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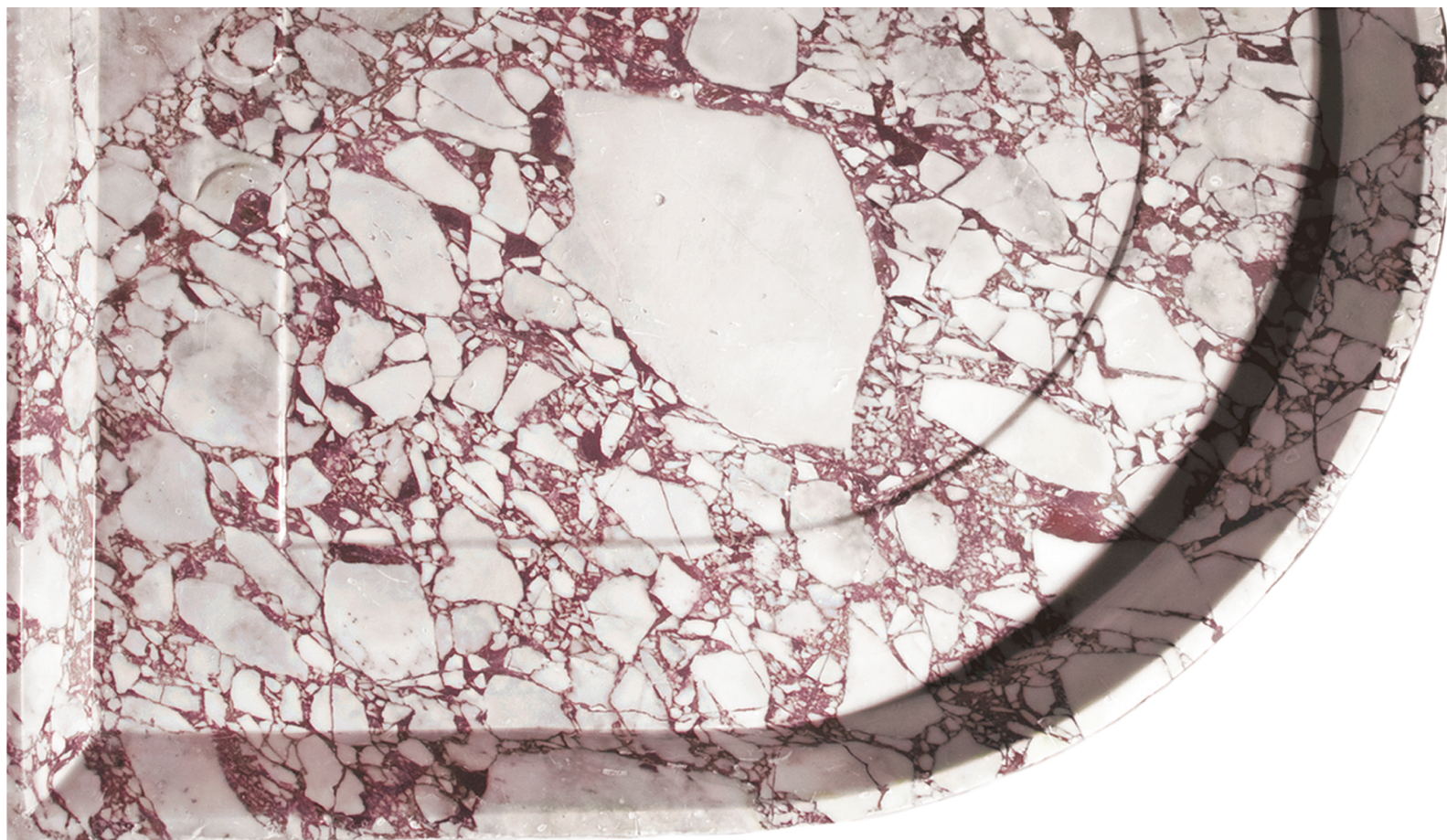
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# ASMOSIA XI

Interdisciplinary Studies on Ancient Stone

## PROCEEDINGS

of the XI ASMOSIA Conference, Split 2015

Edited by Daniela Matetić Poljak and Katja Marasović





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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.

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## PRESENTATION

The limestones of Istria and Dalmatia, two Croatian regions along the Adriatic coast, have long been recognised for their quality and have been exploited since prehistoric times. Largely due to the use of this durable material, the architectural heritage of these regions is still remarkably well preserved. In contrast to the abundant high-quality limestone, however, marble is very scarce along the Croatian coast, and this material began to be imported at the beginning of the 4<sup>th</sup> century BC, following the Greek colonisation of the Adriatic islands. Later on, as the area became a part of the Roman Empire, Roman civilisation became the dominant cultural influence on the local population, and the characteristically Roman standardisation of construction methods and the large-scale production of architectural elements, sepulchral monuments, and sculptures increased the demand for both limestone and marble. At that time numerous limestone quarries were opened up, some of which still remain in operation today. In Roman times the exportation of local limestone products began to spread within the Adriatic basin and beyond, but the Roman fashion for imported marble also affected the populations of the Roman colonies on the eastern Adriatic coast. During the Roman Imperial and Early Byzantine periods, Parentium, Pola, Iader, Salona, Aequum, Narona, and Epidaurum, brought expensive marble products to decorate their buildings from different Mediterranean regions, particularly Greece, Egypt and Asia Minor. Since the importation of marble was interrupted during the Middle Ages, these durable and often colourful materials were reutilised for the production of church furniture, tombs, and sarcophagi. These witnesses of ancient splendour are also found in Renaissance and Baroque buildings in second or even third reutilisation, extending their life span to the present day.

At the ASMOSIA X Conference held in Rome in 2012, the Association Executive Committee members suggested the forthcoming conference be held in Split, and we enthusiastically accepted the proposal. Nearly one hundred sixty scientists and scholars in the fields of archaeology, art history, architecture, geology, chemistry, physics, restoration and conservation of stone coming from twenty-eight countries took part in the ASMOSIA XI Conference, held from May 18 to 22, 2015. Ninety lectures were presented in 8 thematic sessions at the conference: Use of Marble; Provenance Identification I (Marble); Provenance Identification II (Other stone); Advances in Provenance Techniques, Methodologies and Databases; Quarries and Geology; Stone Properties, Weathering

Effects and Restoration; Pigments and Painting on Marble. The tradition of exploiting and the techniques of extracting and processing stone, the quality and types of limestone in ancient Dalmatia and Istria, the export of stone products from this area to the Mediterranean Basin, and the various types of marble imported into the area during Roman times, as well as their reutilisation in later historical periods were presented in the Special Theme Session: The Use of Marble and Limestone in the Adriatic Basin in Antiquity. In two sessions dealing with these topics, seventy-three posters were exhibited as well.

The ASMOSIA XI Conference was organised by the Faculty of Civil Engineering, Architecture and Geodesy and the Arts Academy of the University of Split. All the sessions were held in two Gothic palaces situated within Diocletian's Palace (the Split City Museum and the Zlatna Vrata Centre for Culture and Lifelong Learning), which contributed to the special ambience of the conference. On this occasion, the "*Marmore laudata Brattia*" exhibition by Ivo Donelli was also set up, presenting all the limestone types of the island of Brač, as well as the quarries, traditional tools, and stone extraction techniques. A visit to the archaeological site of the city of Salona and a visit to the Archaeological Museum in Split were organised as part of the conference. Upon the closing of the conference, an excursion to the island of Brač was arranged as well, within which the participants visited the ancient Rasohe quarry, Škrip Museum, the Stonemasonry School, and the contemporary stone quarry in Pučišća. The trip ended with a lunch that enabled the participants to enjoy authentic Dalmatian cuisine within a traditional setting.

We would like to thank the Executive Committee for the honour they bestowed upon us by entrusting us with the organisation of the ASMOSIA XI Conference in Split, thus providing us with the opportunity to introduce our foreign colleagues to our built-in-stone heritage. We would like to thank Yannis Maniatis, President of the ASMOSIA Association, whose detailed instructions helped significantly in the organisation of the conference. A special debt of gratitude is owed to Pilar Lapuente who provided us with precious advice and support. We would like to take this opportunity to thank all the members of the Organising Committee and the staff whose enthusiasm contributed to the successful organization of the conference.

We hold before us the Proceedings of the ASMOSIA XI Conference held in 2015 in Split, containing 96 articles written on 1,012 pages and accompanied by 1231 illustrations. The articles are listed in 8 chapters,

corresponding to the themes of the conference. We would first like to extend our thanks to all the authors for their scientific contribution to the Proceedings. Furthermore, considering all of the papers were subjected to a scientific review, we also thank all the reviewers who performed this demanding task pro bono. Enormous gratitude goes to Kate Bošković, the conference secretary and the Proceedings technical editor, who took care of the overall correspondence with the authors and all the technical work on preparing the publication. Lastly, we would like to say that we are more than pleased with the excellent response from authors who deal with limestone and imported marble on the eastern Adriatic coast, and to express our hopes that this volume of proceedings will encourage further elaboration of the topic, thus ensuring that the region continues to enjoy its well-deserved recognition and continues to expand the understanding of its place on the map of marble and other stone in Antiquity.

Daniela Matetić Poljak and Katja Marasović

## NECROLOGY: NORMAN HERZ (1923-2013)<sup>1</sup>

Professor Emeritus Norman Herz died on 28 May 2013 in Athens, Georgia. He was one of an increasingly rare breed of scholar in the modern academic world: he was both a scientist and a humanist who truly understood the value of interdisciplinary work.<sup>1</sup>

Herz was an early pioneer in the field of geoarchaeology. As he stated in the *Preface* of his useful book, *Geological Methods for Archaeology* (co-authored with Erv Garrison in 1997), his intention in writing that book was to “show archaeologists the many ways that geological sciences can help solve their problems”. And so he did, bringing the new discipline of geoarchaeology into the mainstream of archaeological studies and forever changing the way we look at the study of stone in the ancient world.

Born in New York City, Herz received a Bachelor of Science degree from the City College of New York in 1943. He enlisted in the us Army in the 2<sup>nd</sup> World War and served in the Corps of Engineers and the Air Force. He was commissioned as a 2<sup>nd</sup> lieutenant in the Air Force in March 1945. His book *Operation Alacrity: The Azores and the War in the Atlantic*, published in 2005, reveals his participation (he was unaware of its importance at the time) in a top-secret operation in the Azores that may well have changed the course of the 2<sup>nd</sup> World War.

Herz was awarded a Ph.D. in Geology by The Johns Hopkins University in 1950. A year (1951-1952) in Greece as a Fulbright Senior Research Scholar led to a life-long interest in the applications of geology and geochemistry to archaeological research. In his ground-breaking article, co-authored with W. K. PRITCHETT, *Marble in Attic Epigraphy*, published in “American Journal of Archaeology” in 1953, Herz pointed out that the methods of marble identification then used by archaeologists relied too heavily on subjective visual inspection. He argued for a more geologically based approach. This article began the work that led him to develop a methodology that utilized petrographic (thin section and grain size), geochemical (stable isotopes), and statistical analyses in order to identify the sources of the different white marbles in the Mediterranean that were used in antiquity.

Herz had a stellar career as a hard rock research geologist that included work in the United States and Brazil. From 1952-1970 he was a Research Geologist with the United States Geological Survey; 1956-1962 was spent working in Brazil on a technical assistance program to map



and help develop resources of the country and also as a visiting Professor at the University of São Paulo. In 1970 he was appointed Professor in the Geology Department at the University of Georgia (Athens, ga), a position he held until his retirement in 1994. To augment the standard geology curriculum at the University of Georgia, Herz founded the Center for Archaeological Sciences (cas) in the mid-1980s, creating a place where students could be trained in interdisciplinary work in archaeology and the sciences, one of the very few places of its kind in the United States.

His most notable contribution to the field of geoarchaeology was the promotion of a geochemical technique: the comparative use of two stable isotopes –  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  –, plotted as a ratio against a standard mean in order to identify the sources of white marble used in antiquity in

<sup>1</sup> From *Marmora* 9 (2013), pp. 11-14, courtesy of Fabrizio Serra ed., Pisa-Roma.

the Mediterranean. This technique, pioneered by Craig and Craig, was refined by Herz and then employed as an effective sampling technique to characterize white marble quarries in the Mediterranean. After creating an extensive database of quarries in Greece, Italy, and Turkey, Herz then used the same practice of isotopic analysis on individual marble artifacts in order to determine their provenance (their results were compared to his database of quarry samples), as well as to associate broken pieces of statuary or inscriptions, and to determine the authenticity of weathering patina. Herz's work set the standard for the study of the provenance of white marble in the Mediterranean. His generous publication of his database in 1985 allowed other scholars to build upon and to extend his work.

In 1988, Herz was a founding member of the Association for the Study of Marbles and Other Stones used in Antiquity (ASMOSIA). The purpose of this very active and successful association was to bring archaeologists, art historians, museum curators, geologists, and chemists together in the interdisciplinary study of stone in antiquity. The creation of ASMOSIA reflects everything that Norman Herz stood for as a scholar and researcher and he remained closely involved in the organization until his death.

Herz is the author or co-editor of many books and over two hundred articles. His research was supported by grants from the National Endowment for the Humanities, the National Geographic Society, the National Science Foundation, the Samuel H. Kress Foundation, the American Philosophical Society, the nato Science Committee, and the National Research Council-National Academy of Sciences.

Herz received many honors for his work. In 1995 he was awarded the Archaeological Institute of America's Pomerance Award for Scientific Contributions to Archaeology. In 2007 he received the Geological Society of America's Rip Rapp Archaeological Geology Award for his outstanding contributions to the interdisciplinary field of archaeological geology. In 1981 he won the University of Georgia (Athens, GA) Creative Research Medal. For his accomplishments and teaching in Brazil, he was elected a Foreign Member of the Brazilian Academy of Sciences in 1991.

Norman Herz was a respected scholar, a considerate colleague, and an inspiring teacher. He was also a warm and unpretentious human being with a great sense of humor. He helped many young scholars get their start in the field, was generous with his data and resources, and remained an engaged and positive presence in the field even after his retirement. As a pioneer in the field of geoarchaeology, his visionary work will continue to serve as a paradigm for future research.

Susan Kane

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