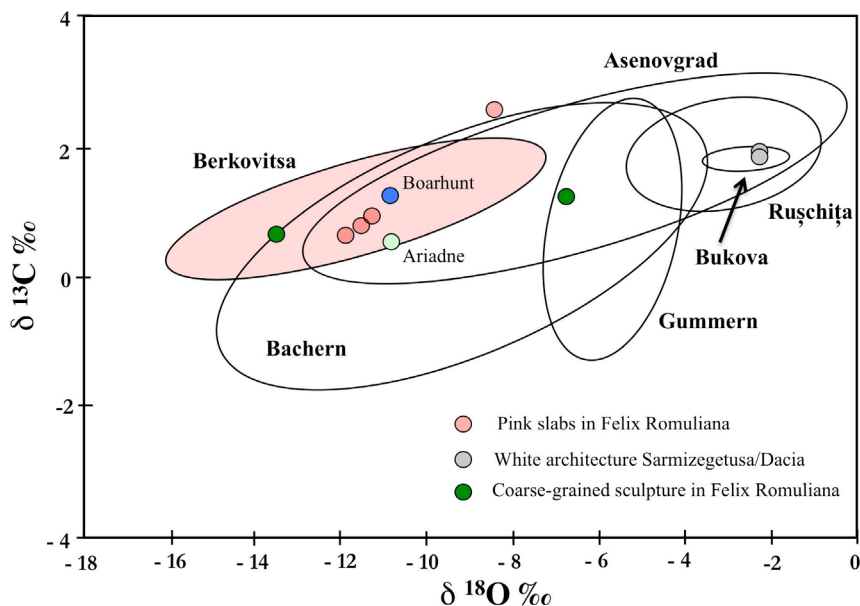


Fig. 10. Isotope diagram for the medium- and coarse-grained marbles and the compositional fields of marble quarries used for the statistical evaluation

3.3. Trace element and fluid inclusion composition

Fine-grained marbles: In accordance with the isotope data the two groups of fine-grained marbles are also attested in their trace element composition. With one exemption the marbles from Afyon/Docimium show a remarkable uniformity in their chemical composition. The low Mg-concentration shows that all marbles of this group are pure calcitic marbles without any dolomitic contribution. Medium to low Mn- and Fe-contents (2-110 and 74-478 ppm) are typical for Docimian marbles.

Similarly, the group of the Pentelic marbles exhibits its typical trace element content pattern with high Mn-concentrations and correspondingly high Fe-numbers.

Medium to coarse-grained marbles: These marbles are characterized by generally high Fe-contents and

moderate to medium Mn-numbers. The very coarse-grained marbles from the gigantic sculpture differ from the medium-grained marbles (“Boar-hunt” and “Ariadne”) in the characteristically high Li-content of the inclusion fluids and slightly higher Mg-contents.

4. Statistical evaluation of the analytical data

To assign the analyzed samples to their corresponding quarry or quarrying area multivariate statistical calculation was applied. The variables used for these statistical operations are indicated in the corresponding figures of the fine-grained and coarse-grained marbles (Figs. 11 and 12). As in the case of the isotope diagrams, the data-fields of the considered reference quarry samples are displayed as 90 % ellipses.

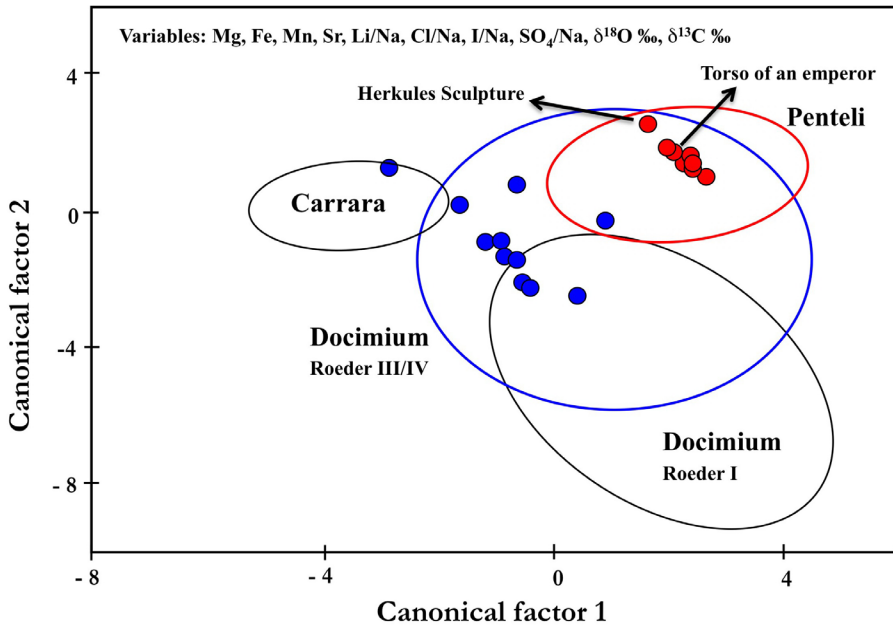


Fig. 11. Bivariate diagram for the fine-grained marbles showing the two most important canonical coordinates obtained by the multivariate analyses

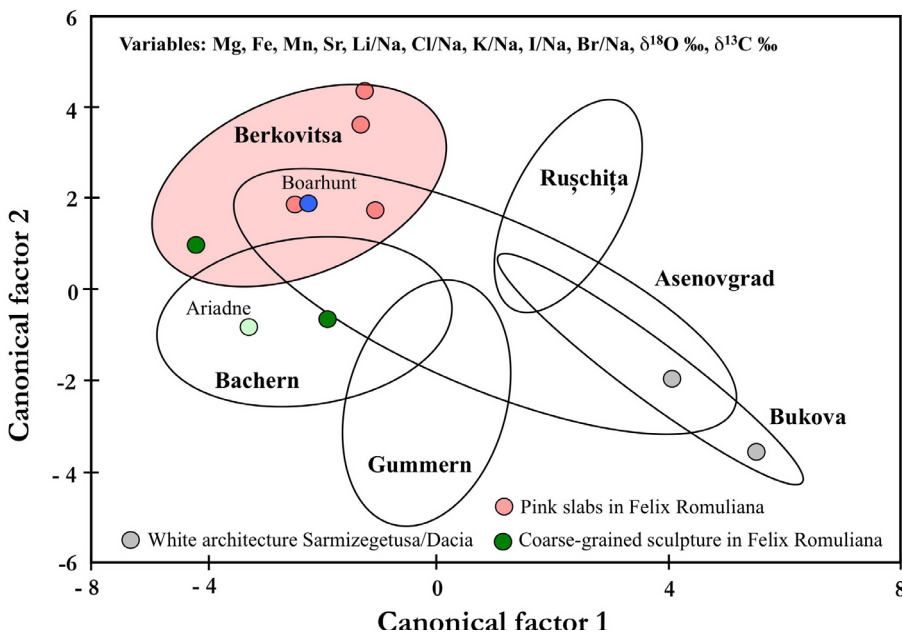


Fig. 12. Bivariate diagram for the medium- to coarse-grained marbles graphically showing the result of the multivariate analyses

Fine-grained marbles: In the multivariate diagram (Fig. 11) the results of the discriminant analysis are displayed by means of the two most powerful canonical coordinates (factor 1 and 2) using the variables Mg, Fe, Mn, Sr, Li/Na, Cl/Na, I/Na, SO₄/Na, ¹⁸O ‰, and ¹³C ‰. In accordance with the isotope composition (Fig. 9) two groups of fine-grained marble samples can be distinguished by the statistical analysis. One group is consistently located in the very centre of the Penteli ellipse, and the second group best fits with the Docimium marbles of quarries III/IV according to the nomenclature of Roeder⁶.

Medium- to coarse-grained marbles: For this group of marbles the variables Mg, Fe, Mn, Sr, DS, Li/Na, Cl/Na, K/Na, Br/Na, I/Na, SO₄/Na, ¹⁸O ‰, and ¹³C ‰ were used for the multivariate statistical calculation, and the results are displayed in Fig. 12. Clearly the “Boar-hunt” plots close to the centre of the compositional field of the marbles from Berkovitsa in the NW Balkan Mountains and coincide with the pink samples from slabs and veneers of Felix Romuliana. The “Ariadne” and the coarse-grained samples from the giant sculpture differ significantly and cannot yet be assigned to a distinct origin with sufficient clarity.

6 ROEDER, 1971.

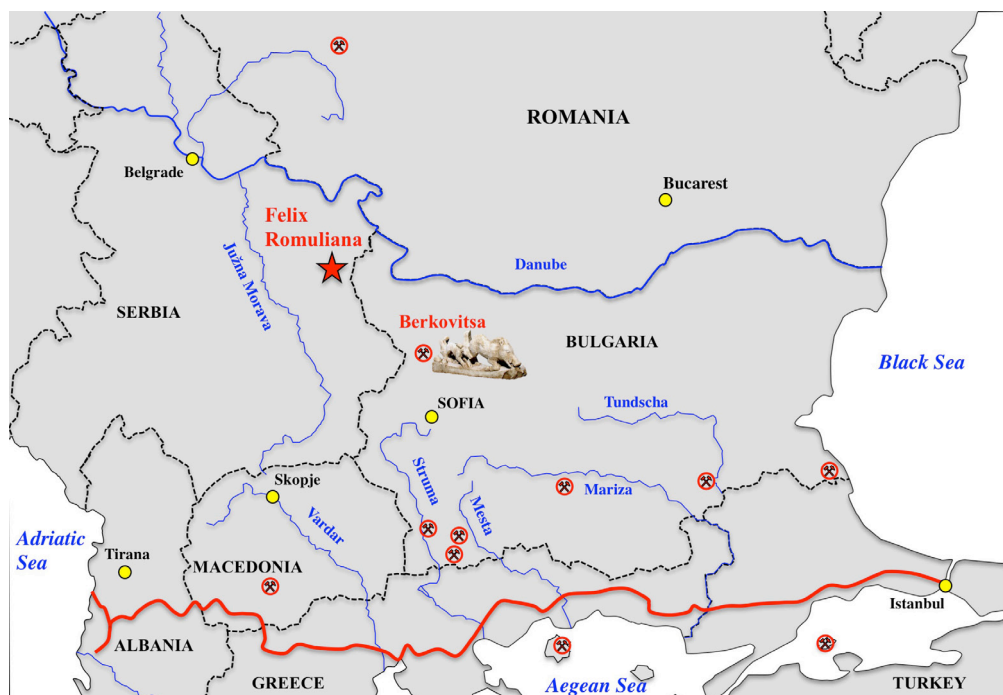


Fig. 13
The location of the marble occurrences of Berkovitsa where the pink marbles of Felix Romuliana and also the white marble of the “Boar-hunt” come from

5. Discussion and conclusions

All marbles investigated are white and of very good quality. Grain-size in most cases is below 1 mm, and only a few sculptures of medium- to coarse-grained marbles were found. The majority of the investigated sculptures are made of fine-grained marbles both from the imperial quarries of Pentelikon and from those of Afyon/Docimium in Asia Minor. The logistic efforts required to haul the marble and also premium building materials for decorative architecture in general to this site are respectable, considering the remote location of Felix Romuliana away from important overland roads⁷. It seems that within the course of an imperial project like Felix Romuliana costs did not play any role and cumbersome and costly efforts were accepted. The River Danube, a very potent waterway some 50 km away, was most probably the essential supply route for Felix Romuliana with respect to long distance trade. However, land transport over long distances and across rugged terrain is also verified by the provenance of the pink marbles and the white marble of the “Boar-hunt” from the NW Balkans. On modern routes the closest road-connection between Felix Romuliana and Berkovitsa in Bulgaria is approx. 150 km (Fig. 13).

The very uniform and homogenous composition of the Afyon/Docimium samples especially in their Sr and Mn-contents (see Table 1) and, also importantly, the nearly identical composition of the Pentelic samples

suggest that these sculptures were not collected incidentally but were part of one special program executed in the course of one single commission.

The medium-grained marble of the “Boar-hunt” does not match any classical marble composition thus defying assignment to given special source when scanning the usual databanks. White marbles occur in the area of Asenovgrad near Plovdiv in Bulgaria and were widely used in Roman Plovdiv (Trimontium). As shown below, there is no match with the marbles of Felix Romuliana. The fact that the marble of the “Boar-hunt” is practically identical to the compositional features of pink marble plates and veneers in Felix Romuliana led us to look for occurrences of pink marbles, which are not very common all and can be used as a “pathfinder” for the white marble in question. This led us to investigate the Dacian marbles north of the River Danube in the region of Bucova, where some pink varieties also occur near Rușchița. However, no resemblance to the pinkish marbles of Felix Romuliana was found. Intensive search for this pink type resulted in the discovery of that marble (pink and white varieties) in the region of Berkovitsa in the NW-Balkan Mountains in Montana province of today’s Bulgaria. These marbles match exactly the composition of the pink veneers of Felix Romuliana and of the white marble of the “Boar-hunt”.

This provenance of the marble of the “Boar-hunt” from Thracian or Moesian sources spurs us to contextualize this sculpture with the general motif of the “Thracian Horseman”. However, these considerations are rather speculative in the moment and have to be entrusted to future art historical investigations.

⁷ DJURIĆ, JOVANOVIĆ, LAZIĆ, PROCHASKA this volume.

The marbles of one or perhaps two giant sculptures are very coarse-grained, and so far we could not work out a convincing suggestion for the provenance of the marble, which is characterized by very light O-isotope composition of around -10 ‰. The occurrence of amphibole minerals (Fig. 6) in the marbles of the giant statue testifies to an origin from a high-grade amphibolite facies terrain. This indicates that the coarse-grained marbles are from a different source than the marble from the “Boar-hunt”, which is of lower metamorphic grade. The chemical characteristics of the two very coarse-grained samples differ considerably, thus indicating that they originate not from one but from two different sculptures. Amphibole-bearing marbles of that grain-size can be found in some locations in the Eastern Alps already mined in Roman times, such as the marbles of the Pohorje/Bachern mountains or those of southern Austria.

REFERENCES

- PROCHASKA W., ATTANASIO D. 2012: “Tracing the origin of marbles by inclusion fluid chemistry”, in *ASMOSIA IX*, 230-237.
- PROCHASKA W., GRILLO S. 2010: “A new method for the determination of the provenance of marbles by chemical analysis of inclusion fluids: the marbles of the Mausoleum of Belevi/ Turkey”, *Archaeometry* 52, 59-82.
- PROCHASKA W. 2013: “A sculptural marble of prime quality used in antiquity - the dolomitic marbles of the Sivec mountains in Macedonia”, *Archaeometry* 22, 179-197.
- ROEDER J. 1971: “Marmor Phrygium. Die antiken Marmorbrüche von Iscehisar in Westanatolien”, *JDAI* 86, 251-321.
- VON BÜLOW G., WULF-REIDT U., SCHÜLER T., OPELT M., BREITNER G. 2009: Das deutsch-serbische Gemeinschaftsprojekt „Romuliana-Gamzigrad“, Bericht über die Arbeitskampagnen 2007 bis 2007, *Germania* 87, 105-171.