

# Recycling of Marble: Apollonia/Sozousa/Arsuf (Israel) as a Case Study

---

Fischer, Moshe; Tambakopoulos, Dimitris; Maniatis, Yannis

Source / Izvornik: **ASMOSIA XI, Interdisciplinary Studies on Ancient Stone, Proceedings of the XI International Conference of ASMOSIA, 2018, 443 - 456**

Conference paper / Rad u zborniku

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

<https://doi.org/10.31534/XI.asmosia.2015/02.29>

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:123:908373>

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

Download date / Datum preuzimanja: **2024-07-18**



Repository / Repozitorij:

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





# 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

<b>PRESENTATION</b> .....	15
<b>NECROLOGY: NORMAN HERZ (1923-2013) by Susan Kane</b> .....	17
<b>1. APPLICATIONS TO SPECIFIC ARCHEOLOGICAL QUESTIONS – USE OF MARBLE</b>	
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 <sup>th</sup> C.) and the Basilica of San Lorenzo (5 <sup>th</sup> 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 <sup>nd</sup> C. Bc – Late 1 <sup>st</sup> C. Ad) <i>Stefan Ardeleanu</i> .....	155
<i>Amethystus</i> : Ancient Properties and Iconographic Selection <i>Luigi Pedroni</i> .....	167
<b>2. PROVENANCE IDENTIFICATION I: (MARBLE)</b>	
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 <sup>th</sup> And 17 <sup>th</sup> 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
<b>3. PROVENANCE IDENTIFICATION II: (OTHER STONES)</b>	
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
<b>4. ADVANCES IN PROVENANCE TECHNIQUES, METHODOLOGIES AND DATABASES</b>	
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
<b>5. QUARRIES AND GEOLOGY</b>	
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
<b>6. STONE PROPERTIES, WEATHERING EFFECTS AND RESTORATION, AS RELATED TO DIAGNOSIS PROBLEMS, MATCHING OF STONE FRAGMENTS AND AUTHENTICITY</b>	
Methods of Consolidation and Protection of Pentelic Marble <i>Maria Apostolopoulou, Elissavet Drakopoulou, Maria Karoglou and Asterios Bakolas</i> .....	749
<b>7. PIGMENTS AND PAINTINGS ON MARBLE</b>	
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
<b>8. SPECIAL THEME SESSION: „THE USE OF MARBLE AND LIMESTONE IN THE ADRIATIC BASIN IN ANTIQUITY”</b>	
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
<b>INDEX OF AUTHORS</b> .....	1009

## RECYCLING OF MARBLE: APOLLONIA/SOZOUSA/ARSUF (ISRAEL) AS A CASE STUDY

Moshe Fischer<sup>1</sup>, Dimitris Tambakopoulos<sup>2</sup> and Yannis Maniatis<sup>2</sup>

<sup>1</sup>Institute of Archaeology, Tel Aviv University, Israel (fischer@post.tau.ac.il)

<sup>2</sup>Laboratory of Archaeometry, Institute of Nanoscience and Nanotechnology, NCSR “Demokritos”, Attiki, Greece. (d.tambakopoulos@inn.demokritos.gr; y.maniatis@inn.demokritos.gr)

### Abstract

The focus of this paper is the latest reuse of marble items (spolia) at the site of Apollonia/Sozousa/Arsuf (Israel) during the Crusader period (12<sup>th</sup> -13<sup>th</sup> centuries CE). In spite of the intensive excavations carried out in the last decades at the site and the richness of information regarding the Roman and Byzantine periods only a few marble items originating in these periods have been found in situ. However, a great part of the items unearthed or surveyed at Apollonia could have been related typologically to these periods. Most of them were found in or close to the massive remains of the Crusader period, and in this case, mainly as spolia, partly in their original shape but mostly refurbished for use other than that first intended.

### Keywords

use, spolia, reuse/recycling, provenance, marble, stable isotopes, EPR, grain size

### Introduction

The site of Apollonia/Sozousa/Arsuf (Israel) is located ca. 15 km north of Tel Aviv-Jaffa (Fig. 1) overlooking the Mediterranean coast (Fig. 2). It is Persian-Hellenistic in origin, known as the Phoenician city of Rishpon, becoming later the Hellenized Apollonia, one more of the tens of cities bearing the name of the god of Greek colonization (SHACHAR 2000). That Greeks or Hellenized Phoenicians were living at the site as early as the Persian period is well supported by Greek pottery (ROLL and TAL 1999) and even by a well preserved Attic *Totenmahl-relief* made of Pentelic marble (FISCHER, TAL 2003). The city developed under Roman and Byzantine rule yet only a few remains have been preserved and that in spite of the intensive excavations carried out at the site over the last decades (for a summary see [http://archaeology.tau.ac.il/?page\\_id=4668](http://archaeology.tau.ac.il/?page_id=4668)). The most outstanding buildings are a Roman maritime villa (ROLL, TAL 2008) and a richly decorated church (BIRNBAUM *et al.* 1990). Due to the massive reuse of the site through the late antique and

medieval periods the main antique structures have been rebuilt and their items refurbished in later times. During the Early Islamic period (8<sup>th</sup>-11<sup>th</sup> century CE) Apollonia, now known as Arsuf, was a strong harbor that incorporated one of the famous outposts along the coast at which the ransoming of prisoners was mainly carried out. In 1101 CE the city was taken by the Crusaders, renamed Arsuf (also Arsur), becoming famous after the victory of Richard the Lion-Heart over Saladin at the Battle of Arsuf in 1191. Becoming a leading fortified city and fortress owned by the House of Ibelin and after 1261 by the Hospitallers, it entered the history of the region through its siege and conquest by the Mameluke sultan Baybars in 1265. The latter razed the city to its foundations, an event from which it never recovered. The relatively long rule of the Crusaders and their intensive building and fortifying policy are the answer to the question of the rather sparse architectural and decorative items of the previous periods. Ninety per cent of this material originates in such recycled structures. The re-and misuse of marble items at Apollonia has a long history culminating in some belligerent events from WWI. Then, a British unit lifted some marble columns from the site in order to mark the spots where the Scottish regiment crossed the River Yarqon; they are still there (MASSEY 1919, 235-36).

Thus the site of Apollonia is a challenging spot for the examination of spolia, and in this case mainly of marble items. Without going here into details regarding the use of spolia and their meaning (SARADI 1997) we focus on the spolia used by the Crusaders for very practical reasons: for fortifications, weapons and architecture, a quite common trend of this culture (GREENHALGH 2008).

As has been pointed out in the past, in Ancient Israel marble decorated mainly Caesarea Maritima (the capital of the province *Palaestina*) and Ascalon both located at the Mediterranean coast (FISCHER 1998), but also Scythopolis (Beth Shean) in the Jordan Valley (MAZOR, ATRASH 2015). Other sites also devoted a part of their efforts in the use of marble for special projects. One of these sites was Apollonia/Sozousa/Arsuf, where the main use of marble can be dated to the Byzantine period and a massive re-used and also misuse have been attributed to the Crusader period. A provenance analysis

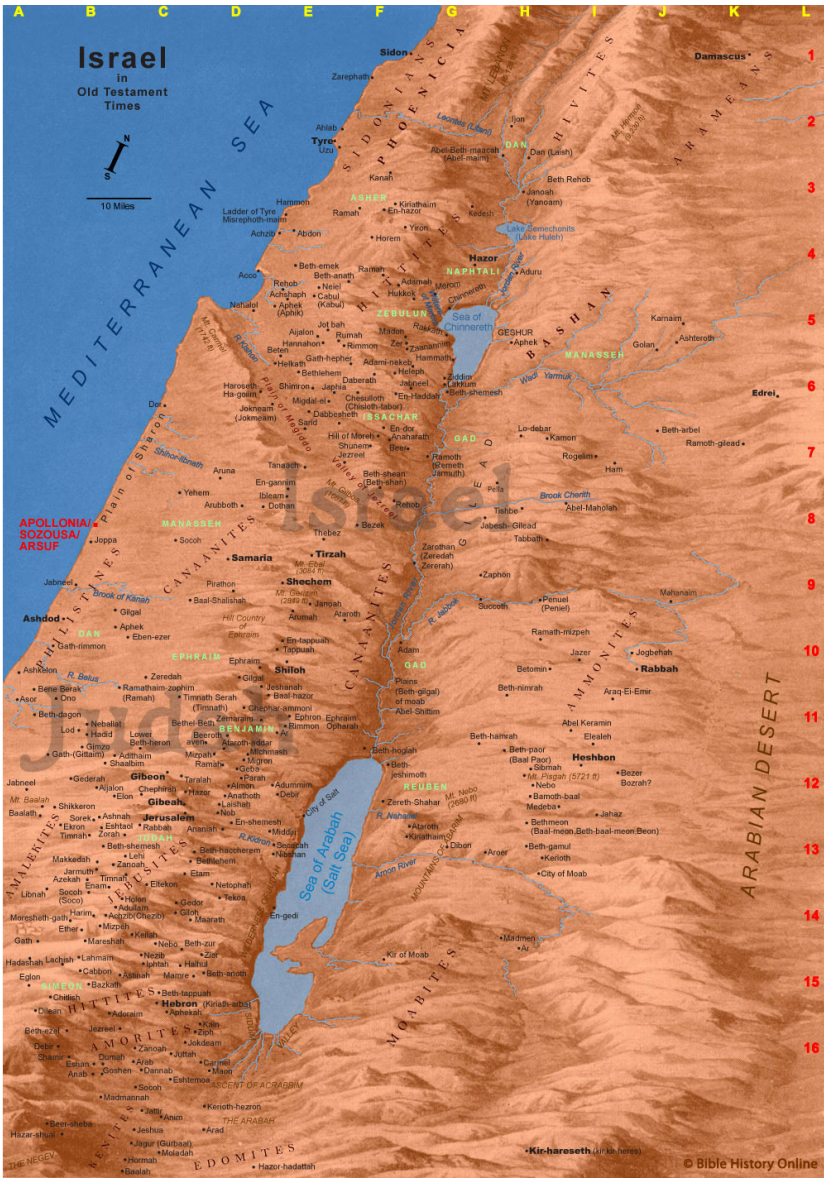


Fig. 1. Location of Apollonia



Fig. 2. Aerial view of Apollonia



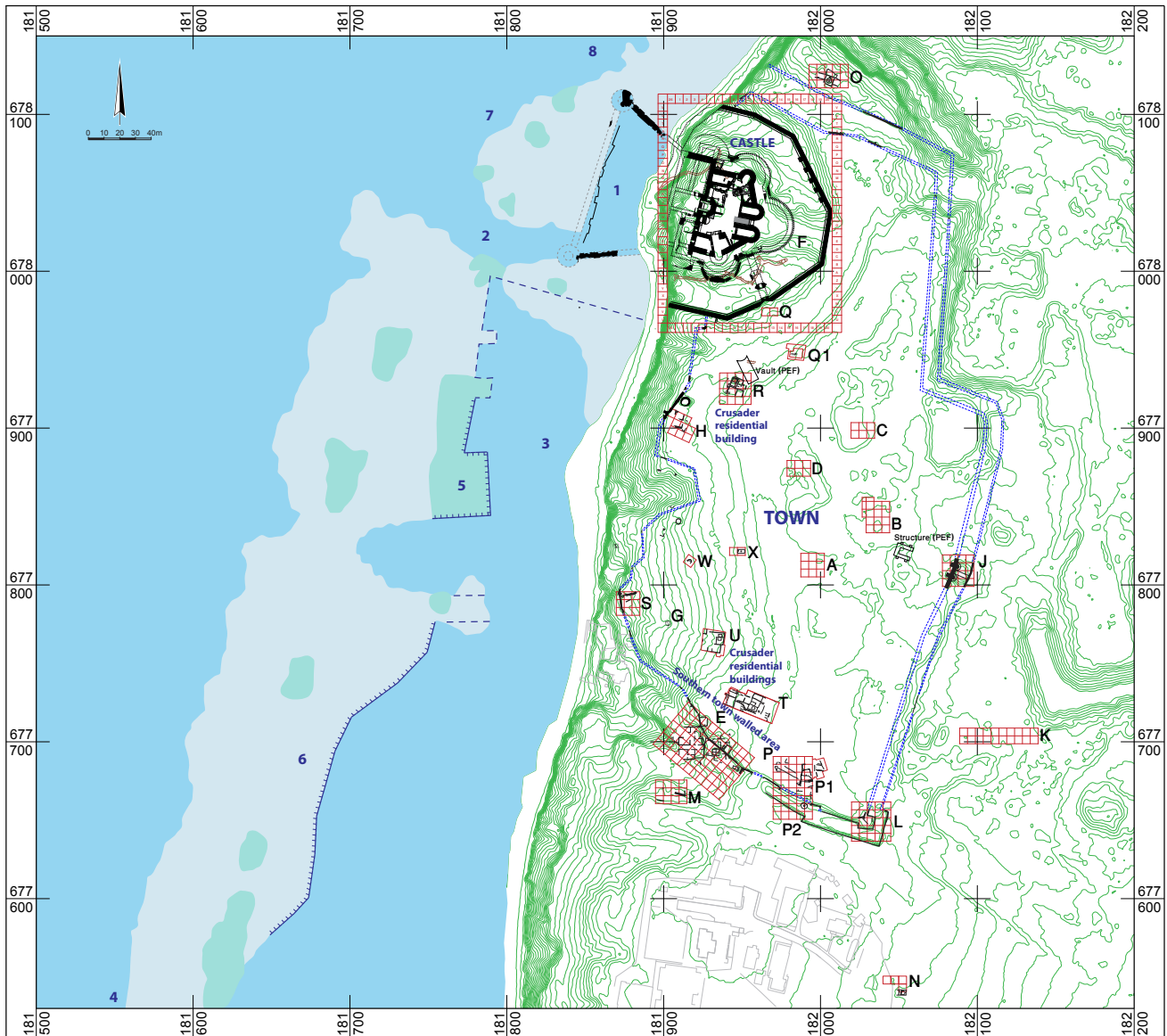


Fig. 3. Plan of the site

with scientific techniques has been carried out for some of these items, which is the subject of this paper.












### The items under examination

For this project 21 items from Apollonia have been chosen, out of 500 items, to be tested for marble provenance examination. Table 1 provides a list of the items with descriptions and photos. They represent column bases, shafts and capitals, most of them with clear signs of reuse in periods later than those of their original use. Following their typological characteristics the items belong to a rather large chronological span beginning with the Roman Imperial period (2<sup>nd</sup> century CE) and ending with the Crusader rule in the region (12<sup>th</sup> century CE).

The items were found in Crusader structures (Fig. 3), cut and refurbished for fortifications (Figs. 4-5)

and weapons. Thus, mainly fragments of columns (**Items 1, 2, 7**, Table 1) were found in one of the central rooms of the fortress in a kind of workshop for cutting columns for catapult stones, which remained in situ (Figs. 6-7). Among these items a fragmentary statuette of a head with curled hair was found (**Item 21**), a relic of a Byzantine period (SMITH 1999, 168, Pl. X: 3-4). This destructive reuse of columns and statuary for catapult missiles is worth mentioning. Their production was due to the exigencies of the time of the Mameluke siege, the Crusader defense and finally the conquest of the city, between April 26 and 29, 1265 (AMITAI 2005). Of these catapult stones, 2748 have been retrieved and recorded in the site, from all over the fortress.

The issue of reuse of marble items (as well as the local kurkar items) for two main purposes is relevant for the history of Apollonia as well as that of the reuse of marble in the region. One of the kinds of reuse is related

 <p><b>Item 1.</b> Column prepared for cutting for catapult missile (Byzantine 6<sup>th</sup> c. CE). Marble: Greyish, transparent</p>	 <p><b>Item 2.</b> Fragment of column prepared for catapult missile. Marble: Whitish</p>
 <p><b>Item 3.</b> Byzantine capital cut in half (6<sup>th</sup> c. CE). Marble: White, high transparency.</p>	 <p><b>Item 4.</b> Byzantine capital without volutes and helices (6<sup>th</sup> c. CE). Marble: Whitish</p>
 <p><b>Item 5.</b> Byzantine medallion capital (6<sup>th</sup> c. CE). Marble: Whitish, transparent</p>	 <p><b>Item 6.</b> Ionic-Attic base (Roman 3<sup>rd</sup> c. CE). Marble: Whitish, transparent</p>
 <p><b>Item 7.</b> Column (Roman 3<sup>rd</sup> c. CE). Marble: Whitish, weathered, fine grey parallel striations</p>	 <p><b>Item 8.</b> Medallion capital with cross (Byzantine 6<sup>th</sup> c. CE). Marble: White, greyish, grains broken and angular</p>
 <p><b>Item 9.</b> Byzantine cyma capital (6<sup>th</sup> c. CE). Marble: White, high transparency</p>	 <p><b>Item 10.</b> Ionic-Attic base (Late Roman, 4<sup>th</sup> c. CE). Marble: Whitish, transparent</p>
 <p><b>Item 11.</b> Ionic-Attic base (Late Roman 4<sup>th</sup> c. CE). Marble: Greyish, well crystallized</p>	 <p><b>Item 12.</b> Ionic-Attic base recut as jamb (Late Roman, 4<sup>th</sup> c. CE). Marble: Whitish, transparent, well crystallized</p>






 <p><b>Item 13.</b> Ionic-Attic base (Late Roman. 4<sup>th</sup> c.CE). Marble: Greyish, transparent, well crystallized</p>	 <p><b>Item 14.</b> Column (Roman or Byzantine). Cut for door/window jambs/thresholds (Roman). Marble: Whitish, well crystallized</p>
 <p><b>Item 15.</b> Column (Roman or Byzantine) with signs of cutting and sawing. Marble: Grey, well crystallized, grains broken and angular</p>	 <p><b>Item 16a-b-c.</b> Ionic-Attic base (Roman 3<sup>rd</sup> c. CE) transformed into a door frame. Marble: Whitish, well crystallized, transparent</p>
 <p><b>Item 17a-b.</b> Fragment of a mutilated statue (Roman 2<sup>nd</sup> c. CE). Marble: White, fine grained, schistolithic veins</p>	<p><b>Item 18.</b> Fragment of figured Capital (Roman 3<sup>rd</sup> c. CE). Marble: White, well crystallized</p> <p><b>Item 19.</b> Handle of bowl (Byzantine 6<sup>th</sup> c. CE) Marble: Light grey</p> <p><b>Item 20.</b> Revetment (Byzantine 6<sup>th</sup> c. CE). Marble: White, well crystallized</p>
 <p><b>Item 21.</b> Head with curly hair of a statuette (Byantine 6<sup>th</sup> c. CE) recycled as catapult missile. Marble: Grey, heteroblastic, one side with ~0.5 mm grains and one with 2-2.4 mm</p>	

Table 1. List of items examined with archaeological and marble descriptions and photos



Fig. 4. Reused column as a threshold of the Crusader fortress gate



Fig. 6. View of the catapult missile workshop



Fig. 5. Reused column as wall stabilization of the Crusader fortress



Fig. 7. View of the catapult missiles in one of the towers of the Crusader fortress

to the building program typical of the few years of the Hospitallers' rule at the site (1261-1265 CE). Every worked item had to be recycled. Thus, our **Item 16** is a wonderful example of reuse, a massive Ionic-Attic base for a door or window jamb, presumably for a main building of this last stage of the site, such as a chapel or church.

A number of columns which were in the process of being cut, sawn and refurbished have also chosen for examination (**Items 1, 2, 7, 14 and 15**). They belong to a larger span of Roman and Byzantine period since it is rather difficult to determine their exact dating.

On the other hand, the Corinthian capitals (**Items 3, 4, 5, 8 and 9**) are perhaps more relevant due to the possibility of their typological and chronological identification. They are of late Roman and Byzantine design. All of them indicate workshops of the Constantinopolitan area, which is supported also by their Proconnesian marble provenience, as shown by the analysis results (Table 3).

**Item 3** is of the type of Late Roman Corinthian capital including a part of the repertoire of the Roman "classic" capital, namely two row of acanthus leaves, volutes and helices, a well-defined abacus without, however, any caules or calyx. In his book, KAUTZSCH (1936, 98-111) presents four types of Late Roman capitals recorded by him in Jerusalem, which have one crucial common trend, namely the full repertoire of the Roman capital but only **Type IV** (1936, 108-111, Nos. 317-337) has both volutes and helices and yet lacks caules and calyx, as in our case. Their acanthus is fleshy yet with sharply cut tips, somewhat curled upwards (Kautzsch's 'aufgekrümmte' *Innenzacken*). A group of such marble capitals occurs in the Temple Mount of Jerusalem (WILKINSON 1987, Nos. 104-108). They are marked with letters/numbers such as IZ (=Greek 17) (104), KA (=21) (105), KB (=22) (106), KE (=25) and were dated by Wilkinson according to Kautzsch to the **5.-6.c.CE**. Further investigations carried out in Constantinople would point to the first third of the 5<sup>th</sup> century CE (ZOLLT 1994: 46-47).



Fig. 8.  
Crusader capital of door jamb  
made of a Roman marble column

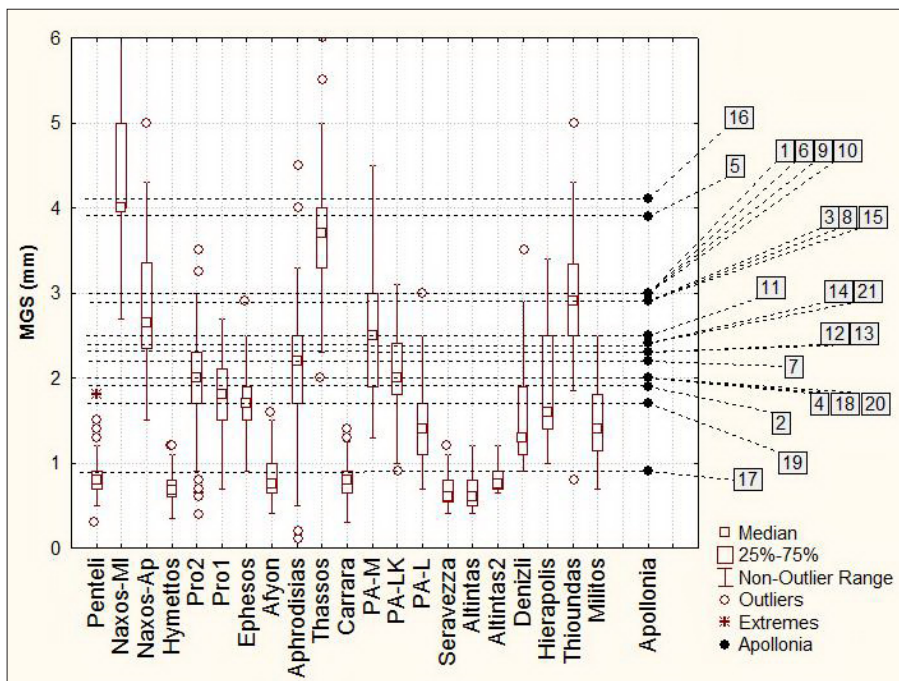


Fig. 9.  
The MGS for the samples  
measure against the database of  
MGS for known ancient quarries.  
Data from own laboratory and  
ATTANASIO 2006.

**Item 4** represents capitals with one row of acanthus leaves and highly grown corner leaves and thin volutes. A central leaf is below the abacus flower. According to ZOLLT (1994, 176, No. 490, Pl. 41) and based on parallels this type can be dated to the 6<sup>th</sup> century CE.

**Item 9** is a Corinthian capital with two rows of acanthus leaves and schematic thin volutes only, yet together with two rhomboid additions marking the place of the helices. A schematic cymatium decorates the upper part of the calathus, beneath the abacus, reminding us of features of the Composite style. The decoration of the calathus by a cymatium is rather uncommon. According to ZOLLT's examples though with plain calathus (1994, 145; 158, Nr. 391 and 429) it can be dated to the second half of the 5<sup>th</sup> century CE.

**Items 5 and 8** are capitals with one row of acanthus leaves, and a bulk emerging from the calathus recalling the shape of an oval medallion which is limited by pseudo-calyces. They represent a rather popular type of the mid-5<sup>th</sup> to mid-6<sup>th</sup> century CE (ZOLLT 1994, Nr.

344, 365, Fig. 11; Pl. 39); One of them (8) has a cross in the medallion, also rather popular through this period, seen for example in a group of capitals from Side (GUIDOBALDI *et al.* 1992: [239-247] Fig. 390; also BARSANTI 1989, 135-138, Figs. 52-58).

Judging from their style these capitals could have been part of the decoration of some monumental structures from the Byzantine period, such as the church mentioned above. Their style is rather eclectic, suggesting a variety of building projects, but this does not mean that they could not have been used in the same building complex, which was a common feature in provincial Byzantine architecture.

Further architectural items could also have been part of such Byzantine structures, but could have been already reused at that time as Roman spolia. This is the case with **Items 6, 10, 11, 13 and 16**, Ionic-Attic bases of Roman design (SHOE MERITT 1969, 188) which can be dated to the Late Roman and Byzantine period (FISCHER 1998, 81-86). The main characteristic of these bases is

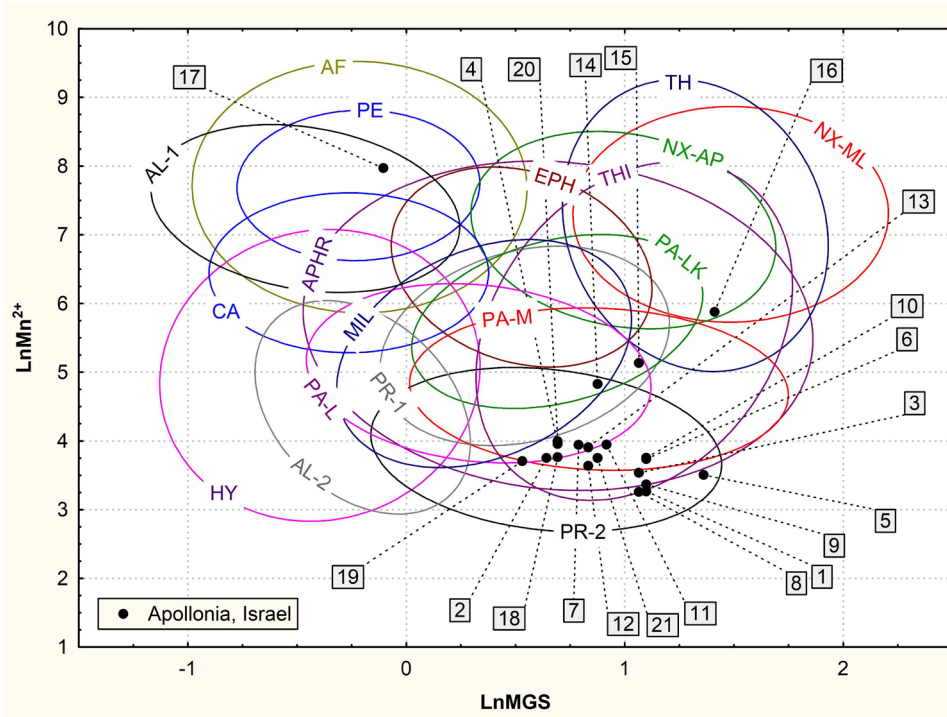


Fig. 10. The natural logarithm of the  $Mn^{2+}$  intensity measured from the EPR spectrum ( $LnMn^{2+}$ ) versus the natural logarithm of the MGS ( $LnMGS$ ) of the archaeological samples plotted against all known ancient marble quarries. The ellipses represent the distribution of the equivalent geological sample parameters: Afyon (Dokimeion) (AF), Altintas (AL-1 and AL-2), Penteli (PE), Naxos-Apollon and Naxos-Mellanes (NX-AP, NX-ML), Ephessos (EPH), Aphrodisias (APHR), Paros-Lychnites (PA-L), Paros-Marathi (PA-M, Paros-Lakoi (PA-LK), Proconnessos (PR-1 and PR-2), Thassos-calcitic (TH), Hymettos (HY), Carrara (CA), Miletos (MIL) and Thiountas (THI). The database is that of the Laboratory of Archaeometry, NCSR “Demokritos” (MANIATIS et al. 1988; MANDI 1993; POLIKRETI 1999; MANIATIS, POLIKRETI 2000; POLIKRETI, MANIATIS 2002; TAMBAKOPOULOS 2007) except from the Carrara, Miletos and Thiountas data which are taken from ATTANASIO (2006).

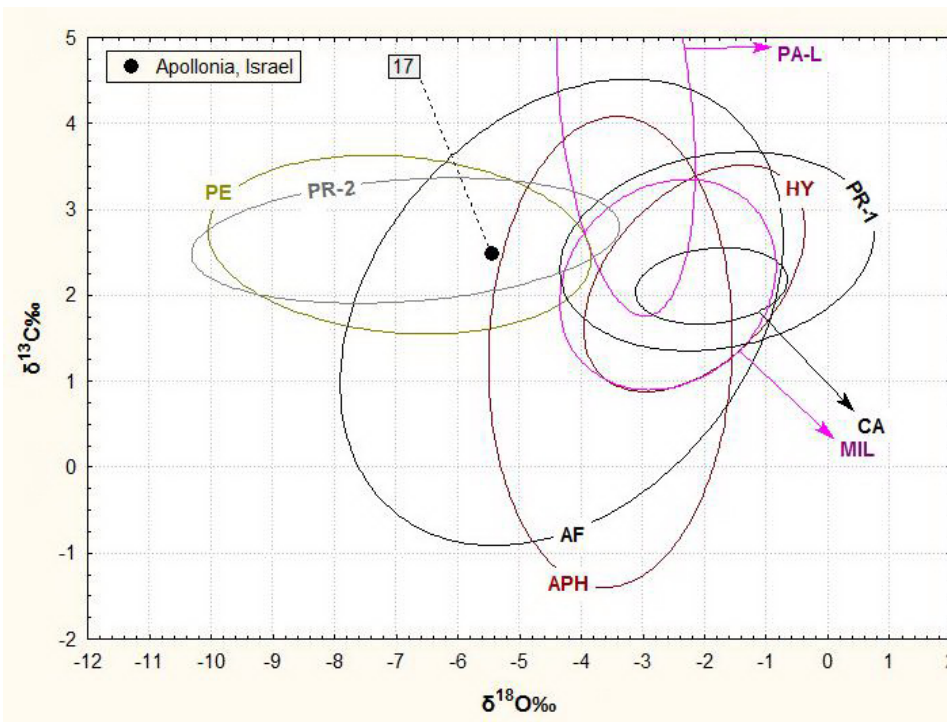


Fig. 11. The isotopic signature of the fine-grained sample no. 17 against the isotopic fields (ellipses) of known quarries with relatively fine-grained marble. Data for the isotopic fields from HERZ 1985, 1987 and 1987; ATTANASIO 2006 and our own laboratory.

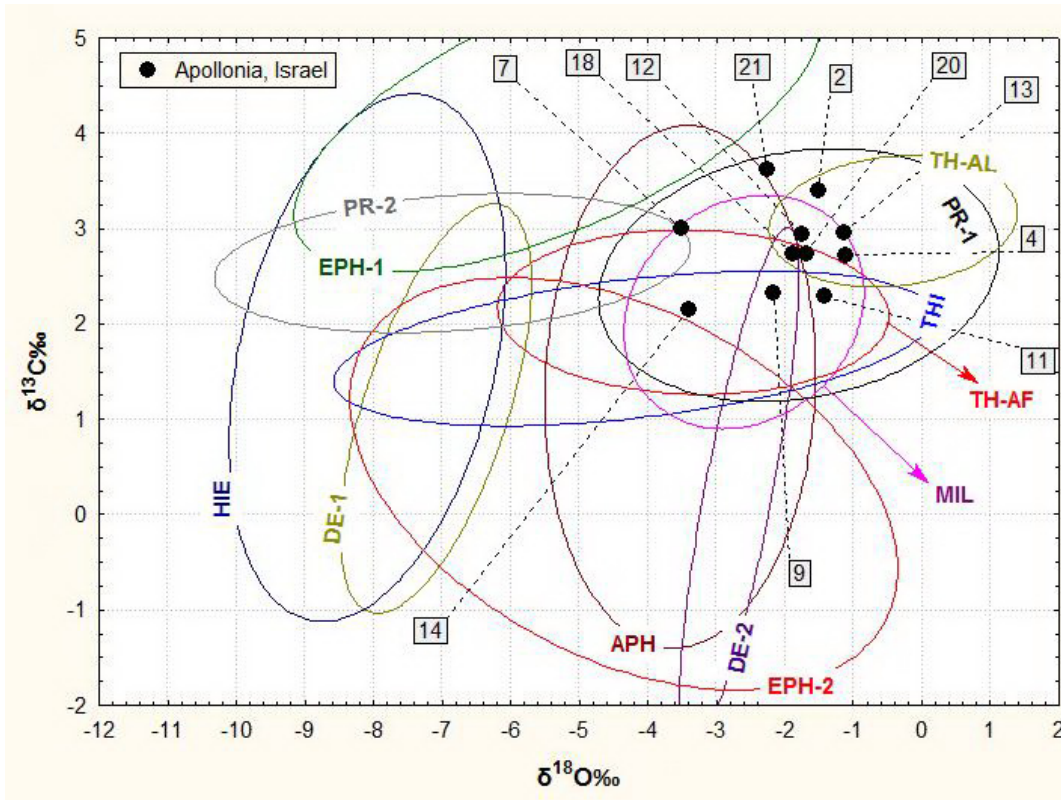


Fig. 12. The isotopic signature of the medium-grained marble samples against the isotopic fields (ellipses) of known quarries with medium-grained marble. Additional quarry fields in this diagram are: Denisli (DE-1 and 2) and Thasos-Akropolis&Fanari (TH-AF). Data for the isotopic fields from HERZ 1985, 1987 and 1987; ATTANASIO 2006 and our own laboratory.

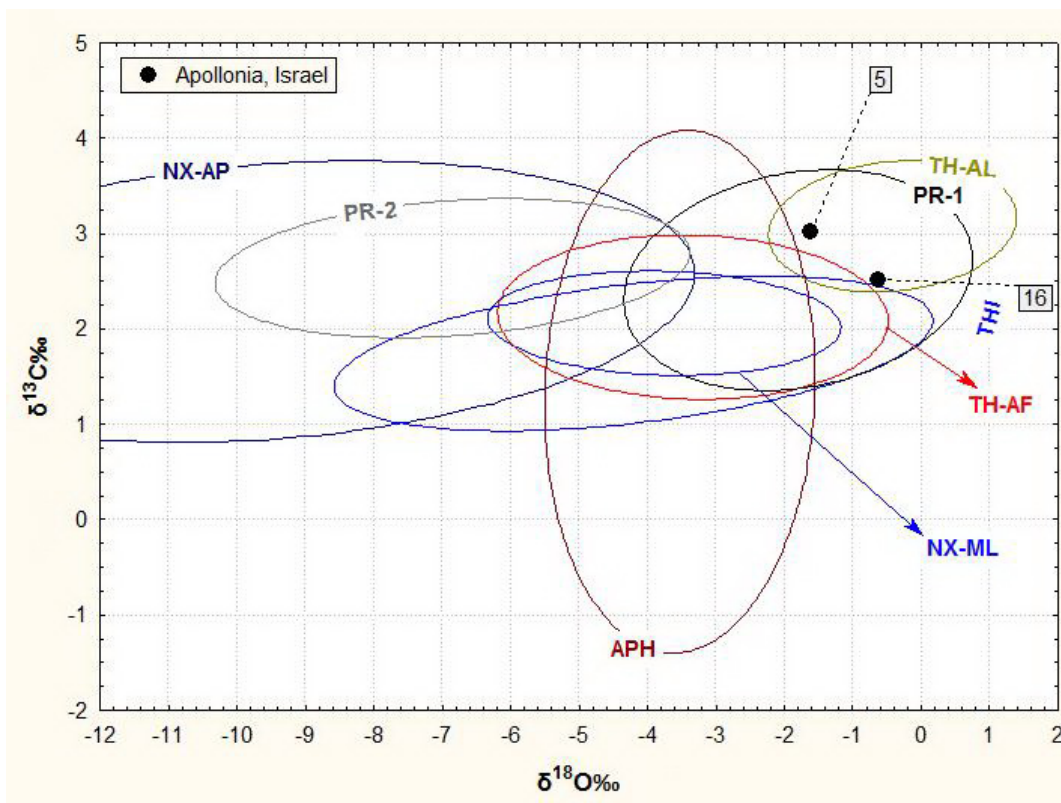


Fig. 13. The isotopic signature of the coarse-grained marble samples against the isotopic fields (ellipses) of known quarries with coarse-grained marble. Data for the isotopic fields from HERZ 1985, 1987 and 1987; ATTANASIO 2006 and our own laboratory.

Sample no	MGS (mm)	MFS (mm)	Dol (%)	Mn <sup>2+</sup> (r.u.)	Width (Gauss)	Fe <sup>3+</sup> (r.u.)	δ <sup>13</sup> C (‰)	δ <sup>18</sup> O (‰)
1	3.0	1.5-2.0	-	26.22	2.20	13.02	-1.30	1.89
2	1.9	1.5	0.26	42.61	2.53	3.13	-1.51	3.41
3	2.9	2.0	-	34.31	2.00	0.00	-1.79	2.60
4	2.0	1.5	-	52.32	1.95	0.00	-1.11	2.72
5	3.9	2.0-3.0	-	33.29	2.82	0.00	-1.61	3.03
6	3.0	1.0-2.5	-	42.02	1.88	9.66	-1.03	2.95
7	2.2	1.0	-	51.66	2.51	5.79	-3.49	2.98
8	2.9	2.0	-	26.00	3.24	6.36	-1.78	2.50
9	3.0	2.0	-	29.03	1.64	0.00	-2.16	2.33
10	3.0	2.0	0.20	42.80	2.67	7.32	-2.30	2.81
11	2.5	1.0-2.0	0.18	51.86	2.88	5.79	-1.41	2.29
12	2.3	1.0-1.5	tr	38.02	2.50	5.27	-1.75	2.94
13	2.3	1.0-1.5	0.25	49.79	2.25	8.00	-1.14	2.96
14	2.4	1.0-1.5	tr	125.35	1.73	14.77	-3.40	2.15
15	2.9	1.0-2.0	-	169.75	2.53	6.53	-2.56	2.14
16	4.1	1.0-2.5	-	357.02	2.43	8.77	-0.58	2.50
17	0.9	0.5	-	2897.97	2.79	11.50	-5.44	2.48
18	2.0	1.0-2.0	-	43.15	1.63	17.53	-1.87	2.73
19	1.7	1.0	0.19	40.68	2.21	6.17	-2.26	2.31
20	2.0	1.0-2.0	-	54.35	1.79	0.00	-1.69	2.73
21	2.4	0.5-2.0	0.34	42.71	4.36	0.00	-2.25	3.62

Note: MGS = Maximum Grain Size, MFS=Most Frequent Grain Size, tr = traces, (r.u.) = relative units.

Table 2. The values of the measured parameters for all the samples

their massive recycling and later reuse, presumably by the Crusaders. Item 16 shows the whole process from a regular Ionic-Attic base to the creation of the door or window jamb. Since these items have been found in the debris of the Crusader fortress it seems that they were prepared for the latter, in one of the most elegant of the buildings, perhaps a chapel, which is still missing in the field. Some decorative remains of such a building have been retrieved; most of them were made of local sandstone (kurkar) but some of them of reused marble. An outstanding well elaborated doorjamb capital with figured decoration was refurbished from an ancient marble column of Proconnesian origin (fig. 8) (TAL ed. 2011, [29-31], Fig. 17).<sup>1</sup>

<sup>1</sup> This item (Reg. Nr.AP2010-0054) altogether with further architectural and decorative remains from the Crusader period have been studied by Vardit Schot-

**Item 17** is probably the most elaborated sculptural fragment of the site. It represents a life-size thigh of a male seated statue and the remains of the drapery covering the piece. It reminds us of the style and design of the seated type of Ares Ludovisi or Apollo Kitharoidus (best examples in Palazzo Altemps) as reflected by many Roman Imperial copies (RIDGWAY 1990, 84, Pls. 48-51), such as the

ten-Hallel as part of her PhD Dissertation submitted to the Hebrew University in Jerusalem and will form part of a Research Project investigating the Crusader chapel at Apollonia, supported by the Israeli Science Foundation and headed by Oren Tal on behalf of the Institute of Archaeology, Tel Aviv University. Our thanks are due to Vardit Schotten-Hallel for her information regarding these items and to Oren Tal for his permanent support of the Research of Marble at Apollonia, carried out by Moshe Fischer during the past years.



Sample no	Type of object	Date	Provenance 1 <sup>st</sup> choice	Provenance 2 <sup>nd</sup> choice
1	Column prepared for cutting for catapult missile	Byzantine 6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
2	Fragment of column prepared for catapult missile	Roman or Byzantine	<b>Proconnesos</b>	-
3	Byzantine capital cut in half	6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
4	Byzantine capital without volutes and helices	6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
5	Byzantine medallion capital recut	6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
6	Ionic-Attic base cut to a quarter of it	Roman Imperial 3 <sup>rd</sup> c. CE	<b>Proconnesos</b>	-
7	Column cut and reused as threshold	Roman Imperial 3 <sup>rd</sup> c. CE	<b>Proconnesos</b>	-
8	Medallion capital with cross	Byzantine 6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
9	Byzantine cyma capital	Byzantine 6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
10	Ionic-Attic base with mason mark	Roman Imperial 3 <sup>rd</sup> c. CE CE	<b>Proconnesos</b>	-
11	Ionic-Attic base cut into a half	Late Roman 4 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
12	Ionic-Attic base transformed in door/window frame	Late Roman 4 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
13	Ionic-Attic base with side cuttings	Roman Imperial 3 <sup>rd</sup> c. CE	<b>Proconnesos</b>	-
14	Column prepared for doorjamb/threshold	Roman or Byzantine	<b>Procennesos</b>	Paros, Aphrodisias, Thiountas, Miletos
15	Column with signs of preparation for cutting	Roman or Byzantine	<b>Procennesos</b>	Miletos, Paros
16	Ionic-Attic base transformed in door/window frame	Roman Imperial 3 <sup>rd</sup> c. CE	<b>Thassos-Aliki</b>	Paros-Lakkoi?
17	Fragment of a mutilated statue	2 <sup>nd</sup> – 3 <sup>rd</sup> c. CE	<b>Penteli</b>	-
18	Fragment of Corinthian figured capital	Roman 3 <sup>rd</sup> c. CE	<b>Proconnesos</b>	-
19	Handle of bowl	Byzantine 6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-
20	Revetment	Byzantine 6 <sup>th</sup> c. CE	<b>Proconnesos</b>	Miletos
21	Curled head of statuette; possibly recycled as catapult missile	Byzantine 6 <sup>th</sup> c. CE	<b>Proconnesos</b>	-

Table 3. Provenance assignment for the objects analyzed

Belvedere Torso (BOL 2007: Figs. 314-315).<sup>2</sup> It has also been found in the area of the fortress but as a surface find, which, unfortunately does not give any indication concerning the precise structure to which it would have belonged. It seems to be of Roman second century CE workmanship though 2<sup>nd</sup> century BCE work would not be excluded. Its marble, identified as Pentelic would also support such a dating.

Finally, another interesting piece is **Item 21**, a fragment of a statuette of a curly haired man retrieved in the area of the workshop of the catapult stones. Together with many fragments of columns they were partly refurbished as catapult stones, partly left on the spot with remains of attempts at sawing and cutting them. It has been previously published (FISCHER 2009: 408, Fig. 7). Its marble has been identified as Aphrodisian. Due to its special character and reuse it was worth reexamination, which was done for this conference. The results led to a revised identification of its origin, now identified as in Proconnesos. Only parts of the hairstyle and forehead have been preserved. The hair is very decoratively designed; reminding us of metal work with individual locks forming a highly intricate pattern of loops and S-curves with tiny drill-holes accentuating the 'eyes'. Although it strongly recalls the early classic style of the Olympia workshop it also represents the artistic trend of the revival of the latter in the sixth century CE, mainly the Justinianic period (INAN, ALFÖLDI-ROSENBAUM 1979, pp. 159-160, no. 112, pl. 269; pp. 201-202, no. 172, pl. 270,3; cf. 'togatus' from Ephesus, INAN, ALFÖLDI-ROSENBAUM 1966, pp. 157-158, no. 202); a rather similar type has been retrieved in Aphrodisias where it has been dated to that period (SMITH 1999: 168, pl. X:3-4).

### Samples and experimental techniques

Small chips were obtained from each object and subject to laboratory examination and analysis. The techniques used are (MANIATIS 2004):

1. *Examination of the chips under a stereoscopic optical microscope, qualitative examination of the marble crystalline features and measuring the maximum grain size (MGS) and most frequent grain size (MFS).*
2. *Electron paramagnetic resonance spectroscopy (EPR).*
3. *Stable isotope analysis (IRMS) for carbon and oxygen.*

Following the examination under the microscope the samples were cleaned of dirt and weathering crusts mechanically and chemically with weak acid and ground gently in an agate mortar. The obtained samples were analyzed first by EPR spectroscopy and the parameters  $Mn^{2+}$ , and  $Fe^{3+}$ , expressed in relative units (r.u.), and

*width* expressed in Gauss, were measured as described in POLIKRETI, MANIATIS 2002 and MANIATIS, POLIKRETI 2000. In addition, aliquots of the prepared samples consisting of very fine grain fractions (<63 µm) were submitted for isotope analysis to a mass spectrometer (IRMS) and the  $\delta$  values for the carbon ( $\delta^{13}C\%$ ) and oxygen ( $\delta^{18}O\%$ ) isotope ratios were measured (HERZ 1985, 1987, 1988). All spectroscopic and isotopic parameters are summarized in Table 2.

### Interpretation of the results

Figure 9 shows the MGS in mm of all the Apollonia samples against the database for MGS of known ancient quarries. Based on this we can see that we have three groups of samples which can be classed as: fine-grained (item 17), coarse-grained (items 5, 16) and medium-grained (all the rest). From this diagram certain quarries can at once be excluded as origin for each group of samples.

In the second approach the logarithm of the intensity of  $Mn^{2+}$ , as measured with EPR spectroscopy, is plotted against the logarithm of the MGS and statistically compared with the same parameters of all ancient known quarries (Fig. 10). From this diagram it can be seen that most of the samples, with just a few exceptions, fall inside the Proconnesos-1 and 2 quarry fields, but some of them in regions where there is some overlap with other quarries as well. Only item 17 falls far away from the Proconnesos fields, due to its fine-grained nature and high  $Mn^{2+}$  content, and item 16 due to its coarse grain size and higher  $Mn^{2+}$  content.

Following the above first steps of analysis and in order to clarify and distinguish the origin of the samples falling to overlapping quarry regions, we ran a statistical analysis of the isotopic signature of the samples in question against the isotopic signatures of ancient known quarries. This was done separately for each group of sample according to its grain-size. The results are presented in figures 11-13.

From the above analysis and statistical treatments in combination of all the parameters, and also with the crystalline features and other macroscopic characteristics of the marble being taken into account (MANIATIS *et al.* 2010), we can assign the provenance of the marble of the items as shown in Table 3.

As it appears from the provenance result, the majority of the objects are made of Proconnesian marble. In particular, 16 out of the 21 objects are clearly Proconnesian while another three are also Proconnesian but may have some alternative provenance. There is only one made of Pentelic marble and one of Thasos\_Aliki or Paros-Lakkoi. This shows a very strong Proconnesian connection which in the Byzantine times is easy to understand since the Proconnesian quarries were owned and managed by the Byzantine Emperors.

2 Our thanks go to Hans-Ruprecht Goette, German Archaeological Institute, Berlin for his help in identifying this fragment.

## Conclusions

One of the main expectations from the provenance analysis is the basis for the tracing of the origin of the marble items. It seems that marble items from Apollonia of an architectural character could have come from or via Caesarea Maritima – the main marble supplier of the province. Another question which we tried to answer was the internal use/reuse of marble which could be hardly identifiable after their massive reuse and thus could support their relation with other items, not so radically recycled.

The Apollonia material and its analysis also revealed the distinction between architectural items and sculpture/statuary. It seems that architectural items have been provided from Proconnesos, and, as stated above, either by direct or transit transportation (via Caesarea Maritima). Various laboratory examinations carried out in the past (summed up in FISCHER 1998, 247-259) also suggested a Proconnesian origin for most of Caesarean objects. This seems to be correlated with the historical sources of the Byzantine period in general and the Talmudic sources in particular (FISCHER 2009b). One of the items (**Item 16**) seems to have originated in Thasos-Aliki, a provider of marble for both Christian and Jewish religious furniture in the Byzantine period (SODINI 2000). On the other side, some sculptural items (**Item 17**) are of different origin. Here, **Item 17** is of Pentelic marble, as is a *Totenmahlrelief* from the site published a couple of years ago (FISCHER, TAL 2003). In summary, this paper represents a further contribution to the identification of marble items and their origin in a geographical area with a *longue durée* and a very intensive reuse of building and artistic materials in Late Antiquity and the Middle Ages.

## ACKNOWLEDGMENTS

This study is part of a larger research project aiming at the examination of marble objects at the site of Apollonia/Sozousa/Arsuf in Israel, partially funded by the Israel Science Foundation (ISF Grant No. 2050/17). Our Thanks go to Oren Tal, director of the Apollonia-Arsuf Project for his support and cooperation.

## BIBLIOGRAPHY

- AMITAI R. 2005: "The conquest of Arsuf by Baybars: political and military aspects", *Mamluk Studies Review* 9 (1), 61-83.
- ATTANASIO D., BRILLI M., OGLE N. 2006: "The isotope signature of Classical marbles", *L'Erma di Bretschneider*, Roma.
- BARSANTI C. 1989: "L'esportazione di marmi dal Proconneso nelle regioni pontiche durante il IV-VI secolo", *Rivista dell'Istituto Nazionale di Archeologia e Storia dell'Arte*, s. III, 12, 91-220.
- BIRNBAUM R. *et al.* 1990: "A Greek inscription from the Early Byzantine church at Apollonia", *Israel Exploration Journal*, 182-191.
- BOL P. C. (ed.) 2007: *Die Geschichte der antiken Bildhauerkunst III: Hellenistische Plastik*, Mainz.
- FISCHER M. 1994: "Historical and philological observations on *Marmorarii* in Byzantine Palestine in the light of two Greek inscriptions", *Mediterranean Language Review* 8, 20-40.
- FISCHER M. 1998: *Marble studies. Roman Palestine and the marble trade*, Konstanz.
- FISCHER M. 2009a: "Marble from Pentelicon, Paros, Thasos and Proconnesus in Ancient Israel: An Attempt at a Chronological Distinction", in *ASMOSIA VII*, 399-412.
- FISCHER M. 2009b: "Caesarea Maritima through its columns and capitals", in Y. PORAT Y., E. AYALON, A. IZDAREKHET (eds.): *Mikhmaney Queysareia-Studies in the History and Archaeology of Caesarea and its Neighborhood*, Jerusalem, 55-80 (Hebrew).
- FISCHER M., GROSSMARK TZ. 1996: "Marble imports and *Marmorarii* in Eretz Israel during the Roman and Byzantine periods", in R. KATZOFF (ed.): *Classical Studies in Honor of David Sohlberg*, Ramat Gan, 319-352.
- FISCHER M., TAL O. 2003: "A fourth century B.C.E. Attic marble *Totenmahlrelief* at Apollonia-Arsuf (Israel)", *Israel Exploration Journal* 53/1, 49-60.
- GALOR K., ROLL I., TAL O., SANDERS D. H., WILKIS A. R., COOPER D. B. 2009: "Apollonia-Arsuf between past and future", *Near Eastern Archaeology* 72 (1), 4-27.
- GREENHALGH M. 2008: *Marble past, monumental present. Building with antiquities in the Mediaeval Mediterranean*, Leiden.
- GUIDOBALDI F., BARSANTI C., GUIGLIA GUIDOBALDI A. 1992: *San Clemente. La scultura del VI secolo*, *San Clemente Miscellany IV*, 2, Rome.
- HERZ N. 1985: "Isotopic analysis of marble", in G. J. RAPP, J. A. GIFFORD (eds.): *Archaeological Geology*, Yale, 331-351.

- HERZ N. 1987: "Carbon and oxygen isotopic ratios: A database for classical greek and roman marble", *Archaeometry* 29 (1), 35-43.
- HERZ N. 1988: "The oxygen and carbon isotopic database for classical marble", in N. HERZ, M. WAEALKENS (eds.): *Classical Marble: Geochemistry, Technology, Trade*, NATO ASI Series E: Applied Sciences, 305-314.
- INAN J., ALFÖLDI-ROSENBAUM E. 1966: *Roman and Early Byzantine Portrait Sculpture in Asia Minor*, London.
- INAN J., ALFÖLDI-ROSENBAUM E. 1979: *Römische und frühbyzantinische Porträtplastik aus der Türkei*. Neue Funde, Mainz.
- MANDI V. 1993: *Characterisation of Marbles with ESR spectroscopy and Neutron Activation Analysis (in Greek)*, Ph. D. Thesis, Department of Chemistry, University of Athens, Greece.
- MANIATIS Y. 2004: "Scientific techniques and methodologies for the provenance of white marbles", in *Proceedings of the international school of physics "Enrico Fermi": Physics methods in archaeometry*, Ios Press, Societa Italiana di Fisica, 179-202.
- MANIATIS Y., POLIKRETI K. 2000: "The characterisation and discrimination of Parian marble in the Aegean region", in D. U. SCHILARDI, D. ATSONOPOULOU (eds.): "PARIA LITHOS", *Proceedings of 1<sup>st</sup> International Conference on the Archaeology of Paros and the Cyclades*, Paros, October 2-5. 1997, Athens, 575-584.
- MANIATIS Y., TAMBAKOPOULOS D., DOTSIKA E., TIVERIOU-STEPHANIDOU TH. 2010: "Marble provenance Investigation of Roman Sarcophagi from Thessaloniki", *Archaeometry* 52 (1), 45-58.
- MANIATIS Y., MANDI V., NIKOLAOU A. 1988: "Provenance Investigation of Marbles from Delphi with ESR Spectroscopy", in N. HERZ, M. WEALKENS (eds.): *Classical Marble: Geochemistry, Technology, Trade*, NATO ASI Series E: Applied Sciences, 443-452.
- MASSEY W.T. 1919: *How Jerusalem Was Won: Being the Record of Allenby's Campaign in Palestine*, London.
- MAZOR G., ATRASH W. 2015: *Nysa-Scythopolis: the Southern and Severan Theaters*, Jerusalem.
- POLIKRETI K. 1999: *Investigation of the Provenance and Authenticity of Ancient Marble Monuments with Electron Paramagnetic Resonance Spectroscopy and Luminescence (in Greek)*, Ph.D. Thesis, Department of Physics, University of Patras, Greece.
- POLIKRETI K., MANIATIS Y. 2002: "A new methodology for marble provenance investigation based on EPR spectroscopy", *Archaeometry* 44 (1), 1-21.
- RAPHAEL K., TEPPER Y. 2005: "The archaeological evidence from the Mamluk siege of Arsuf", *Mamluk Studies Review* 9, 85-100.
- RIDGWAY B. S. 1990: *Hellenistic sculpture (Vol. 1)*, Madison.
- ROLL I., TAL O. 1999: *Apollonia-Arsuf: Final Report of the Excavations. Volume I: The Persian and Hellenistic Periods (with Appendices on the Chalcolithic and Iron Age II Remains)*, Tel Aviv.
- ROLL I., TAL O. 2008: "A villa of the Early Roman period at Apollonia-Arsuf", *Israel Exploration Journal*, 132-149.
- SARADI H. 1997: "The use of Ancient Spolia in Byzantine monuments: the archaeological and literary evidence", *International Journal of the Classical Tradition*, Vol. 3, No. 4, 395-423.
- SHACHAR I. 2000: "Greek colonization and the eponymous Apollo", *Mediterranean Historical Review* 15 (2), 1-26.
- SHOE MERITT L. 1969: "The geographical distribution of Greek and Roman Ionic bases", *Hesperia* 38, 186-204.
- SMITH R. R. R. 1999: "Late antique portraits in a public context: honorific statuary at Aphrodisias in Caria, A. D. 300-600", *Journal of Roman Studies* 89, 155-189.
- SODINI J. P. 2000: "Le commerce des marbres dans la Méditerranée (IV<sup>e</sup>-VII<sup>e</sup> s.), in J. M. GURT, N. TENA (eds.): *V Reuni d'Arqueologia Cristiana Hispanica, Cartagena, 16-19 d'abril de 1998*, Barcelona (Monografies de la Secci Historico-Arqueologica, VII), 423-448.
- TAL O. (ed.) 2011: *The Last Supper at Apollonia. The final days of the Crusader Castle in Herzliya. Catalogue of an exhibition at the Eretz Israel Museum Tel Aviv, Tel Aviv (Hebrew and English)*.
- WILKINSON J. 1987: *Column capitals in al Haram al Sharif (From 138 A.D. to 1118 A.D.)*, Jerusalem.
- ZOLLT T. 1994: *Kapitellplastik Konstantinopels vom 4. bis 6. Jahrhundert n. Chr.* (Asia Minor Studien 14), Bonn.