# Incrustations from Colonia Ulpia Traiana (Near Modern Xanten, Germany)

**Ruppienė, Vilma; Schüssler, Ulrich**

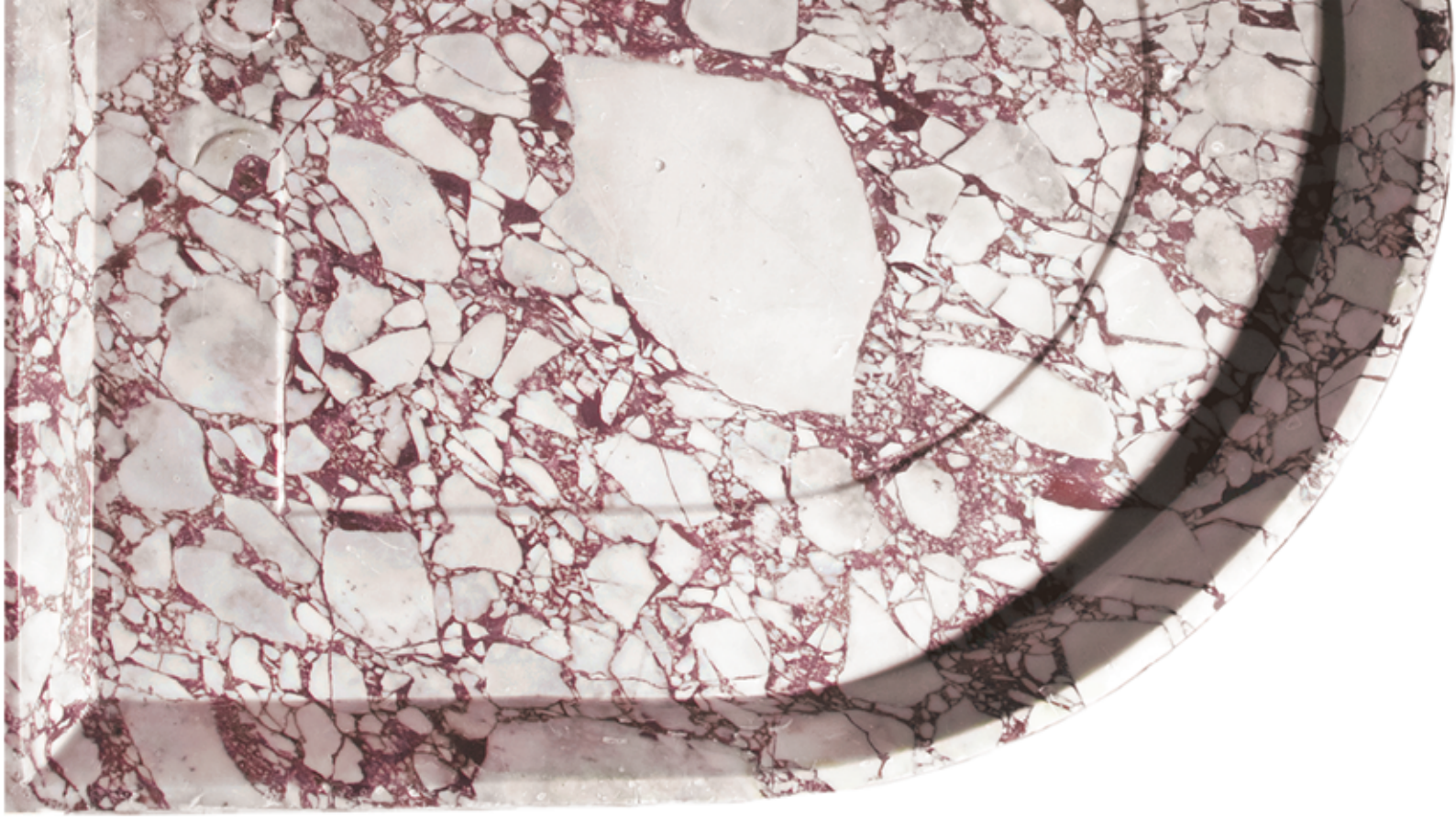
*Source / Izvornik:* **ASMOSIA XI, Interdisciplinary Studies on Ancient Stone, Proceedings of the XI International Conference of ASMOSIA, 2018, 351 - 361**

**Conference paper / Rad u zborniku**

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

https://doi.org/10.31534/XI.asmosia.2015/02.20

*Permanent link / Trajna poveznica:* https://urn.nsk.hr/urn:nbn:hr:123:989349



# ASMOSIA XI

## Interdisciplinary Studies on Ancient Stone

# PROCEEDINGS

## of the XI ASMOSIA Conference, Split 2015

Edited by Daniela Matetić Poljak and Katja Marasović

ARTS ACADEMY IN SPLIT

UNIVERSITY OF SPLIT,
FACULTY OF CIVIL ENGINEERING,
ARCHITECTURE AND GEODESY

# 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
*Patrizio Pensabene* ..... 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
*Massimiliano David, Stefano Succi and Marcello Turci* ..... 33

Alabaster. Quarrying and Trade in the Roman World: Evidence from Pompeii and Herculaneum
*Simon J. Barker and Simona Perna* ..... 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
*Simon J. Barker and J. Clayton Fant* ..... 65

Marble Wall Decorations from the Imperial Mausoleum (4th C.) and the Basilica of San Lorenzo (5th C.) in Milan: an Update on Colored Marbles in Late Antique Milan
*Elisabetta Neri, Roberto Bugini and Silvia Gazzoli* ..... 79

Sarcophagus Lids Sawn from their Chests
*Dorothy H. Abramitis and John J. Herrmann* ..... 89

The Re-Use of Monolithic Columns in the Invention and Persistence of Roman Architecture
*Peter D. De Staebler* ..... 95

The Trade in Small-Size Statues in the Roman Mediterranean: a Case Study from Alexandria
*Patrizio Pensabene and Eleonora Gasparini* ..... 101

The Marble Dedication of Komon, Son of Asklepiades, from Egypt: Material, Provenance, and Reinforcement of Meaning
*Patricia A. Butz* ..... 109

Multiple Reuse of Imported Marble Pedestals at Caesarea Maritima in Israel
*Barbara Burrell* ..... 117

Iasos and Iasian Marble between the Late Antique and Early Byzantine Eras
*Diego Peirano* ..... 123

Thassos, Known Inscriptions with New Data
*Tony Kozelj and Manuela Wurch-Kozelj* ..... 131

The Value of Marble in Roman *Hispalis*: Contextual, Typological and Lithological Analysis of an Assemblage of Large Architectural Elements Recovered at Nº 17 Goyeneta Street (Seville, Spain)
*Ruth Taylor, Oliva Rodríguez, Esther Ontiveros, María Luisa Loza, José Beltrán and Araceli Rodríguez* ..... 143

*Giallo Antico* in Context. Distribution, Use and Commercial Actors According to New Stratigraphic Data from the Western Mediterranean (2nd C. Bc – Late 1st C. Ad)
*Stefan Ardeleanu* ..... 155

*Amethystus*: Ancient Properties and Iconographic Selection
*Luigi Pedroni* ..... 167

**2. PROVENANCE IDENTIFICATION I: (MARBLE)**

Unraveling the Carrara – Göktepe Entanglement
*Walter Prochaska, Donato Attanasio and Matthias Bruno* ..... 175

The Marble of Roman Imperial Portraits
*Donato Attanasio, Matthias Bruno, Walter Prochaska and Ali Bahadir Yavuz* ..... 185

Tracing Alabaster (Gypsum or Anhydrite) Artwork Using Trace Element Analysis and a Multi-Isotope Approach (Sr, S, O)
*Lise Leroux, Wolfram Kloppmann, Philippe Bromblet, Catherine Guerrot, Anthony H. Cooper, Pierre-Yves Le Pogam, Dominique Vingtain and Noel Worley* ..... 195

Roman Monolithic Fountains and Thasian Marble
*Annewies van den Hoek, Donato Attanasio and John J. Herrmann* ..... 207

Archaeometric Analysis of the Alabaster Thresholds of Villa A, Oplontis (Torre Annunziata, Italy) and New Sr and Pb Isotopic Data for *Alabastro Ghiaccione del Circeo*
*Simon J. Barker, Simona Perna, J. Clayton Fant, Lorenzo Lazzarini and Igor M. Villa* ..... 215

Roman Villas of Lake Garda and the Occurrence of Coloured Marbles in the Western Part of "Regio X Venetia et Histria" (Northern Italy)
*Roberto Bugini, Luisa Folli and Elisabetta Roffia* ..... 231

Calcitic Marble from Thasos in the North Adriatic Basin: Ravenna, Aquileia, and Milan
*John J. Herrmann, Robert H. Tykot and Annewies van den Hoek* ..... 239

Characterisation of White Marble Objects from the Temple of Apollo and the House of Augustus (Palatine Hill, Rome)
*Francesca Giustini, Mauro Brilli, Enrico Gallocchio and Patrizio Pensabene* ..... 247

Study and Archeometric Analysis of the Marble Elements Found in the Roman Theater at Aeclanum (Mirabella Eclano, Avellino - Italy)
*Antonio Mesisca, Lorenzo Lazzarini, Stefano Cancelliere and Monica Salvadori* ..... 255

Two Imperial Monuments in Puteoli:
Use of Proconnesian Marble in the Domitianic and Trajanic Periods in Campania
*Irene Bald Romano, Hans Rupprecht Goette, Donato Attanasio and Walter Prochaska* ..... 267

Coloured Marbles in the Neapolitan Pavements (16th And 17th Centuries):
the Church of *Santi Severino e Sossio*
*Roberto Bugini, Luisa Folli and Martino Solito* ..... 275

Roman and Early Byzantine Sarcophagi of Calcitic Marble from Thasos in Italy:
Ostia and Siracusa
*Donato Attanasio, John J. Herrmann, Robert H. Tykot and Annewies van den Hoek* ..... 281

Revisiting the Origin and Destination of the Late Antique Marzamemi
'Church Wreck' Cargo
*Justin Leidwanger, Scott H. Pike and Andrew Donnelly* ..... 291

The Marbles of the Sculptures of Felix Romuliana in Serbia
*Walter Prochaska and Maja Živić* ..... 301

Calcitic Marble from Thasos and Proconnesos in Nea Anchialos (Thessaly)
and Thessaloniki (Macedonia)
*Vincent Barbin, John J. Herrmann, Aristotle Mentzos and Annewies van den Hoek* ..... 311

Architectural Decoration of the Imperial Agora's Porticoes at Iasos
*Fulvia Bianchi, Donato Attanasio and Walter Prochaska* ..... 321

The Winged Victory of Samothrace - New Data on the Different Marbles
Used for the Monument from the Sanctuary of the Great Gods
*Annie Blanc, Philippe Blanc and Ludovic Laugier* ..... 331

Polychrome Marbles from the Theatre of the Sanctuary of Apollo Pythios
in Gortyna (Crete)
*Jacopo Bonetto, Nicolò Mareso and Michele Bueno* ..... 337

Paul the Silentiary, Hagia Sophia, Onyx, Lydia, and Breccia Corallina
*John J. Herrmann and Annewies van den Hoek* ..... 345

Incrustations from Colonia Ulpia Traiana (Near Modern Xanten, Germany)
*Vilma Ruppienė and Ulrich Schüssler* ..... 351

Stone Objects from Vindobona (Austria) – Petrological Characterization
and Provenance of Local Stone in a Historico-Economical Setting
*Andreas Rohatsch, Michaela Kronberger, Sophie Insulander,*
*Martin Mosser and Barbara Hodits* ..... 363

Marbles Discovered on the Site of the Forum of Vaison-la-Romaine (Vaucluse, France):
Preliminary Results
*Elsa Roux, Jean-Marc Mignon, Philippe Blanc and Annie Blanc* ..... 373

Updated Characterisation of White Saint-Béat Marble. Discrimination Parameters
from Classical Marbles
*Hernando Royo Plumed, Pilar Lapeunte, José Antonio Cuchí,*
*Mauro Brilli and Marie-Claire Savin* ..... 379

Grey and Greyish Banded Marbles from the Estremoz Anticline in Lusitania
*Pilar Lapuente, Trinidad Nogales-Basarrate, Hernando Royo Plumed, Mauro Brilli and Marie-Claire Savin* ..... 391

New Data on Spanish Marbles: the Case of *Gallaecia* (NW Spain)
*Anna Gutiérrez Garcia-M., Hernando Royo Plumed and Silvia González Soutelo* ..... 401

A New Roman Imperial Relief Said to Be from Southern Spain:
Problems of Style, Iconography, and Marble Type in Determining Provenance
*John Pollini, Pilar Lapuente, Trinidad Nogales-Basarrate and Jerry Podany* ..... 413

Reuse of the *Marmora* from the Late Roman Palatial Building at Carranque
(Toledo, Spain) in the Visigothic Necropolis
*Virginia García-Entero, Anna Gutiérrez Garcia-M. and Sergio Vidal Álvarez* ..... 427

Imperial Porphyry in Roman Britain
*David F. Williams* ..... 435

Recycling of Marble: Apollonia/Sozousa/Arsuf (Israel) as a Case Study
*Moshe Fischer, Dimitris Tambakopoulos and Yannis Maniatis* ..... 443

Thasian Connections Overseas: Sculpture in the Cyrene Museum (Libya)
Made of Dolomitic Marble from Thasos
*John J. Herrmann and Donato Attanasio* ..... 457

Marble on Rome's Southwestern Frontier: Thamugadi and Lambaesis
*Robert H. Tykot, Ouahiba Bouzidi, John J. Herrmann and Annewies van den Hoek* ..... 467

Marble and Sculpture at Lepcis Magna (Tripolitania, Libya):
a Preliminary Study Concerning Origin and Workshops
*Luisa Musso, Laura Buccino, Matthias Bruno, Donato Attanasio and Walter Prochaska* ..... 481

The Pentelic Marble in the Carnegie Museum of Art Hall of Sculpture,
Pittsburgh, Pennsylvania
*Albert D. Kollar* ..... 491

Analysis of Classical Marble Sculptures in the Michael C. Carlos Museum,
Emory University, Atlanta
*Robert H. Tykot, John J. Herrmann, Renée Stein, Jasper Gaunt, Susan Blevins and Anne R. Skinner* ..... 501

**3. PROVENANCE IDENTIFICATION II: (OTHER STONES)**

Aphrodisias and the Regional Marble Trade. The *Scaenae Frons* of the Theatre at Nysa
*Natalia Toma* ..... 513

The Stones of Felix Romuliana (Gamzigrad, Serbia)
*Bojan Djurić, Divna Jovanović, Stefan Pop Lazić and Walter Prochaska* ..... 523

Aspects of Characterisation of Stone Monuments from Southern Pannonia
*Branka Migotti* ..... 537

The Budakalász Travertine Production
*Bojan Djurić, Sándor Kele and Igor Rižnar* ..... 545

Stone Monuments from Carnuntum and Surrounding Areas (Austria) –
Petrological Characterization and Quarry Location in a Historical Context
*Gabrielle Kremer, Isabella Kitz, Beatrix Moshammer, Maria Heinrich and Erich Draganits* ..... 557

Espejón Limestone and Conglomerate (Soria, Spain):
Archaeometric Characterization, Quarrying and Use in Roman Times
*Virginia García-Entero, Anna Gutiérrez Garcia-M, Sergio Vidal Álvarez,
María J. Peréx Agorreta and Eva Zarco Martínez* ..... 567

The Use of Alcover Stone in Roman Times (*Tarraco, Hispania Citeri*or).
Contributions to the *Officina Lapidaria Tarraconensis*
*Diana Gorostidi Pi, Jordi López Vilar and Anna Gutiérrez Garcia-M.* ..... 577

**4. ADVANCES IN PROVENANCE TECHNIQUES, METHODOLOGIES AND DATABASES**

Grainautline – a Supervised Grain Boundary Extraction Tool
Supported by Image Processing and Pattern Recognition
*Kristóf Csorba, Lilla Barancsuk, Balázs Székely and Judit Zöldföldi* ..... 587

A Database and GIS Project about Quarrying, Circulation and Use of Stone
During the Roman Age in *Regio X - Venetia et Histria*.
The Case Study of the Euganean Trachyte
*Caterine Previato and Arturo Zara* ..... 597

**5. QUARRIES AND GEOLOGY**

The Distribution of Troad Granite Columns as Evidence for Reconstructing
the Management of Their Production
*Patrizio Pensabene, Javier Á. Domingo and Isabel Rodà* ..... 613

Ancient Quarries and Stonemasonry in Northern Choria Considiana
*Hale Güney* ..... 621

Polychromy in Larisaean Quarries and its Relation to Architectural Conception
*Gizem Mater and Ertunç Denktaş* ..... 633

Euromos of Caria: the Origin of an Hitherto Unknown Grey Veined Stepped Marble
of Roman Antiquity
*Matthias Bruno, Donato Attanasio, Walter Prochaska and Ali Bahadir Yavuz* ..... 639

Unknown Painted Quarry Inscriptions from Bacakale at *Docimium* (Turkey)
*Matthias Bruno* ..... 651

The Green Schist Marble Stone of Jebel El Hairech (North West of Tunisia):
a Multi-Analytical Approach and its Uses in Antiquity
*Ameur Younès, Mohamed Gaied and Wissem Gallala* ..... 659

Building Materials and the Ancient Quarries at *Thamugadi* (East of Algeria),
Case Study: Sandstone and Limestone
*Younès Rezkallah and Ramdane Marmi* ..... 673

The Local Quarries of the Ancient Roman City of *Valeria* (Cuenca, Spain)
*Javier Atienza Fuente* ..... 683

The Stone and Ancient Quarries of Montjuïc Mountain (Barcelona, Spain)
*Aureli Álvarez* ..... 693

*Notae Lapicidinarum*: Preliminary Considerations about the Quarry Marks from the Provincial Forum of *Tarraco*
*Maria Serena Vinci* ..... 699

The Different Steps of the Rough-Hewing on a Monumental Sculpture at the Greek Archaic Period: the Unfinished Kouros of Thasos
*Danièle Braunstein* ..... 711

A Review of Copying Techniques in Greco-Roman Sculpture
*Séverine Moureaud* ..... 717

Labour Forces at Imperial Quarries
*Ben Russell* ..... 733

Social Position of Craftsmen inside the Stone and Marble Processing Trades in the Light of Diocletian's Edict on Prices
*Krešimir Bosnić and Branko Matulić* ..... 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
*Maria Apostolopoulou, Elissavet Drakopoulou, Maria Karoglou and Asterios Bakolas* ..... 749

**7. PIGMENTS AND PAINTINGS ON MARBLE**

Painting and Sculpture Conservation in Two Gallo-Roman Temples in Picardy (France): Champlieu and Pont-Sainte-Maxence
*Véronique Brunet-Gaston and Christophe Gaston* ..... 763

The Use of Colour on Roman Marble Sarcophagi
*Eliana Siotto* ..... 773

New Evidence for Ancient Gilding and Historic Restorations on a Portrait of Antinous in the San Antonio Museum of Art
*Jessica Powers, Mark Abbe, Michelle Bushey and Scott H. Pike* ..... 783

Schists and Pigments from Ancient Swat (Khyber Pukhtunkhwa, Pakistan)
*Francesco Mariottini, Gianluca Vignaroli, Maurizio Mariottini and Mauro Roma* ..... 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
*Guntram Koch* ..... 809

Funerary Monuments and Quarry Management in Middle Dalmatia
*Nenad Cambi* ..... 827

Marble Revetments of Diocletian's Palace
*Katja Marasović and Vinka Marinković* ..... 839

The Use of Limestones as Construction Materials for the Mosaics of Diocletian's Palace
*Branko Matulić, Domagoj Mudronja and Krešimir Bosnić* ..... 855

Restoration of the Peristyle of Diocletian's Palace in Split
*Goran Nikšić* ..... 863

Marble Slabs Used at the Archaeological Site of Sorna near Poreč Istria – Croatia
*Đeni Gobić-Bravar* ..... 871

Ancient Marbles from the Villa in Verige Bay, Brijuni Island, Croatia
*Mira Pavletić and Đeni Gobić-Bravar* ..... 879

Notes on Early Christian Ambos and Altars in the Light of some Fragments
from the Islands of Pag and Rab
*Mirja Jarak* ..... 887

The Marbles in the Chapel of the Blessed John of Trogir
in the Cathedral of St. Lawrence at Trogir
*Đeni Gobić-Bravar and Daniela Matetić Poljak* ..... 899

The Use of Limestone in the Roman Province of Dalmatia
*Edisa Lozić and Igor Rižnar* ..... 915

The Extraction and Use of Limestone in Istria in Antiquity
*Klara Buršić-Matijašić and Robert Matijašić* ..... 925

Aurisina Limestone in the Roman Age:
from Karst Quarries to the Cities of the Adriatic Basin
*Caterina Previato* ..... 933

The Remains of Infrastructural Facilities
of the Ancient Quarries on Zadar Islands (Croatia)
*Mate Parica* ..... 941

The Impact of Local Geomorphological and Geological Features
of the Area for the Construction of the Burnum Amphitheatre
*Miroslav Glavičić and Uroš Stepišnik* ..... 951

Roman Quarry Klis Kosa near Salona
*Ivan Alduk* ..... 957

Marmore Lavdata Brattia
*Miona Miliša and Vinka Marinković* ..... 963

Quarries of the Lumbarda Archipelago
*Ivka Lipanović and Vinka Marinković* ..... 979

Island of Korčula – Importer and Exporter of Stone in Antiquity
*Mate Parica and Igor Borzić* ..... 985

Faux Marbling Motifs in Early Christian Frescoes
in Central and South Dalmatia: Preliminary Report
*Tonči Borovac, Antonija Gluhan and Nikola Radošević* ..... 995

**INDEX OF AUTHORS** ..... 1009

DOI: https://doi.org/10.31534/XI.asmosia.2015/02.20

# INCRUSTATIONS FROM COLONIA ULPIA TRAIANA (NEAR MODERN XANTEN, GERMANY)

**Vilma Ruppienė and Ulrich Schüssler**
Lehrstuhl für Geodynamik und Geomaterialforschung,
Institut für Geographie und Geologie, Julius-Maximilians-Universität, Würzburg, Germany
(vilma.ruppiene@uni-wuerzburg.de; uli.schuessler@uni-wuerzburg.de)

**Abstract**

In the Colonia Ulpia Traiana, numerous fragments of former wall and floor incrustations were found during archaeological excavations, particularly in the area of insulae with public buildings like Harbor-Temple, Capitolium, public baths and forum. From optical examination of 3256 fragments and use of analytical methods for investigation of selected representative samples, more than 40 stone types could be distinguished and characterized, 83% of them deriving from the Mediterranean and 15% from regional sources. Mediterranean decorative stones were exclusively used for veneer slabs and small cornices, but not for larger architectural elements. Furthermore, special combinations of stones were very selectively chosen for the decoration of particular buildings. The incrustations reflect the contemporary 2nd century AD decoration style in Rome, but also regional trends.

*Keywords*
incrustations, provenance, decorative stones, use of marble, Colonia Ulpia Traiana

## Brief location and context

Colonia Ulpia Traiana (CUT) is located on the west bank of the River Rhine in the vicinity of modern Xanten. It was the second largest settlement of the northern Roman province of Germania inferior. CUT was given the rights of a colonia at the end of the 1st century AD by the Roman emperor Trajan. All major buildings, like the city wall, the temples, the forum, the baths and the amphitheatre, were erected and decorated in the course of the 2nd century AD. In 275, the colonia was destroyed by Germanic tribes. In the following decades the area of CUT was significantly reduced and fortified. During the 4th century AD the colonia became more and more dilapidated. In the close vicinity of the former Roman colonia the town Xanten was built during the early medieval ages. Since stones are very scarce in this region, all useful stones were recovered from the Roman site and reused by the locals. Only the foundations made of opus caementicium were preserved. Most probably not only the building materials but also precious decorative stones were taken from their original places.

Nevertheless, numerous fragments of incrustations were brought to light during archaeological excavations. None of them were discovered *in situ*. Most of the preserved fragmented incrustations originate from the insulae 37 (Harbor-Temple, 1469 fr), 26 (Capitolium, 949 fr), 10 (baths, 517 fr), 25 (forum, 86 fr), 18 (representative public building, 79 fr). Few fragments of incrustations were also discovered in the area of the amphitheatre (ins. 40, 25 fr), the Matronen-Temple (ins. 20, 7 fr), the hostel (ins. 38, 18 fr) and in the area of insulae with private houses (ins. 3, 10 fr; ins. 12, 4 fr; ins. 19, 27 fr; ins. 33, 21 fr; ins. 39, 7 fr, Figs. 1; 2).

Since there are no local quarries around CUT that produced building stones or decorative stones for incrustations, they all had to be imported from regional and foreign sources. Until today, not much was known about Roman quarrying in Germania inferior or about the scale of trade with Mediterranean decorative stones. Only few studies dealt with this topic in the past[1]. Therefore the aim of this study was to investigate the art of incrustations in a Roman colonia of the 2nd century AD at the outermost edge of the Roman imperium. The main goal was to gain knowledge about the provenance of decorative stones in order to get new insights about the Roman quarrying in the region and about the trade with stones from Mediterranean sources. Further the art of decorative furnishing of walls and floors with incrustations was to be investigated in the buildings of various purposes.

1 HORN 1987, 157–159; FISCHER 1997; FISCHER 1999; FISCHER 2001. For incrustations from Gallia Belgica see: BINTZ *et al.* 1981 (Villa Echternach); DODT 2015 (Baths in Trier); DREESEN/COQUELET 2013; DREESEN *et al.* 2015 (Tongeren).

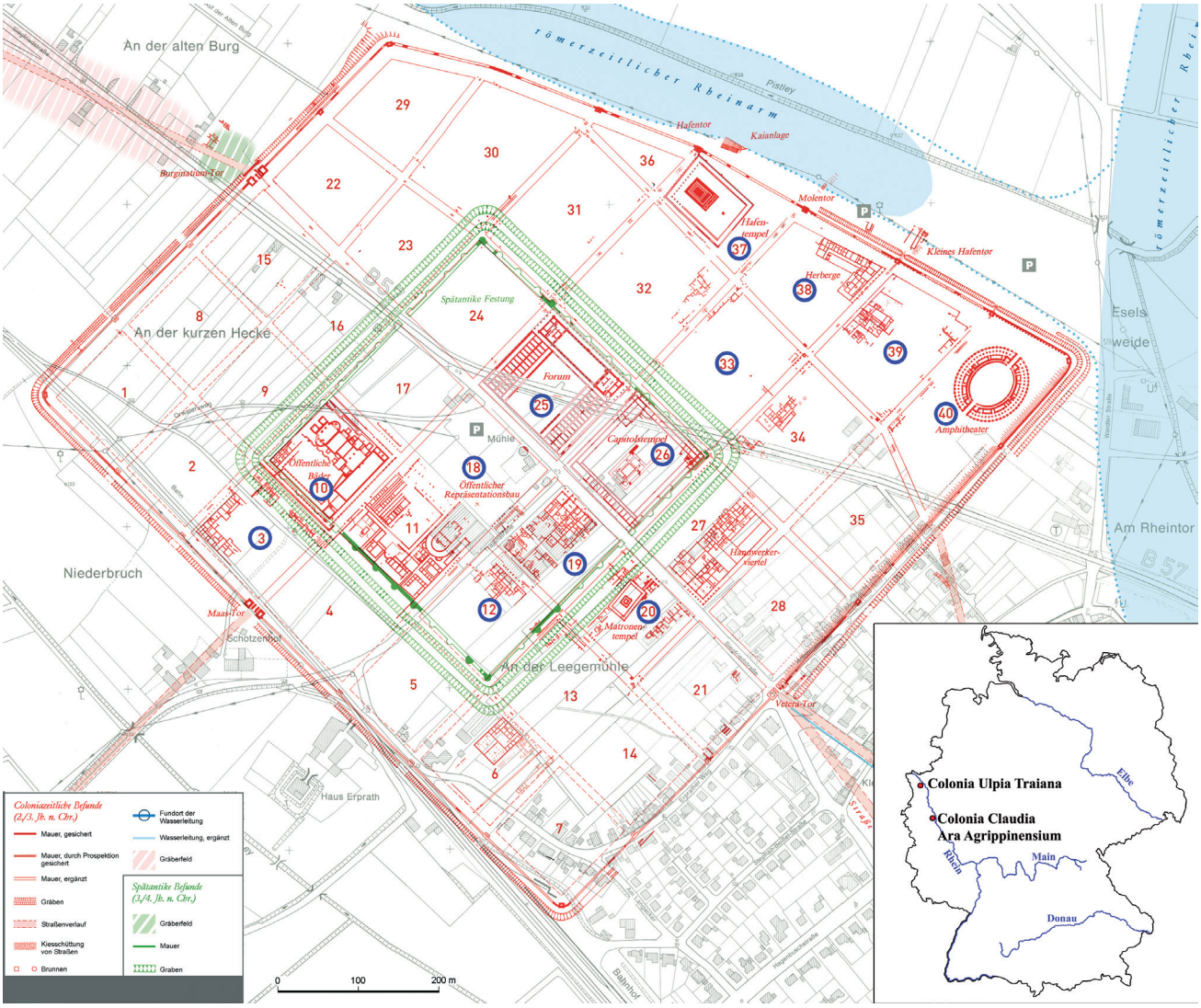



Fig. 1. Map of Colonia Ulpia Traiana. Insulae at which fragments of incrustations have been discovered are marked in blue. Picture H. Stelter, LVR-Archäologischer Park Xanten/LVR-RömerMuseum, slightly modified by V. Ruppienė

## Methods

In all, 3256 fragments were macroscopically examined and documented in the catalogue. A representative number of samples of each rock type (ca. 260) were selected for different analytical methods to pinpoint the origin of the stones. Depending on the stone type, a selected combination of methods was applied: petrographic investigations (optical microscopy on thin sections, electron microprobe analysis, X-ray powder-diffraction, infra-red-spectroscopy), chemical analysis (X-ray fluorescence spectroscopy, analysis of fluid inclusions) and analysis of the stable oxygen and carbon isotopes.

## Results

The investigations revealed that more than 40 different types of decorative stones were used for incrustations in the buildings of CUT. Most of the stone fragments (83%, 2703 fr) originate from Mediterranean quarries, whereas 15 % (472 fr) of preserved fragments could be attributed to regional sources[2]. About 2% originate from sources not known at present. Regarding the weight of the preserved incrustations, 66% (359 kg) can be attributed to Mediterranean, 32% (172 kg) to regional and 2% (12 kg) to unknown sources (Fig. 3).

2 As regional sources are here defined stones originating from Germania inferior and from neighbouring provinces Gallia Belgica and Gallia Lugdunensis.

| Stone type | 3 | 4/11 | 10 | 12 | 12/19 | 18 | 19 | 20 | 25 | 26 | 33 | 37 | 38 | 38/39 | 39 | 39/40 | 40 | Single finds | All |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| White fine-grained marbles (Pentelic/Carrara) | 5 | 7 | 223 | 3 | | 2 | 13 | 3 | 13 | 35 | 14 | 116 | 1 | 1 | | | 1 | 5 | 442 |
| Thassian marble (dolomitic) | | | | | | | | | | 1 | | | | | | 1 | | | 2 |
| Proconnesian marble | | | | | | 4 | | | | 7 | | 21 | | | | | | | 32 |
| Proconnesian "Greco scritto" | | | | | | | | | | 8 | | 166 | | | | | | | 174 |
| Ephesian Greco scritto | | | | | | | | | | 8 | | | | | | | | | 8 |
| Hymettian marble | | | | | | | | | | | | 17 | | | | | | 1 | 18 |
| Marble from Odenwald | | | 11 | | 1 | 4 | 2 | | 6 | 6 | | 3 | 1 | | | | 1 | | 35 |
| Medium/coarse grained marble (Proconnesian?/Odenwald?) | | | 6 | | | 1 | | | 3 | 24 | | 8 | | | | | 2 | | 44 |
| Mylonitic marble (unknown provenance) | | | | | | | | | | 8 | | | | | | | | | 8 |
| Fior di pesco | | | 2 | | | | 1 | | 1 | 65 | | 981 | | | | | | | 1050 |
| Breccia di Sciro | | 1 | 7 | 1 | | | 1 | | 6 | 490 | | 3 | | 1 | | 1 | | | 511 |
| Breccia corallina | | | | | | | | | | 44 | | | | | | 1 | 1 | 2 | 48 |
| Pavonazzetto | 4 | | 8 | | | 59 | 7 | 1 | 52 | 9 | 2 | 1 | 13 | | | | | 1 | 157 |
| Red marble (Rosso antico/Marmo Iassense/unknown) | | | | | | | | | | 34 | | | | | | | | | 34 |
| Porfido rosso | | | 1 | | | | | | | | | | | | 2 | | | 1 | 4 |
| Cipollino verde | | | 1 | | | | | | | 43 | | 126 | | | | | | | 170 |
| Verde antico | | | 1 | | | | | | | 24 | | | | | | | | 3 | 28 |
| Porfido verde antico | | | | | | | | | | 2 | | | | | 2 | 1 | | | 5 |
| Africano | | | | | | | | | | 7 | | 2 | | | | | | 1 | 10 |
| Granito verde minuto della sedia di San Lorenzo | | | | | | | | | | 1 | | | | | | | | | 1 |
| Trachyte from Drachenfels | | | | | | | 1 | | | | | | | | | | | | 1 |
| Trachyte from Berkum | | | 3 | | | 2 | | | 1 | 2 | 3 | | 1 | | 1 | | | | 13 |
| Diabase from Trier | | | | | | | | | | 1 | | 1 | | | 1 | 1 | | 1 | 5 |
| Carboniferous limestone (Kohlenkalk) | | | 82 | | | 4 | 2 | 1 | | 23 | | 5 | 2 | | 1 | 2 | | | 122 |
| Red Belgian limestone | | | 1 | | | | | | | 13 | | | | | | | | | 14 |
| Baelen Marble | | | 1 | | | | | | | | | 1 | | | | | | | 2 |
| Beige limestone (Lutetian limestone/unknown) | 1 | | 153 | | | 1 | | 2 | 3 | 57 | 2 | 8 | | | | | | 3 | 230 |
| Limestone from Norroy | | | 12 | | | 1 | | | | 7 | | | | | | 1 | 20 | | 41 |
| Pierre de Pouillenay | | | | | | | | | | 1 | | | | | | | | | 1 |
| Rosé de Prémeaux | | | | | | | | | | 2 | | | | | | | | | 2 |
| Sandstones (Ruhr-Sandstein/jotnischer Sandstein) | | | 1 | | | | | | | 6 | | 1 | | | | | | | 8 |
| Diverse coloured stones of unknown provenance | | | 4 | | | 1 | | | 1 | 21 | | 9 | | | | | | | 36 |

Fig. 2. The numbers and stone types of incrustation fragments in various buildings of CUT

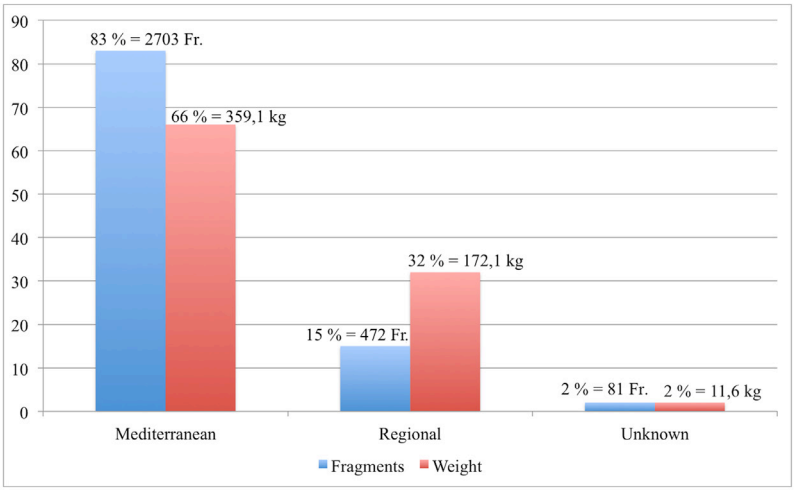



Fig. 3.
Incrustations from CUT. Blue columns express the amount of incrustation fragments in %, red columns – the weight of fragments in %

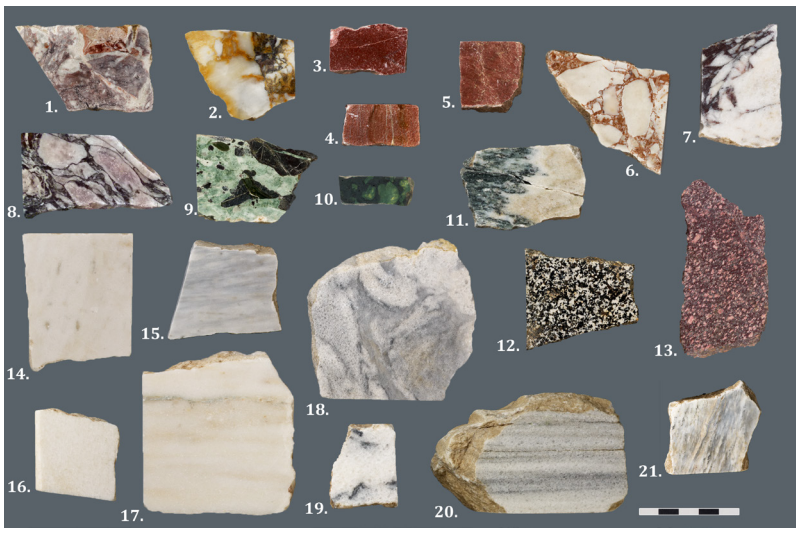



Fig. 4.
Incrustations from CUT. Mediterranean types of decorative stones: 1 Fior di pesco, 2 Breccia di Sciro, 3 Marmo Iassense rosso uniforme, 4 Rosso antico, 5 Red marble of unknown provenance, 6 Breccia corallina, 7 Pavonazzetto, 8 Africano, 9 Verde antico, 10 Porfido verde antico, 11 Cipollino verde, 12 Granito verde minuto della sedia di San Lorenzo, 13 Porfido rosso, 14 Carrara marble, 15 Hymettian marble, 16 Dolomitic Thassian marble, 17 Pentelic marble, 18 "Greco scritto" from Proconnesus, 19 Greco scritto from Ephesos, 20 Proconnesian marble, 21 Mylonitic marble of unknown provenance. Photo S. Arend (Medienzentrum Rheinland/LVR), modified by V. Ruppienė

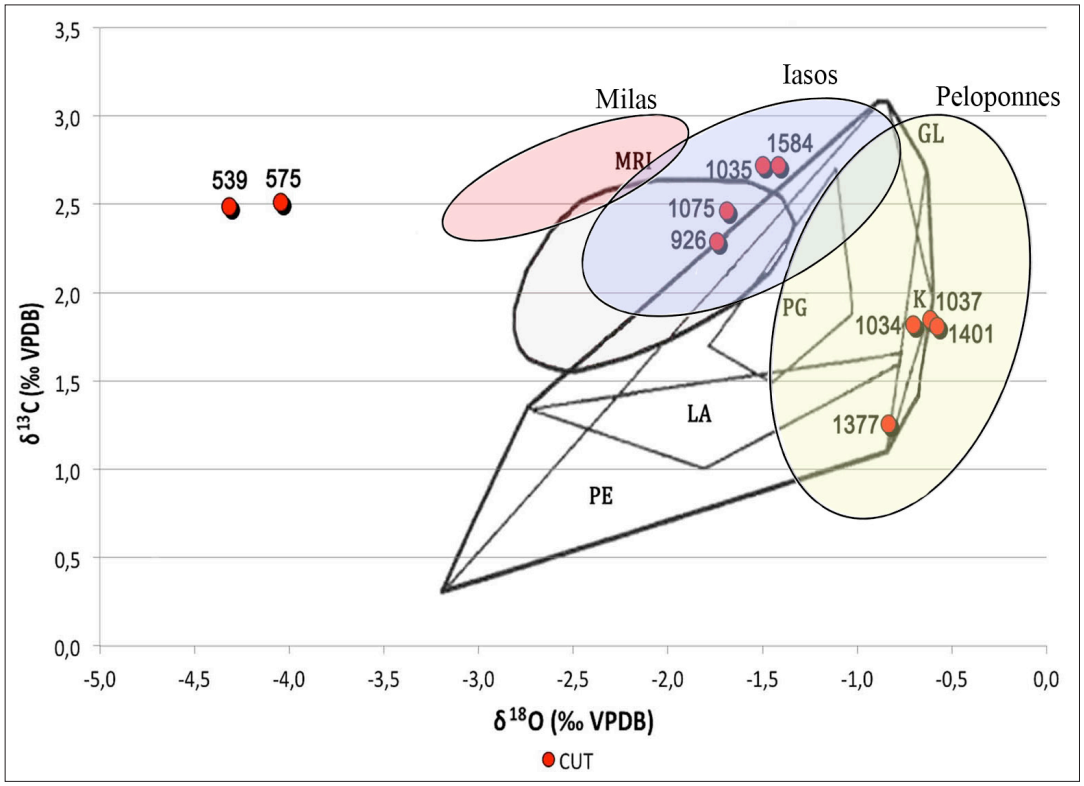



Fig. 5. Red marbles from CUT in a δ13C (‰ VPDB) vs δ18O (‰ VPDB) diagram of various red marbles from Peloponnese, Iasos and Milas (LAZZARINI 2008, 88 Fig. 48. Red marbles from Iasos (MRI), Profitis Elias (PE), Làghia (LA), Paganéa (PG), Kokkinoghia (K), global field of red marbles from Cap Tenaro (GL); data of W. PROCHASKA)

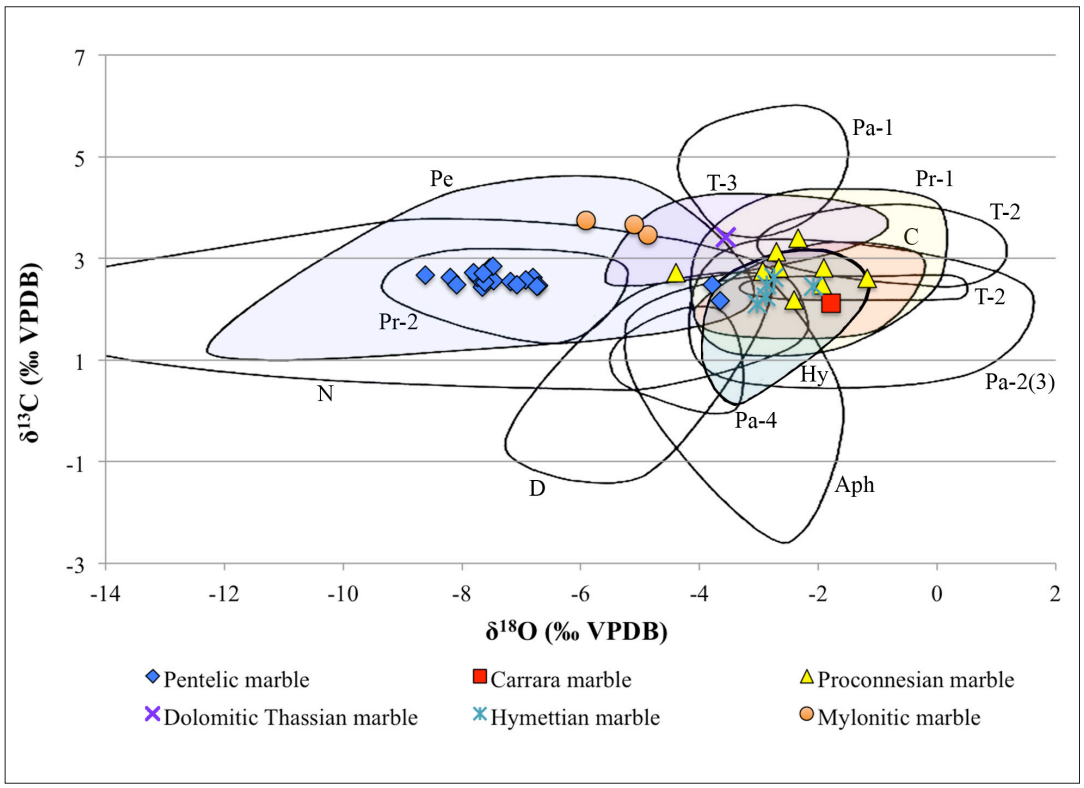



Fig. 6. White and grey marbles from CUT in a δ13C (‰ VPDB) vs δ18O (‰ VPDB) diagram of GORGONI *et al.* 2002, 123 Fig. 5a and LAZZARINI 2004, 121 Abb. 2: Carrara (C), Hymettos (H), Dokimeion (D), Naxos (N), Paros (Pa), Penteli (Pe), Proconnesus (Pr), Thassos (T), Aphrodisias (Aph)

**Provenance of stones**

*Stones from Mediterranean sources:*

The following Mediterranean stone types were proven in CUT (see Figs. 2; 4):

*Fior di pesco* from the island of Euboea (1050 fr) is frequently found in CUT and most commonly used in the Harbor-Temple (981 fr.).

*Breccia di Sciro* and its variety *Semesanto* from the island of Skyros (511 fr) was almost exclusively used in the porticus on the Capitolium insula (480 fr).

*Pavonazzetto* from Turkey (157 fr). The biggest share was discovered in the area of the Forum of CUT (ins. 25, 52 fr) and of the insula 18 (which borders on Forum insula) in buildings of unclear (probably representative) purpose (59 fr).

*Breccia corallina* (48 fr) from Vezirhan in Turkey was almost exclusively found on the Capitolium insula (44 fr).

*Cipollino verde* from the island of Euboea (170 fr) was preferably used in the Harbor-Temple (126 fr) and to a lesser extent also on the Capitolium insula (43 fr).

*Red marbles*. Three types of red marbles were identified in CUT. All fragments were discovered on the Capitolium insula (34 fr). According to petrography and isotopic signature of carbon and oxygen, type one with uniform red (Rosso antico, Fig. 4.4) and red-white-green veined varieties could be attributed to the quarries on Peloponnesus in Greece. The second uniform red type originates from Turkish sources near Iassos (Marmo iassense rosso uniforme, Fig. 4.3). The third uniform red type (Fig. 4.5) shows much lower oxygen values and originates from quarries unknown at present (Fig. 5).

*Verde antico* from Thessaly in Greece (28 fr) was found most frequently on the Capitolium insula and was preferably used for listels.

*Porfido verde antico* from Krokeae in Greece (5 fr).

*Porfido rosso* from Egyptian Mons Porphyrites quarries (4 fr).

*Africano* from Theos in Turkey (10 fr). The dark variety and also Africano verde were used in CUT.

*Granito verde minuto della sedia di San Lorenzo* (1 fr) from Egyptian Wadi Umm Wikala quarries.

*Pentelic and Carrara marble*. White fine-grained marbles used in CUT originate from Pentelic quarries near Athens and from Carrara. Pentelic marble seems to be the more frequent marble type. The attribution of all studied marbles to certain sources was carried out on the basis of results provided by optical microscopy of thin sections, grain-size analysis, XRD and isotopic analysis ($\delta^{18}O$ and $\delta^{13}C$; Fig. 6).

*Hymettian marble*[3] was also occasionally used in CUT. Seventeen fragments of this material were found in the area of the Harbor-Temple (Fig. 6).

*Dolomitic Thassian marble*. Two fragments of white medium grained marble could be attributed to Thassian Vathy-Saliara quarries providing dolomitic marbles (Fig. 6).

*Proconnesian marble* from Turkey was preferably used for small cornices, rarely also for tiles (Fig. 6).

*Greco scritto*. There were two types of white to grey medium-grained marble with dark grey sprinkles and patches observed in CUT: according to results of discriminant analysis[4], the first variety with white background and dark sprinkles (8 fr, Fig. 4.19) very much resembles the so-called Greco scritto and originates from an Ephesian source (Fig. 7, blue dot). The second type with white to light grey background and dark grey patches (Proconnesian "Greco scritto", 174 fr, Fig. 4.18) was most probably imported from Proconnesian quarries (Fig. 7, red dots). The origin of both varieties from Algerian sources can be excluded.

*Mylonitic marble*. The provenance of fine-grained mylonitic light grey marble with white veins could not be determined. This marble is surely not of regional origin. The provenance from Carrara quarries considered could be excluded on the basis of isotopic signature (Fig. 6; lower oxygen and higher carbon values[5]).

*Regional stones*

Even though Mediterranean stone types were used more frequently than stones from regional sources, there were surprisingly many regional stone varieties identified in CUT that were known to Romans and quarried by them during the 2nd century AD. Some of them originate from German, some from Belgian and French sources (Fig. 8).

*Marble from Odenwald* (Germany, Fig. 8.8). This medium to coarse-grained marble variety was quarried in the Odenwald marble quarries near Auerbach on the right side of the River Rhine. Several small marble deposits (no Roman quarrying traces present) are situated

3 However, it can not be excluded that this grey fine-grained marble originates from the Carrara quarries in Italy (Bardiglio): the isotopic fields of Carrara and Hymettian marble overlap largely and the analysed samples lie in the overlapping area. The clearly perceptible smell of hydrogen sulfide ($H_2S$) points to Hymettian origin, whereas the polygonal fabric with numerous triple-points suggests an origin in Carrara (RUPPIENĖ 2015, 38–42).

4 Analyses were carried out by W. Prochaska, Montan-University in Leoben, Austria.

5 Isotopic values of three studied samples: 3,75 and -5,91; 3,47 and -4,87; 3,67 and -5,10 ($\delta^{13}C$; $\delta^{18}O$ (‰ VPDB)).

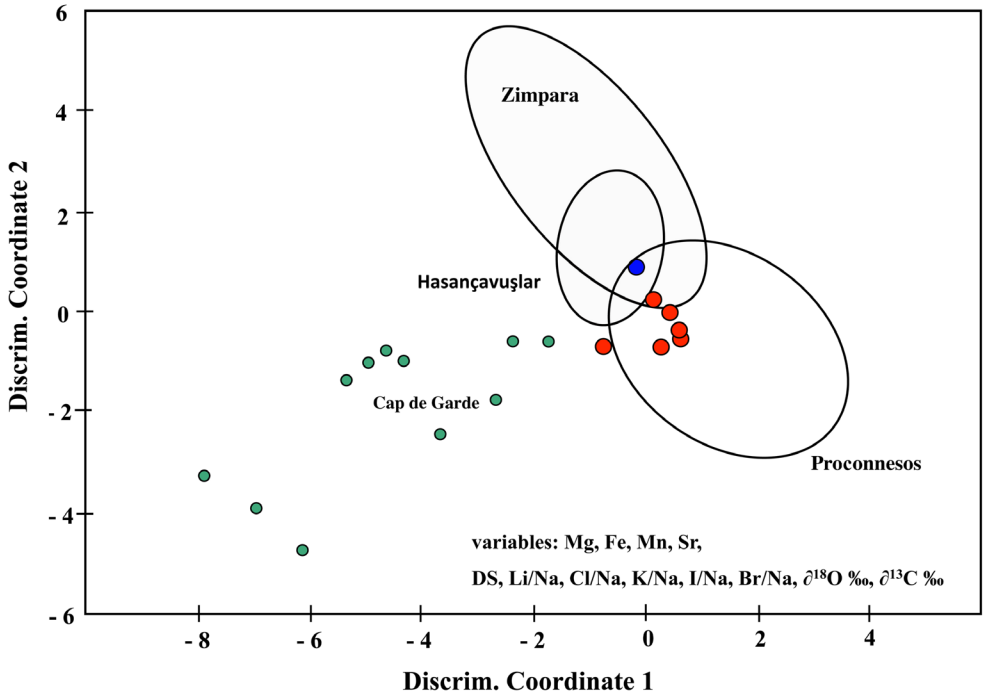



Fig. 7.
Samples from CUT (red and blue dots) in the statistical discriminant graph of "Greco scritto" marbles from Ephesian (Zimpara, Hasançavuşlar), Proconnesian and Algerian (Cap de Garde) quarries (W. PROCHASKA). Blue dot (Nr. 476, Ephesian Greco scritto, Fig. 4.19); red dots (Nr. 155, 163, 198, 541, 1112, 1397, Proconnesian "Greco scritto", Fig. 4.18)

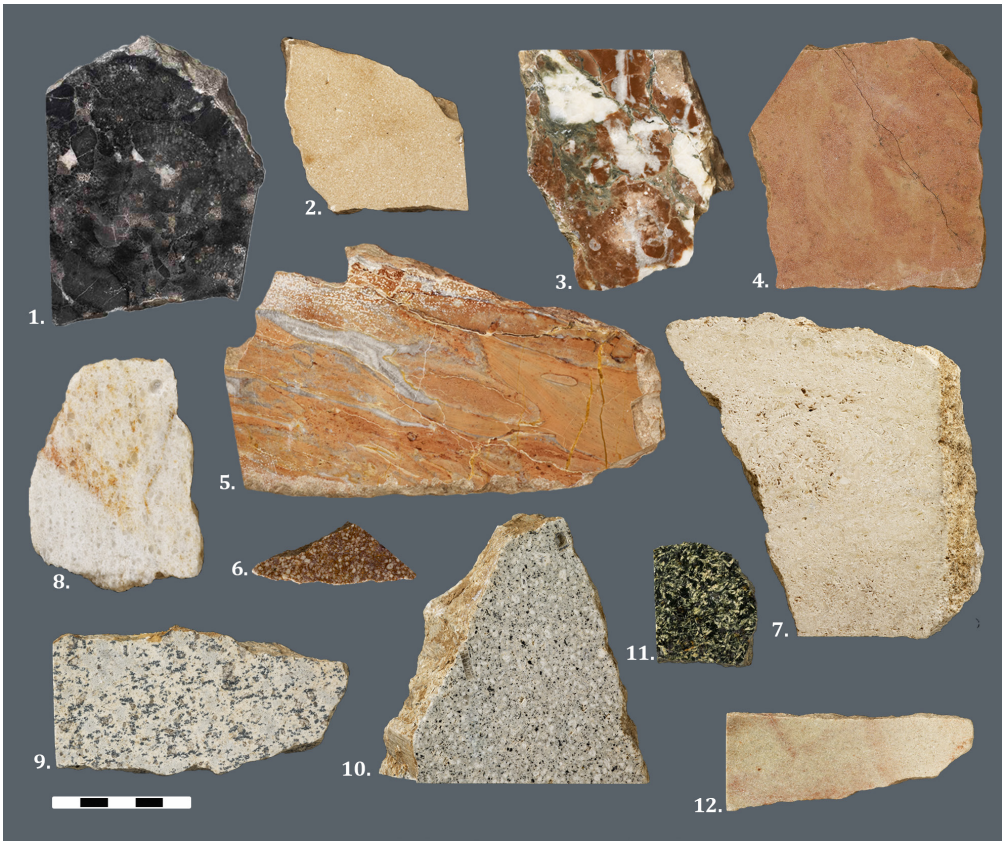



Fig. 8.
Incrustations from CUT. Stone types from regional sources: 1. Carboniferous limestone, 2 Lutetian limestone, 3 Red Belgian limestone, 4 Rosé de Prémeaux, 5 Baelen marble, 6 Pierre de Pouillenay, 7 Limestone from Norroy, 8 Marble from Odenwald, 9 Trachyte from Berkum, 10 Trachyte from Drachenfels, 11 Diabase from Trier, 12 Ruhr-Sandstone. Photo S. Arend (Medienzentrum Rheinland/LVR), modified by V. Ruppienė

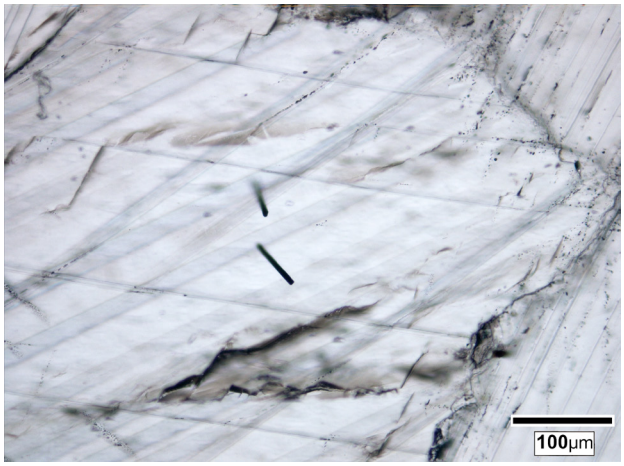



Fig. 9. Photomicrograph of the coarse-grained marble from Odenwald (Nr. 1204). Pyrite needles in calcite under polarized light (photo V. Ruppienė)

only a few kilometers from the Roman quarries of the so-called *Felsberg Granite* (=Diorite). Frequent macroscopic characteristics of Odenwald marble are orange to brown colored stains. It contains numerous accessories like quartz, albite, apatite, chlorite, tremolite, phlogopite, titanite and opaque minerals. The most characteristic feature of this marble is the needle-shaped pyrite (Fig. 9). This marble was used by the Romans for incrustations, architectural parts like capitals or cornices and as sculptural material[6].

*Carboniferous limestone* (*Kohlenkalk,* Fig. 8.1). The most popular regional stone in CUT, used in preference in the baths, is grey to black colored limestone of Lower Carboniferous age (Viseum) with often macroscopically visible fossil remains (122 fr). This rock originates most probably both from Germany near Aachen and from Belgian sources (along the Meuse river banks between Namur and Liège)[7].

*Red Belgian limestones* (Fig. 8.3). Some red limestone varieties of Upper Devonian age with white and grey veins originate from various Belgian sources in Wallonia (14 fr). Samples from CUT resemble the Belgian varieties Rouge Royal, Griotte, Rouge of Rance[8]. Another variety of red Belgian limestone is the so-called Baelen marble (2 fr, Fig. 8.5). It is a limestone of Middle Famennian age (late Upper Devonian)[9]. The use of Baelen marble in CUT proves for the first time its use in the Roman age. Interestingly, red Belgian limestones were used in CUT very seldom, since only 16 of the 3256 fragments examined are of Belgian provenance, whereas the majority of red stones were imported from Euboea, Skyros and Dokimeion.

*Lutetian limestone* (France, Fig. 8.2). A stone variety frequently used in CUT is the beige Lutetian limestone of Tertiary age from the Paris Basin[10]. A characteristic feature of this limestone is the white foraminifera (Miliolids) that can be seen with an optical lens and sometimes even macroscopically.

*Limestone from Norroy* (France, Fig. 8.7). Another light beige limestone of Middle Jurassic age originates from Norroy in Lorraine (41 fr). This stone was occasionally used for tiles, but more frequently as building and sculptural stone[11].

*Rosé de Prémeaux* (France, Fig. 8.4). Two fragments of the Jurassic limestone Rosé de Prémeaux originate from the quarries between Dijon and Chagny in France.

*Pierre de Pouillenay* (France, Fig. 8.6). One small fragment of orange-brownish limestone with white sprinkles (crinoid stem fragments) was identified as Pierre de Pouillenay of Middle Jurassic age (Bajocium), quarried in the northwest of Burgundy (south eastern part of Paris Basin)[12].

*Trachyte from Drachenfels* (Germany, Fig. 8.10). Trachyte from Drachenfels is not much used in CUT as decorative stone (1 fr), but very often as building stone and stone for pavements. It is easily identifiable by centimeter-long sanidine inclusions in the light grey matrix (Fig.10). Numerous traces of Roman quarrying can be still observed on-site (Ruppienė 2015, 160–166).

6 RUPPIENĖ *et al.* 2013; RUPPIENĖ 2015, 42–61.

7 RIBBERT 2010, 39–58; COQUELET *et al.* 2014, 57; DE CEUKELAIRE *et al.* 2014, 206–234; DREESEN *et al.* 2014, 19; RUPPIENĖ 2015, 183–190.

8 CNUDDE *et al.* 1987; DE CEUKELAIRE *et al.* 2014, 116–154; 160–166; DREESEN *et al.* 2015, 208 f. fig. 2; RUPPIENĖ 2015, 190–196.

9 DREESEN *et al.* 2013, 182–184 Abb. 7; DE CEUKELAIRE *et al.* 2014, 155–159.

10 BLANC *et al.* 1991, 250 f. Abb. 3; BLANC *et al.* 2002, 104 f. Abb. 3b; FRONTEAU *et al.* 2010; DREESEN *et al.* 2012, 44 Abb. 31; RUPPIENĖ 2015, 196–200. 230 fragments of beige limestone were discovered in CUT. Microscopically, three different varieties could be identified: Lutetian limestone and two varieties of unknown provenance. The precise share of Lutetian limestone could not be determined by optical means (RUPPIENĖ 2015, 196–200).

11 RÖDER 1960; RÖDER 1970, 9; STRIBRNY 1987, 20–22 Abb. 22; HARTKOPF-FRÖDER/BRACHERT 2004; COQUELET *et al.* 2013; RUPPIENĖ 2015, 200–204.

12 DREESEN *et al.* 2012, 48–50 Abb. Tab. 2 Abb. 41; RUPPIENĖ 2015, 203–206.


Fig. 10. Photomicrograph of trachyte from Drachenfels (Nr. 2049). Sanidine inclusion in the fine-grained matrix of plagioclase, quartz, pyroxene, biotite and opaque minerals under crossed polarized light (photo: V. Ruppienė)

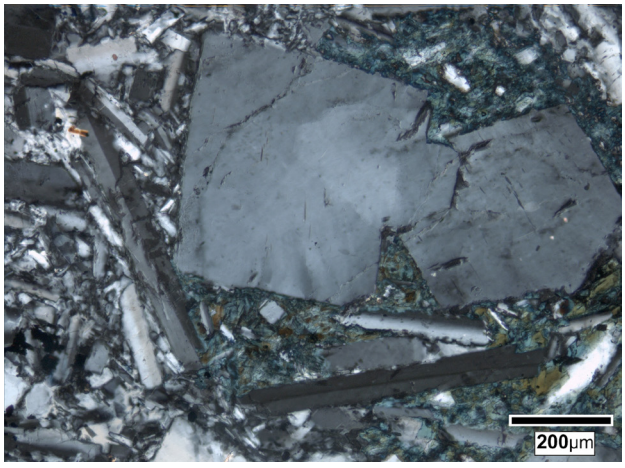



Fig. 11. Photomicrograph of trachyte from Berkum (Nr. 442). Feldspar inclusions (sanidine and anorthoclase) in the fine-grained matrix of arfvedsonite (bluish-green), feldspar, quartz and opaque minerals under crossed polarized light (photo: V. Ruppienė)

*Trachyte from Berkum* (Germany, Fig. 8.9). Another trachyte type used for floor tiles in CUT is the trachyte from Berkum (13 fr). Like trachyte from Drachenfels, this type of trachyte with some millimeter-long feldspar inclusions and greenish-bluish sprinkles of the amphibole arfvedsonite (Fig. 11) was used in Germania inferior as building stone and occasionally as sculptural stone (RUPPIENĖ 2015, 166–178).

*Diabase (Germany, Fig. 8.11)*. Five fragments of a dark green diabase with white to yellowish sprinkles were found in different areas of CUT (5 fr). These fragments, which look quite similar to what is called *Granito verde a erbetta* (which was attributed in the past to the Wadi Umm Wikala quarries in Egypt), originate from Hunsrück: some deposits providing stones with similar petrographic features were discovered in the valley of the river Ruwer near Trier (Roman Augusta Treverorum)[13]. Due to modern overprinting no Roman quarrying traces have been observed yet in any of the deposits studied [14].

Incrustations made of this type of stone were frequently used in the buildings of various purposes in Germania inferior and Gallia Belgica.

*Ruhr-Sandstone* (Germany, Fig. 8.12). Sandstones originating from the deposits near the River Ruhr (on the right –"barbaric" side of the River Rhine) were also used for decorative purposes in CUT (RUPPIENĖ 2015, 206–212).

**Incrustations in buildings of Colonia Ulpia Traiana**

*Harbor-Temple*

In the Harbor-Temple, which is located near the ancient Harbor (deity not known; considered as temple of the Imperial cult) mainly four types of rock for wall and floor incrustations were used: Fior di pesco (981 fr), Cipollino (126 fr), white fine-grained marble (Pentelic and Carrara, 116 fr) and light grey marble with dark grey patches of most probably Proconnesian provenance (Proconnesian "Greco scritto", 166 fr). A few other stone types are preserved in isolated samples (Fig. 2). Fior di pesco is by far the most frequent decorative stone in the Harbor-Temple. This is quite astonishing, because it happens to be a stone that was never used in any public imperial building in Rome. The most frequently used red stone in contemporaneous imperial buildings in Rome is Pavonazzetto. Fior di pesco probably served in CUT as a cheaper substitute for this appreciated and sought-after stone.

According to preserved fragments of wall paintings, of incrustations and of architectural elements (pilaster and capitals), only the lower part of the cella wall was decorated with incrustations, whereas the upper part was divided by pilasters and covered with paintings. Fragments of cornices, tiles and straps indicate that the incrusted part of the wall was subdivided into two or

13 (RUPPIENĖ/GLUHAK, in preparation).

14 An important indication about the Roman use of Trierer diabase is the mention of water-powered marble saws in the Ruwer-valley by Ausonius (4th century AD). Since no marble (in modern terms) is outcropping along the river Ruwer, Ausonius can only be speaking about saws cutting green diabase (Auson. Mos. 359–364). Some blocks with clearly visible sawing traces found in Trier suggest also, that this stone is of regional origin and was sawn to tiles on-site. So far no blocks of imported Mediterranean rocks with sawing traces have been found in Germania inferior or Gallia Belgica. Mediterranean rocks were most probably imported in a prefabricated state in order to save transportation costs.

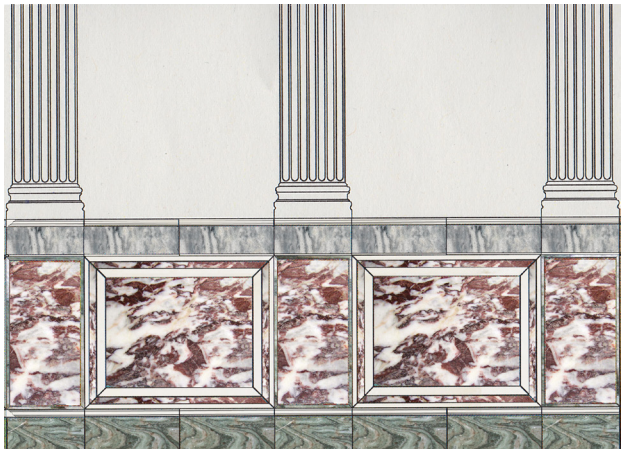


Fig. 12. Suggested reconstruction for wall revetments in the Harbor-Temple of CUT (V. Ruppienė)

Fig. 13. Suggested reconstruction for the floor pattern in the frigidarium (baths) of CUT (V. Ruppienė)

even three zones: the lower zone (most probably monochrome) was separated by a cornice from the upper zone and consisted of rectangular fields, corresponding to the order of pilasters above. According to the fragments of listels, rectangular fields were framed by listels made of white marble, Fior di pesco and Cipollino verde. The central zone was probably topped by a narrow monochrome upper zone (Fig. 12). Floor tiles consisted in the larger part of Fior di pesco, followed by white fine-grained marble, grey Proconnesian "Greco scritto" and Cipollino verde (RUPPIENĖ 2015, 233–242).

*Baths*

In contrast to the Harbor-Temple, regional stones like Carboniferous limestone and Lutetian limestone were used on a large scale in the baths (Fig. 2). They were combined with white Mediterranean fine-grained marbles. The combination of these three types of stones was found in all the rooms of the baths (basilica thermarum, apodyterium, frigidarium, sudatorium, caldarium). It seems that white and beige rocks were more frequently used for wall incrustations, whereas floor patterns were arranged by use of more contrasty white marble, beige limestone and dark Carboniferous limestone.

The frigidarium is the only room in CUT, where imprints of tiles are still preserved in mortar. They provide a clear indication about the pattern of the floor. Fragments of beige and black limestone and white marble are preserved. Beige and black tiles were of triangular shape; nothing can be said about the shape of white tiles. The exact arrangement of colors cannot be determined any more, but one possible arrangement is suggested in Fig. 13 (RUPPIENĖ 2015, 256–271).

*Forum*

Most of the fragments from the forum-insula originate from the area of the basilica and the porticus in front of it. The most frequent stone used here is Pavonazzetto, combined with white marble and few other stone types (Fig. 2). In contrast to the Harbor-Temple, where Fior di pesco was the dominating red decorative stone, the forum was decorated with Pavonazzetto, which was one of the most expensive and sought-after stones in antiquity and which was used for all imperial fora in Rome. The use of Pavonazzeto for the forum of CUT can possibly be interpreted as a reference to these imperial fora. In contrast to the situation in Rome, no Giallo antico, Africano or Portasanta, almost always present in imperial projects, has yet been proven in the forum of CUT (RUPPIENĖ 2015, 249–254).

*Capitolium*

In the southeastern part of the Capitolium insula numerous fragments of former wall and floor incrustations were discovered (949 fr.; Fig. 2). The find site indicates that incrustations most probably did not belong to the interior decoration of the temple, which is situated in the center of the insula, but rather to the porticus facing the court from the eastern and southern sides. On this site more than 30 different rock types were identified. The most common rocks are of red color – Breccia di sciro (490 fr), Fior di pesco (65 fr), Breccia corallina (44 fr) and red marbles (34 fr), being followed by various white and grey marbles, beige limestones (57 fr) and green stones – Cipollino verde (43 fr) and Verde antico (24 fr). The other stone types are present in isolated samples. Most of these rocks are moderately expensive, whereas the more expensive stones, often used in imperial public buildings in Rome, are either very scarce (Pavonazzetto, 9 fr., Africano 7 fr) or not present at all (Giallo antico, Portasanta, RUPPIENĖ 2015, 242–247).

## Conclusions

The investigations revealed that more than 40 different types of decorative stones were used in CUT. Most of the fragments (83 %) were attributed to Mediterranean sources. But stones from various sources in Germania inferior and the neighboring provinces (Gallia Belgica and Gallia Lugdunensis) were also exploited and used by the Romans for decorative purposes, to a lesser extent, however (15 %): marble from Odenwald, trachytes from Drachenfels and Berkum, diabase from Trier, red Belgian limestones, Carboniferous limestone from Aachen and from Belgian sources. Few types of stone were imported from French quarries: Lutetian limestone, Jurassic limestone from Norroy, Rosé de Prémeaux and Pierre de Pouillenay.

Thus it turns out that in contrast to previous assumptions Mediterranean decorative stones were much more frequently used in CUT than regional stones. They became common in Germania inferior as early as at the beginning of the 2nd century AD at the latest. It is worth noting here, that Mediterranean decorative stones were used in CUT exclusively for veneer slabs and small cornices. There is no evidence for their use for large architectural elements.

It can be further observed, that every building was decorated with a variety of decorative stones especially selected for this building. In the forum of CUT the assortment of stones was chosen based on examples from Rome (preferred use of Pavonazzetto). Unlike the forum, the Harbor-Temple was preferably decorated with Fior di pesco, which is not confirmed in any public building of Rome. Incrustations in the baths of CUT consisted primarily of regional Carboniferous limestone, Lutetian limestone and Mediterranean white fine-grained marble. To decorate the porticus of the Capitolium insula an immense variety of stones (ca. 30 types, preferred use of red colored stones) was selected.

It seems that the fashion of incrustation in the CUT of the 2nd century AD both reflected the contemporary art in Rome and at the same time developed a regional taste based on financial capabilities and depending on the resource availability in the region.

## ACKNOWLEDGEMENTS

Martin Müller and Bernd Liesen from The Archäologischer Park Xanten are thanked for providing samples for this investigation. We also thank Peter Späthe, preparator at the Würzburg University, for excellent repolishing of lots of fragments and the production of high-quality thin sections. Generous financial support from Stiftung der Deutschen Wirtschaft is gratefully acknowledged. We further thank Lorenzo Lazzarini, Walter Prochaska, Harald Tragelehn and Roland Dreesen for their invaluable assistance and support.

## REFERENCES

BINTZ J., GROSSENS E., VANDENVEN G. 1981: "A propos des marbres de la villa romaine d'Echternach", in: METZLER J., ZIMMER J., BAKKER L., Ausgrabungen in Echternach, Luxemburg, 145-152.

BLANC A., LORENZ C., VIRÉ M. 1991: "Le liais de Paris et son utilisation dans les monuments", in: LORENZ J., BENOIT P. (eds.): Carrières et constructions en France et dans les pays limitrophes. Actes du 115e Congrès National des Sociétés Savantes, Section des Sciences et Section d'Histoire des Sciences et des Techniques, Avignon, 9-12 avril 1990, Paris, 247-259.

BLANC A., HOLMES L.L., HARBOTTLE G. 2002: "Lutetian limestones in the Paris region: petrographic and compositional characterization", in: ASMOSIA V, 103-109.

CNUDDE C., HAROTIN J. J., MAJOT J. P. 1987, Steine und Marmore aus der Wallonie, Bruxelles.

COQUELET C., CREEMERS G., DREESEN R., GOEMAERE É. 2013: "Les «pierres blanches» dans les monuments publics et funéraires de la cité des Tongres", Signa 2, 29-34.

COQUELET C., CREEMERS G., DREESEN R. 2014: "Le décor du grand temple Nord de Tongres", Signa 3, 55-64.

DE CEUKELAIRE M., DOPERÉ F., DREESEN R., DUSAR M., GROESSENS E. 2014: Belgisch Marmer, Gent.

DODT M. 2015: "Marmorluxus in den großen römischen Thermen der Stadt Trier", Funde und Ausgrabungen im Bezirk Trier 46, 52-67.

DREESEN R., CNUDDE V., DUSAR M., DE CEUKELAIRE M., BOSSIROY D., GROESSENS E., ELSEN J., DE KOCK T., DEWANCKELE J. 2012: "In het voetspoor van Camerman: de opmars van de Franse steen in België" in VAN HEES R. P. J., de CLERCQ H., QUIST W. J. (eds.): Stenen van binnen, stenen van buiten: natuursteen in de jonge bouwkunst, Delft, 33-63.

DREESEN R., COQUELET C. 2013: "Steenmateriaal van de tempelsite van Tongeren", in COSYNS P., SFINGOPOULOS S., VANDEWAL S., van RECHEM H. (eds.): Bouwmeesters voor de Goden, Een Romeins tempelcomplex aan de Keversstraat, Tongeren ) 27-31.

DREESEN R., MARION J.-M., MOTTEQUIN B. 2013: The red marble of Baelen, a particular historical building stone with global geological importance and local use, Geologica Belgica 16, 3, 179-190.

DREESEN R., COQUELET C., CREEMERS G., DE CLERCQ W., FRONTEAU G., GLUHAK T., HARTOCH E., HENRICH P., LAFITTE J.-D., PICAVET P., RENIERE S., RUPPIENE V., THIÉBAUX A., VANDERHOEVEN A., VYNCKIER G., GOEMAERE E. 2014: "Unraveling geological and geographical provenances of lithic materials during Roman times in Belgium: a fruitful collaboration between geologists and archaeologists", European Geologist 38, 14-20.

DREESEN R., BOGAERT L., COQUELET C., CREEMERS G., DE WINTER N., DRIESEN P., GOEMAERE E., VANDERHOEVEN A., VYNCKIER G. 2015: "Van heinde en verre: gebruik en herkomst van polychrome marmers in Romeins Tongeren – een eerste stand van zaken", Signa 4, 103-118.

FISCHER G. (ed.) 1997: Antiker Marmorluxus von Rom bis zum Rhein. Ausstellung Regionalmuseum Xanten 23. Februar - 27. April 1997, Führer und Schriften Regionalmuseums Xanten 44, Köln.

FISCHER G. 1999: "Köln als Mittler des Marmorluxus im römischen Rheinland?", Kölner Jahrbücher 32, 1999, 677-687.

FISCHER G. 2001: "Inkrustationselemente", in LIESEN B., Die Grabungen südlich und westlich des Kölner Doms. II. Glas, organische Reste, Steinbaumaterial, Objekte aus Ton. Kölner Jahrbücher 34, 333-471.

FRONTEAU G., MOREAU C., THOMACHOT-SCHNEIDER C., BARBIN V. 2010: "Variability of some Lutetian building stones from the Paris Basin, from characterisation to conservation", Engineering Geology 115, 158-166.

GORGONI C., LAZZARINI L., PALLANTE P., TURI B. 2002: An updated and detailed mineropetrographic and C-O stabile isotopic reference database of the main mediterranean marbles used in antiquity, in: ASMOSIA V, 115-131.

HARTKOPF-FRÖDER C., BRACHERT T. C. 2004: "Der Werkstein des römischen Reliefsarkophags von Weilerswist-Klein Vernich", Bonner Jahrbücher 204, 59-69.

HORN H. G. 1987: "Das Leben im römischen Rheinland", in HORN H. G. (ed.): Die Römer in Nordrhein-Westfalen, Stuttgart 139-317.

LAZZARINI L. 2004: "Archaeometric aspects of white and coloured marbles used in antiquity: the state of the art", Periodico di Mineralogia 73, 113-125.

LAZZARINI L. 2007: Poikiloi Lithoi, versiculores maculae: i marmi colorati della Grecia antica. Storia, uso, diffusione, cave, geologia, caratterizzazione scientifica, archeometria, deterioramento, Pisa.

RIBBERT K.-H. 2010: Geologie im Rheinischen Schiefergebirge. Teil 1: Nordeifel, Krefeld.

RÖDER J. 1960: "Sägespuren an römischen Kalksteindenkmälern", Kölner Jahrbuch für Vor-und Frühgeschichte 5, 38-50.

RÖDER J. 1970: Die mineralischen Baustoffe der römischen Zeit in Rheinland. Bonner Universitätsblätter, 7-19.

RUPPIENĖ V., SCHUESSLER U., UNTERWUZACHER M. 2013: "Auerbach Marble Quarries in the Odenwald near Hochstädten – Exploitation during Roman and Medieval Times", in: SILVERTANT J. (ed.): Mining and Cultural Landscape, 8th Internat. Symposium on Archaeological Mining History, Reichelsheim, 9.-11. Mai 2013, Reichelsheim, 120-129.

RUPPIENĖ V. 2015: "Natursteinverkleidungen in den Bauten der Colonia Ulpia Traiana. Gesteinskundliche Analysen, Provenienzbestimmung und Rekonstruktion", Xantener Berichte 28, Darmstadt/Mainz.

STRIBRNY C. 1987: Die Herkunft der römischen Werksteine aus Mainz und Umgebung. Vergleichende petrographische und geochemische Untersuchungen an skulptierten Kalksteinen. CSIR Deutschland II 8, Mainz.