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## INDEX

<i>Presentation</i> .....	XI
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### I VOLUME

#### 1. APPLICATION TO SPECIFIC ARCHAEOLOGICAL QUESTIONS - USE OF MARBLE

Architecture with concave and convex rhythms and its decoration in Hadrian age: the Maritime Theatre and the Southern pavilion of Piazza d'Oro in Hadrian's Villa, <i>B. Adembri, S. Di Tondo, F. Fantini</i> .....	3
Imported marbles found in three Roman cities of the territory of "Cinco Villas" (Zaragoza), north of Hispania Citerior, <i>J. Andreu Pintado, H. Royo Plumed, P. Lapuente, M. Brilli</i> .....	13
Pentelic marble in the Severan Complex in Leptis Magna (Tripolitania, Libya), <i>F. Bianchi, M. Bruno, S. Pike</i> .....	23
The limestone quarries of Wadi Gadatza in the territory of Leptis Magna, <i>M. Bruno, F. Bianchi</i> .....	35
Provenance and distribution of white marbles in the arches of Titus and Septimius Severus in Rome, <i>M. Bruno, C. Gorgoni, P. Pallante</i> .....	43
The imitation of coloured marbles in a first style wall painting from the Etruscan-Roman town of Populonia (LI – Italy), <i>F. Cavari, F. Droghini, M. Giamello, C. Mascione, A. Scala</i> .	55
Small Euboean quarries. The local community markets, <i>M. Chidiroglou</i> .....	63
Lumachella at Cosa: late Republican?, <i>J. Collins-Clinton</i> .....	73
Ancientmarbles.org: an open community for sharing knowledge about ancient marble from different approaches, <i>S. Costa, F. Marri</i> .....	81
The use of marble in Lusitania between Rome and Islam, <i>M. Cruz Villalón</i> .....	85
"Marmora Ostiensa". New results from the Ostia Marina Project, <i>M. David, S. Succi, M. Turci</i> .....	93
A column shaft in 'verde rana ondato' from the archaeological excavations in Palazzo Altamps, <i>M. De Angelis d'Ossat, S. Violante, M. Gomez Serito</i> .....	103
The exploitation of coralline breccia of the Gargano in the Roman and late antique periods, <i>A. De Stefano</i> .....	113
Ships lapidariae and the wreck, with <i>marmor numidicum</i> , discovered in Camarina: hypothesis of route, <i>G. Di Stefano</i> .....	119

INDEX

The use of marble in the roman architecture of Lugdunum (Lyon, France), <i>D. Fellague, H. Savay-Guerraz, F. Masino, G. Sobrà</i> .....	125
Marmora and other stones in the architectural decoration of early imperial Barcino (Barcelona, Spain), <i>A. Garrido, A. Álvarez, A. Doménech, A. Gutiérrez Garcia-M., I. Rodà, H. Royo</i> .....	135
Provenance of the Roman marble sarcophagi of the San Pietro in Bevagna Wreck, <i>M. T. Giannotta, G. Quarta, A. Alessio, A. Pennetta</i> .....	143
Thasian Exports Of Prefabricated Statuettes, <i>J. J. Herrmann, Jr., D. Attanasio, A. van den Hoek</i> .....	155
Multimethod marble identification for figural sculpture in Hippo Regius (Annaba, Algeria), <i>J. J. Herrmann, Jr., R. H. Tykot, A. van den Hoek, P. Blanc</i> .....	163
Awaiting identity: Copenhagen’s “diskophoros” and its auxiliary support, <i>M. B. Hollinshead</i>	171
Provenance, distribution and trade of the local building materials in the Sarno river plain (Campania) from the 6th century BC to AD 79, <i>P. Kastenmeier, G. Balassone, M. Boni, G. di Maio, M. Joachimski</i> .....	179
White and coloured marble on Pantelleria, <i>T. Lappi</i> .....	185
Local stones and marbles found in the territory of “Alto Aragon” (Hispania), in Roman times, <i>P. Lapuente, H. Royo, J.A. Cuchi, J. Justes, M. Preite-Martinez</i> .....	191
The Marmor Lesbium reconsidered and other stones of Lesbos, <i>E. Leka, G. Zachos</i> .....	201
The marbles from the Villa of Trajan at Arcinazzo Romano (Roma), <i>Z. Mari</i> .....	213
The introduction of marble in the cavea of the Theatre of Hierapolis: building process and patronage, <i>F. Masino</i> .....	225
Shipwrecks with sarcophagi in the Eastern Adriatic, <i>I. Mihajlović, I. Mihaljek</i> .....	233
The marble decoration of the peristyle building in the SW quarter of Palmyra (Pal.M.A.I.S. Mission), <i>S. Nava</i> .....	241
Stone materials in Lusitania reflecting the process of romanization, <i>T. Nogales-Basarrate, P. Lapuente, H. Royo, M. Preite-Martinez</i> .....	253
A uotorum nuncupatio from Colonia Augusta Firma. An analytical approach, <i>S. Ordóñez, R. Taylor, O. Rodríguez, E. Ontiveros, S. García-Dils, J. Beltrán, J. C. Saquete</i> .....	263
The Muses in the Prado Museum and the pentelic marble of the Odeon in Hadrian’s villa: workshops and statuary programmes. Preliminary report, <i>A. Ottati</i> .....	269
Local workshops of the Roman imperial age. A contribution to the study of the production of Campanian Sarcophagi, <i>A. Palmentieri</i> .....	283
Ceraunia and <i>lapis obsianus</i> in Pliny, <i>L. Pedroni</i> .....	295
Marbles from the Domus of ‘Bestie ferite’ and from the Domus of ‘Tito Macro’ in Aquileia (UD), Italy, <i>C. Previato, N. Mareso</i> .....	299
Production and distribution of Troad granite, both public and private, <i>P. Pensabene, I. Rodà, J. Domingo</i> .....	311
The use of Almadén de la Plata marble in the public programs of Colonia Augusta Firma – Astigi (Écija, Seville, Spain), <i>O. Rodríguez, R. Taylor, J. Beltrán, S. García-Dils, E. Ontiveros, S. Ordóñez</i> .....	323

INDEX

Architectural elements of the Peristyle Building of the SW quarter of Palmyra (PAL.M.A.I.S. (PAL.M.A.I.S. Mission), <i>G. Rossi</i> .....	339
Casa del Rilievo di Telefo and <i>opus sectile</i> at Herculaneum, <i>A. Savalli, P. Pesaresi, L. Lazzarini</i> .....	349
The use of marble in Roman Pula, <i>A. Starac</i> .....	363
Architectural decoration of the episcopal church of Rhodiapolis in Lycia, <i>A. Tiryaki</i> .....	377
Byzantine carved marble slabs from Çanakkale Archaeology Museum, <i>A. Turker</i> .....	385
First preliminary results on the marmora of the late roman villa of Noheda (Cuenca, Spain), <i>M. A. Valero Tévar, A. Gutiérrez García-M., I. Rodà de Llanza</i> .....	393
Parian lychnites and the Badminton Sarcophagus in New York, <i>F. Van Keuren, J. E. Cox, D. Attanasio, W. Prochaska, J. J. Herrmann, Jr., D. H. Abramitis</i> .....	403
The use of Estremoz marble in Late Antique Sculpture of Hispania: new data from the petrographic and cathodoluminescence analyses, <i>S. Vidal, V. Garcia-Entero</i> .....	413
Montegrotto Terme (Padova) – Marble and other stone used in architectonic decoration of the Roman villa, <i>P. Zanovello, C. Destro, M. Bressan</i> .....	421
2. PROVENANCE IDENTIFICATION I: MARBLE	
The monument landscape and associated geology at the sanctuary of Zeus on mt. Lykaion, <i>I. Bald Romano, G. H. Davis, D. G. Romano</i> .....	429
Marbles of the Aracena Massif (Ossa-Morena zone, Spain): aspects of their exploitation and use in roman times, <i>J. Beltrán Fortes, M. L. Loza Azuaga, E. Ontiveros Ortega, J. A. Pérez Macías, O. Rodríguez Gutiérrez, R. Taylor</i> .....	437
Isotopic analysis of marble from the Stoa of Attalos in the Athenian Agora and the Hellenistic quarries of Mount Pentelikon, <i>S. Bernard, S. Pike</i> .....	451
An update on the use and distribution of white and black Göktepe marbles from the first century AD to Late Antiquity, <i>M. Bruno, D. Attanasio, W. Prochaska, A.B. Yavuz</i> .....	461
The use of coloured marbles in the neapolitan Baroque: the work of Cosimo Fanzago (1591-1678), <i>R. Bugini, L. Cinquegrana</i> .....	469
The imitation of coloured marbles in the Venetian Renaissance painting, <i>R. Bugini, L. Folli</i> .....	475
Stones and ancient marbles of the ‘Francesco Belli’ Collection: archaeological, art-historical, antiquarian, geological - technical and petrographical aspects, <i>R. Conte, A. D’Elia, E. Delluniversità, G. Fioretti, E. Florio, M. C. Navarra</i> .....	485
Provenance investigation of a marble sculptures from Lyon Museum, <i>M.P. Darblade-Audoin, D. Tambakopoulos, Y. Maniatis</i> .....	503
The limestone quarries of the Karaburum peninsula (southern Albania), <i>A. De Stefano</i> ...	513
The main quarries of the central part of Dardania (present Kosova) during the Roman period: their usage in funerary and cult monuments, <i>E. Dobruna-Salibu</i> .....	519
The use of marble in Hispanic Visigothic architectural decoration, <i>J.A. Domingo Magaña</i> .	527
Preliminary study of Los Bermejales, a new roman quarry discovered in the province of Cádiz, Southwestern Spain, <i>S. Domínguez-Bella, M. Montañés, A. Ocaña, J. M. Carrascal, J. Martínez, A. Durante, J. Rendón Aragón, J. Rios</i> .....	537

## INDEX

Marble pavements from the house of Jason Magnus in Cyrene, <i>E. Gasparini, E. Gallocchio</i>	545
The Portoro of Portovenere: notes about a limestone, <i>S. Gazzoli, G. Tedeschi Grisanti</i> . . . .	555
Saw cuts on marble sarcophagi: New York and Ostia, <i>J. J. Herrmann, Jr., M. Bruno, A. van den Hoek</i> . . . . .	559
The basalt of the sacred caves at Ajanta (India): characterization and conservation, <i>F. Mariottini, M. Mariottini</i> . . . . .	565
Marble and stones used in the central eastern Alpine area and in the northern area of Benacus: topographical reconstruction of trade routes and aspects of use in the Roman Era, <i>A. Mosca</i> . . . . .	575
Life of Nora (Province of Cagliari - South Sardinia). Roman quarries and their organization in the rural landscape, <i>C. Nervi</i> . . . . .	585
Naxian or parian? Preliminary examination of the Sounion and Dipylon kouroi marble, <i>O. Palagia, Y. Maniatis</i> . . . . .	593
Analysis of the stony materials in the Arucci city, <i>E. Pascual, J. Bermejo, J. M. Campos</i> . . . .	601
Blocks and quarry marks in the Museum of Aquileia, <i>P. Pensabene</i> . . . . .	611
Archaeology and archaeometry of the marble sculptures found in the “Villa di Poppea” at Oplontis (Torre Annunziata, Naples), <i>P. Pensabene, F. Antonelli, S. Cancelliere, L. Lazzarini</i> . . . . .	615
“Marmo di Cottanello” (Sabina, Italy): quarry survey and data on its distribution, <i>P. Pensabene, E. Gasparini, E. Gallocchio, M. Brilli</i> . . . . .	629
A quantitative and qualitative study on marble revetments of service area in the Villa del Casale at Piazza Armerina, <i>P. Pensabene, L. Gonzalez De Andrés, J. Atienza Fuente</i> . . . . .	641
Quarry-marks or masonry-marks at Palmyra: some comparisons with the Phoenician-Punic documentation, <i>D. Piacentini</i> . . . . .	651
Fine-grained dolomitic marble of high sculptural quality used in antiquity, <i>W. Prochaska</i> . .	661
Discriminating criteria of Pyrenean Arties marble (Aran Valley, Catalonia) from Saint-Béat marbles: evidence of Roman use, <i>H. Royo, P. Lapuente, E. Ros, M. Preite-Martinez, J. A. Cuchí</i> . . . . .	671

## II VOLUME

### 3. PROVENANCE IDENTIFICATION II: OTHER STONES

The stone architecture of Palmyra (Syria): from the quarry to the building, <i>R. Bugini, L. Folli</i> . . . . .	683
Quarries in rural landscapes of North Africa, <i>M. De Vos Raaijmakers, R. Attoui</i> . . . . .	689
Local and imported lithotypes in Roman times in the Southern part of the X Regio Augusta Venetia et Histria, <i>L. Lazzarini, M. Van Molle</i> . . . . .	699
Preliminary study of the stone tesserae of Albanian mosaics. Materials identification, <i>E. Omari</i> . . . . .	713

### 4. ADVANCES IN PROVENANCE TECHNIQUES METHODOLOGIES AND DATABASES

Provenance investigation of some funeral marble sculptures from ancient Vienna (France), <i>V. Gaggadis-Robin, J.-L. Prisset, D. Tambakopoulos, Y. Maniatis</i> . . . . .	725
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## INDEX

Isotopic testing of marble for figural sculpture at Guelma, Algeria, <i>J. J. Herrmann, Jr., R. H. Tykot, D. Attanasio, P. Blanc, A. van den Hoek</i> .....	739
5. QUARRIES AND GEOLOGY	
Analysis and discrimination of Phrygian and other Pavonazzetto-like marbles, <i>D. Attanasio, M. Bruno, W. Prochaska, A. B. Yavuz</i> .....	753
Roman stone-carvers and re-carving: ingenuity in recycling, <i>S. J. Barker, C. A. Ward</i> .....	765
Can a fire broaden our understanding of a Roman quarry? The case of el Mèdol (Tarragona, Spain), <i>A. Gutiérrez García-M., S. Huelin, J. López Vilar, I. Rodà De Llanza</i> .....	779
The Roman marble quarries of Aliko Bay and of the islets of Rinia and Koulouri (Skyros, Greece), <i>M. Karambinis, Lorenzo Lazzarini</i> .....	791
The splendor of Andesite. quarrying and constructing in Larisa (Buruncuk) Aeolis, <i>T. Sener, U. Almaç</i> .....	805
Carving a corinthian capital. New technical aspects regarding the carving process, <i>N. Toma</i> .	811
New evidence on ancient quarrying activity at the Mani Peninsula, <i>M.P. Tsouli</i> .....	823
Ancient lithic naval cargos around Sicily, <i>S. Tusa</i> .....	831
An unusual Roman stone cinerary urn from London, <i>D.F. Williams, R. Hobbs</i> .....	843
Presenting and interpreting the processes of stone carving: <i>The Art Of Making In Antiquity</i> Project, <i>W. Wooton, B. Russell</i> .....	851
The Roman Mio-Pliocene underground quarries at Ksour Essaf (Tunisia), <i>A. Younès, M. Gaied, W. Gallala</i> .....	861
6. STONES PROPERTIES, WEATHERING EFFECTS AND RESTORATION	
A strigilated sarcophagus in providence: ancient, modern or both?, <i>G. E. Borromeo, M. B. Hollinshead, S. Pike</i> .....	871
Art historical and scientific perspectives on the nature of the orange-red patina of the Parthenon, <i>O. Palagia, S. Pike</i> .....	881
7. PIGMENTS AND PAINTINGS ON MARBLE	
The polychromy of Roman polished marble portraits, <i>A. Skovmøller, R. H. Therkildsen</i> ..	891
Some observations on the use of color on ancient sculpture, contemporary scientific exploration, and exhibition displays, <i>J. Pollini</i> .....	901
The Ulpia Domnina's sarcophagus: preliminary report about the use of digital 3d model for the study and reconstruction of the polychromy, <i>E.Siotto, M. Callieri, M. Dellepiane, R. Scopigno</i> .....	911
8. SPECIAL THEME SESSION: ORDERS, REPERTOIRES AND MEANING OF MARBLE WITHIN THE PUBLIC AND THE DOMESTIC CIRCLE FROM ANTIQUITY TILL POST-ANTIQUITY TIME	
Marbles from the theatre of Colonia Caesar Augusta (provincia Hispania Citerior), <i>M. Beltrán, M. Cisneros, J. Á. Paz</i> .....	923

INDEX

Calculating the cost of columns: the case of the Temple of Apollo at Didyma, <i>P. Barresi</i> . . .	933
The decorative stoneworks in the east and center of Roman Gaul: recent data of the archaeological operations, <i>V. Brunet-Gaston</i> . . . . .	941
Colored columns and cult of the emperors in Rome, <i>B. Burrell</i> . . . . .	947
Roman sculpture in Pannonia between imports and local production, <i>M. Buzov</i> . . . . .	955
A New Julio-Claudian Statuary cycle from Copia Thuri. Brief remarks on quality and methods of extraction and processing of marble used for the sculptures, <i>A. D'Alessio</i> . . . .	969
Stone in the decorative programs of Villa A (So-Called Villa Of Poppaea) at Oplontis, <i>J. C. Fant, S. J. Barker</i> . . . . .	977
Stable isotope analysis of Torano valley, Carrara, marble used in 18th-century french sculpture, <i>K. Holbrow, C. Hayward</i> . . . . .	987
Cassiodorus on marble, <i>Y.A. Marano</i> . . . . .	997
Colored marbles of Diocletian's Palace in Split, <i>K. Marasović, D. Matetić Poljak, Đ. Gobić Bravar</i> . . . . .	1003
<i>Fabri Luxuriae</i> . Production and consumption of coloured stone vases in the Roman Period, <i>S. Perna</i> . . . . .	1021
Porphyry bathtubs in the sacred space, <i>O. Senior-Niv</i> . . . . .	1031
Mythological sculptures in late antique domus and villas: some examples from Italy, <i>C. Sfameni</i> . . . . .	1039
Architectural language and diffusion of decorative models: a group of unpublished figured capitals from Hierapolis in Phrygia, <i>G. Sobrà</i> . . . . .	1049

# THE MONUMENT LANDSCAPE AND ASSOCIATED GEOLOGY AT THE SANCTUARY OF ZEUS ON MT. LYKAION

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## Abstract

*The recent campaign of excavation and survey of the Sanctuary of Zeus on Mt. Lykaion in Arcadia, Greece includes architectural and topographical documentation of all the buildings and monuments, as well as geological mapping of the site and surrounding region. The corpus of this study comprises approximately 31 square, rectangular, and round limestone monument bases, once supporting sculpture, inscribed stelai, anthropomorphic pillars, columns, and possibly bronze tripod cauldrons and other votive or honorific monuments. Few of the monuments themselves survive; none are inscribed. All of the bases are made from local limestone quarried on Mt. Lykaion, the majority from the Thick White Limestone Beds formation characterized by abundant stylolites, with a small number of other bases of a blue/gray limestone from the Flysch Transition Beds. The bases date from the 6th to late 3rd or early 2nd centuries B.C., the majority probably of the 4th-3rd centuries B.C. Clusters of the monument bases provide indications of the main public areas of the site.*

## Keywords

Mt. Lykaion; limestone; monument bases

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## The Sanctuary of Zeus on Mt. Lykaion

The Sanctuary of Zeus on Mt. Lykaion lies high in the mountains of southwestern Arcadia, Greece, 1,382 m above sea level at the southern peak of the mountain. It is located on or near the boundary of three regions of the Peloponnesos, Arcadia, Elis, and Messenia, a position of significance in antiquity. The site is 37 km “as the eagle flies” from the other famous Zeus sanctuary at Olympia, at least a day’s walk through the Arcadian mountains into Elis. It is also within sight of and a three-hour walk to the Temple of Apollo Epikourios at Bassai. Ancient sources record the importance of Mt. Lykaion as (one of) the mythological birthplace(s) of Zeus, vying with Cretan Mt. Ida for that honor (Kallimachos, *Hymn*

*to Zeus*, I.4-5). The Sanctuary to Zeus was an important religious and political center for the Arcadians where Pan Arcadian athletic and equestrian competitions every four years provided an opportunity for Arcadian identity to be celebrated, while athletes and visitors came from many parts of the Greek world (see <http://lykaionexcavation.org/> for the ancient literary and epigraphical sources for Mt. Lykaion).

## Mt. Lykaion Excavation and Survey Project

Since 2006 archaeological excavations have been conducted at the Sanctuary of Zeus under the direction of the Lambda Theta Ephorate of Prehistoric and Classical Antiquities in Tripolis, in collaboration with the University of Arizona and the University of Pennsylvania Museum of Archaeology and Anthropology, co-directed by Drs. Anna Vassiliki Karapanagiotou, Michalis Petropoulos, David Gilman Romano, and Mary Voyatzis, under the auspices of the American School of Classical Studies at Athens (Romano 1997; Romano 2005; Romano and Voyatzis 2010; Romano and Voyatzis 2014; <http://lykaionexcavation.org/>). Previous archaeological explorations in the late 19th and early 20th century by Kontopoulos and Kourouniotis uncovered many of the major buildings and monuments of the sanctuary (Kontopoulos 1898; Kourouniotis 1903; Kourouniotis 1904a; Kourouniotis 1904b; Kourouniotis 1905a; Kourouniotis 1905b; Kourouniotis 1909). The sanctuary was monumentalized in the first half of the 4th century B.C. with the construction of a hippodrome-stadium complex, a large administrative building, a stoa, seating area, and fountain houses (Fig. 1). There was no temple at the sanctuary, and worship of Zeus was focused on an open-air altar on top of the southern peak of the mountain. Recent excavations have revealed evidence for continuous worship at the altar from at least as early as the Mycenaean period through the Late Classical period (Romano and Voyatzis 2010; Romano and Voyatzis 2014).

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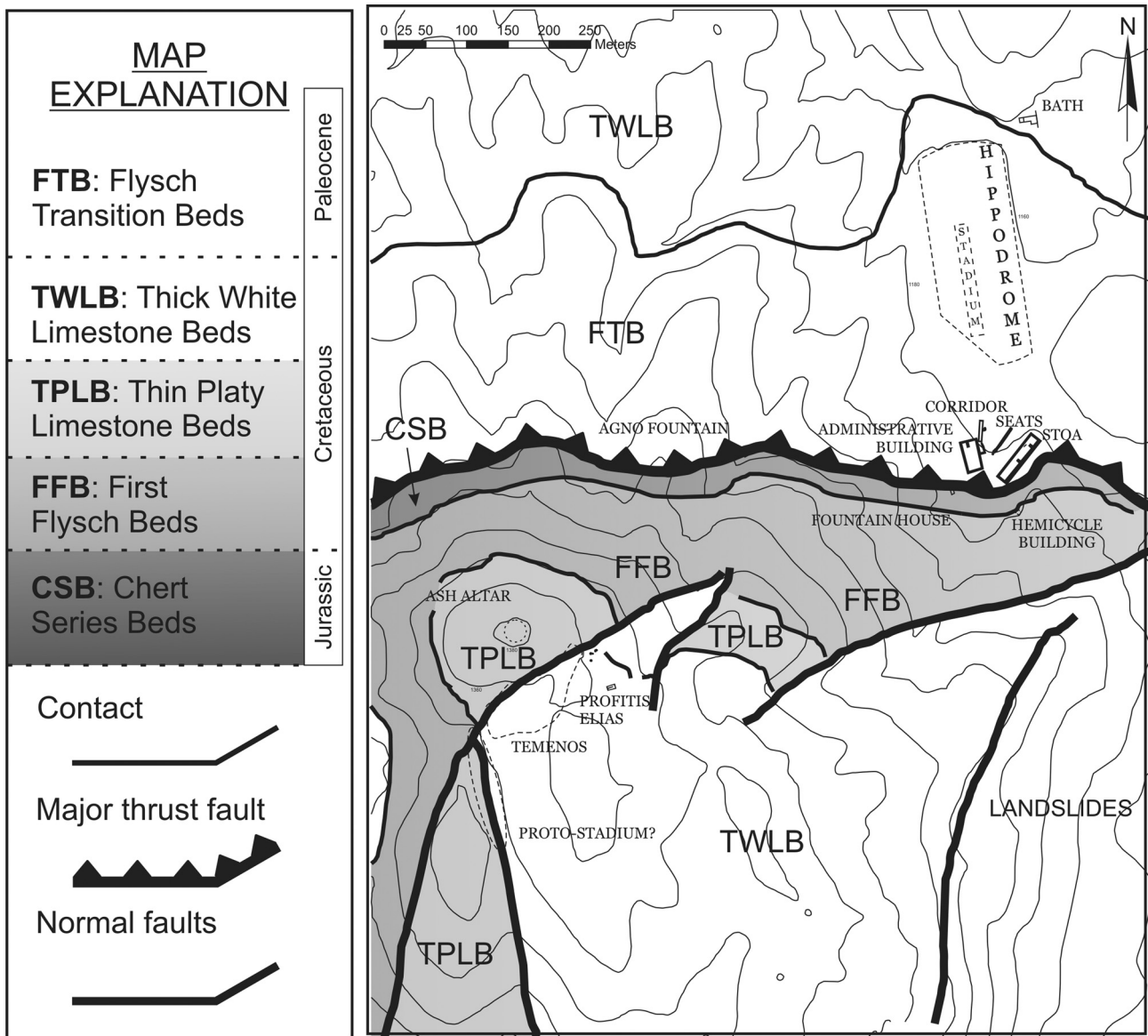


Fig. 1. Site plan for the Sanctuary of Zeus on Mt. Lykaion with simplified geological map and stratigraphic column for Pindos Group Formations. Courtesy of the Mt. Lykaion Excavation and Survey Project and G.H. Davis.

### Geology and its Relevance to the Built Environment of the Sanctuary

The integrated research program at Mt. Lykaion includes comprehensive geological mapping of the site and surrounding region by George H. Davis (Davis 2009). The bedrock is composed of Jurassic to Eocene sedimentary strata, comprising four basic formations within the Pindos Group: from oldest to youngest, Chert Series (Jurassic to Lower Cretaceous; ~100 m), First Flysch (Upper Cretaceous; ~100 m), Limestones (Upper Cretaceous; ~200 m), and Flysch Transition Beds (Paleocene to Eocene; ~50 m) (Lalechos 1973; Papadopoulos 1997). Davis (2009) separated the limestones into “Thin Platy Limestone Beds” and overlying “Thick White Limestone Beds”. (See fig. 1) The strata are deep-water carbonates and siliciclastic rocks deposited in a narrow basin within part of the Neotethys

ocean, and subsequently thrust-faulted, folded, and uplifted as the Neotethys became tectonically ‘sutured’ between major tectonic plates (Africa and Eurasia) (Dregan and Robertson 1997).

The stratigraphic provenance for the vast majority of the building stones at the Sanctuary of Zeus is the Thick White Limestone Beds formation. The bedrock outcrops of Thick White Limestone Beds are in close proximity to the sanctuary and the areas of architectural monuments. (See Fig. 1) The “bedding” in typical outcrops of Thick White Limestone is flaggy, composed of thin, slightly undulating, discontinuous layers ranging in thickness from 0.02 to 2.0 m. (Fig. 2) This same “bedding” expression is also manifest in the worked building stones. (Fig. 3) The flaggy bedding, however, is, in fact, pseudo-bedding, produced by burial stresses at the time when the deep-water carbonates were being buried and compacted (Merino *et al.* 1983;



Fig. 2. Outcrop of folded pseudo-bedding in Thick White Limestone Beds, Mt. Lykaion. Photo by G.H. Davis.

Simpson 1985; Alvarez *et al.* 1985; Larbi 2003; Davis 2014). Compaction of the limestone was achieved by pressure-dissolution, causing calcite to dissolve under the influence of burial stresses resulting from gravitational loading. The sites of missing material are now marked by stylolites, which have serrated “teeth” resembling brain sutures, ranging up to 0.02 m. in height (Aharanov and Katsman 2009; Merino *et al.* 1983; Merino 1992). (fig. 4) It is along the clayey-residue seams that weathering and erosion are most efficient, causing the limestone to be irregularly grooved. Indeed, the most distinctive characteristic of the weathered limestone monument bases is this grooving, controlled by pseudo-bedding. Recesses along weathered grooves are as deep as 0.05 m. (See Figs. 2 and 3)

Notwithstanding the rock-property disadvantages to masons by the paucity of evenly-spaced fracturing (jointing) and the presence of closely-spaced primary stylolites and stylolite surfaces in this pseudo-bedded limestone, the Thick White Limestone Beds is the bedrock of choice for worked blocks in the Sanctuary of Zeus. It is the dominant block source for the bath, seats, stoa, administrative building, and fountains, and is also one of two formations used for the monument bases. (See Fig. 1) Countermanding the disadvantages associ-

ated with block quarrying and shaping blocks from the pseudo-bedded Thick White Limestone Beds, this is the only formation in the Pindos Group that exhibits layers consistently 0.5 to 2.0 m in thickness and, therefore, advantageous to use as building blocks. Layering is thinner, for example, in the Flysch Transition Beds, typically less than 0.3 m, but some layers in this formation are sufficiently thick and sturdy for use in parts of built structures and for some monument bases.

Outcrops of Thick White Limestone Beds and Flysch Transition Beds (and worked blocks derived from these same formations) are marked by fractures (e.g., joints) and calcite veins, most of which were formed as a natural product of pressure dissolution during post-lithification deformation. In the case of the monument bases and other worked blocks, some calcite veins were produced during the formation of the primary stylolites, i.e., during burial and compaction. The pressure-dissolved calcite re-precipitated nearby where porosity permitted (Aharanov and Katsman 2009).

For some of the monument bases made from the Thick White Limestone Beds, the blocks may have been



Fig. 3. Pseudo-bedding in worked block of Thick White Limestone Beds formation, Sanctuary of Zeus, Mt. Lykaion. Note the deep weathering of the block along the surfaces separating individual pseudo-beds. Photo by G.H. Davis.



Fig. 4. Stylolites expressed in the limestone bedrock of Thick White Limestone Beds, Mt. Lykaion. Note the sutured teeth-like patterns. Photo by G.H. Davis.



Figs. 5a and b. Base for multiple stelai, limestone from Thick White Limestone Beds, A034, Sanctuary of Zeus, Mt. Lykaion. Fig. 5a. Note the vertical orientation of the pseudo-bedding, the longitudinal stelai cuttings along stylolite surfaces separating pseudo-beds, and the calcite vein that crosses the block and was used as a plane of weakness in cutting the stele cavity. Fig. 5b: Detail of the complete stele cutting at the end of the block. Note that the sutured undulating stylolite surface remains visible along the right edge of the cutting. Photos by G.H. Davis

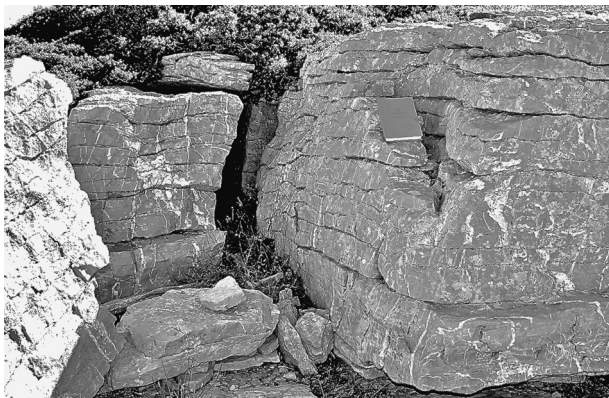


Fig. 6. Outcrop of Thick White Limestone Beds from which blocks were quarried, Sanctuary of Zeus, Mt. Lykaion. The ancient quarry is located adjacent to the temenos of the sanctuary. Photo by G.H. Davis.

chosen to minimize the presence of pseudo-bedding. For example, pseudo-bedding might be evident in the lower part of a block, but not near the upper zone. There are cases where the masons dealt with the anisotropy of pseudo-bedding in practical and ingenious ways. Normally the monument bases fashioned from pseudo-bedded Thick White Limestone Beds were cut so that the pseudo-bedding is parallel to the upper surface of the block. In other cases (e.g., fig. 5a,b), the block was cut with the pseudo-bedding oriented vertically, with the stelai cavities cut along the weaknesses afforded by the stylolite surfaces between pseudo-beds. In the example shown in Fig. 5, the mason chose not to smooth the walls of the cavities, and thus the sutures of the stylolites remain visible. Moreover, the floor of the complete stele cutting at one end of the base (see fig. 5a) coincides with the surface of a white calcite vein (see detail of cavity in fig. 5b), which provided a natural weakness or parting utilized in cutting the cavity. As emphasized above, the bedrock from the Flysch Transition Beds was, apparently, inadequate in bed

thickness for common use for built structures and monument bases. However, in some cases the masons chose the thinner limestone of the Flysch Transition Beds lacking pseudo-bedding in order to fashion blocks in a more homogeneous stone. (See below fig. 9 for an example of a base of this grey limestone.)

Geological surveying of Mt. Lykaion has provided evidence for the locations of some limestone quarry areas. The blue/gray limestone blocks were cut from the bedrock within tens of meters of their final destination. The blocks from the Thick White Limestone Beds were also quarried nearby, with good quality limestone never more distant than 1.0 km. At several locations within the sanctuary itself there is clear evidence for quarrying of this stone (fig. 6).

### The Corpus of Monument Bases

Limestone monument bases were recovered from many parts of the sanctuary by the late 19th and early 20th century excavators, but little description of their appearance or specific find spots was published. As part of the recent campaign of excavation and survey of the Sanctuary of Zeus comprehensive topographical and architectural documentation of all of the buildings and monuments, including the bases, has been undertaken. The corpus of this study comprises approximately 31 monument bases, mostly square and rectangular and a few round (e.g., A011), once supporting sculpture, inscribed stelai, anthropomorphic pillars, columns, and possibly bronze tripod cauldrons or other votive or honorific monuments. Few of the monuments themselves have been recovered: one fragmentary limestone pillar with its limestone base and lead footing was found in 2008 (see below); a fragment of the upper part of a marble stele was found in a secondary context in the fountain house near the lower sanctuary (A146); and two marble victor inscriptions with no associated bases (IG



Fig. 7. Pillar base, white limestone from Thick White Limestone Beds, A188, Sanctuary of Zeus, Mt. Lykaion. Photo by I.B. Romano.

V, 2.549 and IG V, 2.550), important documents for the Lykaion Games, were discovered in the early excavations (KOUROUNIOTIS 1905a, 166-171).

None of the bases are inscribed. Indeed, inscribing on the uneven surfaces of the white limestone with abundant stylolites (see above) would have presented challenges for a mason, while the more homogeneous, blue/gray limestone from the Flysch Transition beds would have provided a better surface for inscriptions. For the stelai bases, the stele itself would, in most cases, have carried the message. We have found no evidence for reliefs or painted inscriptions or for cuttings on the fronts or tops of any of the bases for the attachment of plaques of marble or another material, such as wood or bronze, that might have been inscribed. (Marble plaques with inscriptions are more common for Roman statue bases than for Greek [Højte 2005, 37-39, 40-42].) From ancient sources we know, however, that there were inscriptions identifying statues at Mt. Lykaion. For example, in the 2nd century A.D. Pausanias (8.38.5) recorded that he saw on Mt. Lykaion, perhaps near the hippodrome/stadium based on the context of his description, bases for statues (ἀνδριάντων βάθρα) missing their statues, one with an elegaic inscription that identified the statue as a portrait (εἰκόνα) of Astyanax of the Arceas family.

Some of the preserved blocks represent only the lower course(s) of bases, thus providing minimal evidence for the type of monument the base once supported. For others, however, the form of the base and the cuttings in the upper surfaces allow general hypotheses regarding the monument type. There is little specific evidence for the dating from the bases themselves, but association with structures and the general chronology of the site indicate that most date from the 6th to late 3th or early 2nd centuries B.C., with the majority probably of the 4th-3rd centuries B.C.

Approximately 16 monument bases at the site once held stelai or hermaic pillars (Fig. 7). Anthropomorphic stelai or hermaic pillars (i.e., shafts with human heads or pyramids at the terminus) have been identified at other Arcadian sites, especially Tegea, as a primary votive monument type (KOURSOMIS and KARAPANAGIOTOU 2009, 376; 2012, 211-19). In Messenia similar pillar-like limestone stelai terminating in roughly carved human heads were used as grave markers in the Hellenistic period (THEMELIS 2000, 158-65, figs. 146-52). In the Lykaion sanctuary in 2008 a white limestone base was found with its rectangular lead footing or pan that secured the pillar to its base, as well as fragments of the lower part of a grey limestone pillar of possible hermaic type (with no trace of an inscription or painted or sculpted decoration) (A179+MTL120: Pillar: P.H. 0.34; P.W. 0.29; Max. Th. 0.165 m). Unfortunately, the upper part of the pillar was not recovered. It is also possible that some of the bases supported pillars surmounted by statuettes, as, for example, the statuette dedicated at Rhamnous in the latter 5<sup>th</sup> c. B.C. by Lysikleides, whose plinth was set into a depression in the top of a 1.04 m high pillar (Athens, National Museum 199; Kaltsas 2002, no. 223).

Many of the Mt. Lykaion stelai bases are characterized by very shallow cuttings, of between 0.04 m (A029) and 0.08 m (A027) deep. (fig. 8) The lengths of the cuttings (and, therefore, the lower widths of the stelai) generally range from 0.51 to 0.63 m; the widths are between 0.125 and 0.31 m. Several bases have cuttings for multiple stelai (e.g., A034 fig 5a,b; A107). In general, the majority of the bases at Mt. Lykaion are rather small, between 0.71 and 1.45 m in length, 0.40 and 0.77 m in width, and 0.20 and 0.30 m in height, and are formed of a single, solid block. The largest base at the site (A001-A004), *in situ* to the east of the seats and stoa, is composed of a series of solid blocks in at least three courses, with the largest block of the upper course measuring 1.93 m in length, 1.03 m in width, 0.297 m in height. A reconstruction on paper and a close study of the cuttings in the upper surface may help to determine its



Fig. 8. Stele base, white limestone from Thick White Limestone Beds, A027, Sanctuary of Zeus, Mt. Lykaion. Photo by I.B. Romano.



Fig. 9. Plinth for bronze statuette, grey limestone from Flysch Transition Beds, A062, Sanctuary of Zeus, Mt. Lykaion. Photo by G.H. Davis.



Fig. 10. Southern base for one of the “Columns of Zeus”, white limestone from Thick White Limestone Beds, A115-118, with marble column drum, Sanctuary of Zeus, Mt. Lykaion. Photo by G.H. Davis.

function. We have identified no so-called orthostate bases with roughly-cut stones filling the center, framed by upright slabs around the perimeter (see Kosmopoulou 2002, esp. 11-14).

There are four examples of rectangular limestone plinths for bronze statuettes of human figures preserving depressions for their feet in the upper surface of the block. Two of these are made of limestone from the Flysch Transition Beds. One is located southeast of the northern foundation of the stoa (A062: Max. L. 0.92; W. 0.63; Th. 0.20-0.22 m; cuttings for feet: L. 0.24; 0.27 m) (fig. 9) and another is in front of the seats (A012: P.L. 1.45; W. 0.65; P.H. 0.25 m; cuttings for feet: L. 0.22 m; 0.23 m). Both are for approximately three-quarters-lifesized statuettes, and we can suppose that these were dedications, possibly images of dedicants, athletes, officials of the sanctuary, or military or civic leaders. For sculpture of the Hellenistic period, there is some evidence that marble was the preferred medium for statues of deities, while honorific statues were more commonly made of bronze (Tuchelt 1979, 70-90; Höghammer 1993, 68-70; Højte 2005, 45-46). Typically, a base for a marble statue would have a round, oval or rectangular depression for the setting of a plinth. Among the corpus of Mt. Lykaion monument bases there is only one possible base for a marble statue that has been identified thus far (A019: Max. P.L. 0.69; Max. P.W. 0.64; P.H. 0.27; large cutting for plinth Max. P.L. 0.39; Max. P.W. 0.29; P.Depth 0.05 m). In fact, evidence for the use of marble at Mt. Lykaion is very limited, including in the preserved architecture. Among the few large fragments of marble found at the site are a coffer block from the lower sanctuary (A119); the Doric column drum re-erected (and possibly not originally associated with the base) in the temenos (see below and fig. 10), which Kourouniotis described as marble from Doliana (Kourouniotis 1904b, 175); a fragment of the upper part of a stele (A146: P.H.: 0.27; P.W.: 0.153; P.Th. 0.08 m); and two victor inscriptions (*IG* V, 2.549 and *IG* V, 2.550). It is very likely, however, that marble blocks were removed

from the site over the centuries for reuse in local buildings or burned in kilns for lime powder, as was common in post-ancient times.

Pindar (*Nemean Odes* X. 45) suggests that the prizes at the Lykaion Games were of bronze, and a scholiast on Pindar identifies these prizes as bronze tripods (Polemon Peregetai, frag. 26, on Pindar, *Olympian Odes* VI-II, 153, FHG III, 123). The presence of many miniature bronze tripod cauldrons among the dedications to Zeus in the open-air altar atop the southern peak of Mt. Lykaion confirms the importance of this vessel type at the Sanctuary of Zeus. It would not be surprising, therefore, if large bronze tripod cauldrons would have been set up as dedications in the sanctuary, just as they were at Delphi, Dodona, on the Athenian Acropolis, and at Olympia (see Willemsen 1957, 161-165 for their secondary findspots in deposits in nearly every part of the sanctuary at Olympia, with the greatest numbers around the Temple of Zeus and in the stadium). In our examination of the monument bases from Mt. Lykaion, however, we have not yet been able to positively identify any tripod cauldron bases of the typical square or triangular shape with a circular cutting for a central support and three narrow rectangular cuttings in a triangular arrangement for the tripod legs (e.g., Themelis 2000, 48, fig. 39; Amandry and Spyropoulos 1974).

We know that some of the bases at Mt. Lykaion are not *in situ*, e.g., one group of eight bases to the east of the seated area was possibly gathered there in modern times. The clustering of the *in situ* bases in specific locations, however, helps to define the primary public areas of the sanctuary. Seven bases are on and around the seated area; at least six are in or around the stoa. In addition, Kourouniotis mentions a base for a possible equestrian statue in front of the west end of the stoa, though this base has not been located in the current campaign (Kourouniotis 1909, 188-189). Several bases were found by previous excavators reused in the area of the large public building (labeled by them the “xenon” or hotel), including the two inscriptions recording vic-

tors in the quadrennial Lykaion games held in the years between 320 and 304 B.C. (*IG V*, 2.549; *IG V*, 2.550: P.H. 0.67; W. 0.461; Th. 0.16 m)(Kourouniotis 1905a, 166-171).

There are at least two bases for stelai in the area of the temenos in the upper plateau below the peak of the mountain (A109; A121). In addition, in the 2<sup>nd</sup> century B.C. Polybios (IV.33) recorded that the Messenians in the time of Aristomenes (7<sup>th</sup> century B.C.) set up a stele “beside” the altar of Lykaion Zeus (παρὰ τὸν τοῦ Διὸς τοῦ Λυκαίου βωμὸν ἀνέθεσαν στήλην ἐν τοῖς κατ’ Ἀριστομένην καιροῖς) commemorating the treachery of the Messenian Aristocrates and warning the Arcadians in elegiac verse to remember this incident. Pausanias (IV.22.7) mentions this same stele in the 2<sup>nd</sup> century A.D.; he probably used Polybios as his source and may not have actually seen the inscription.

Two square bases, 7 m apart, were located by Kontopoulos, just below and east of the southern peak of the mountain in the area of the temenos (Kontopoulos 1898). (fig. 10) These bases (A111-A118; A115-A118), framing the peak with the open-air altar above as a kind of entrance to the most sacred space at the sanctuary, are presumed to be for the columns Pausanias saw in the 2<sup>nd</sup> century A.D. that once supported golden eagles of Zeus (8.38.7). The lower course of each base was preserved *in situ* (1.45 x 0.35 m); Kontopoulos and Kourouniotis re-assembled the next course on both the northern and southern bases from similar blocks found nearby, and moved a fluted Doric marble column drum from another area of the site to the southern base. Kourouniotis also added a third course to the northern base, but this is no longer in position. The lower two courses of each base are composed of two side-by-side blocks, joined by clamps, and with a flat raised rim around the upper perimeter (Kourouniotis 1904b, 162-3; 173-5). Kourouniotis describes a cutting for a wedge to secure the column in the upper surface of a third, now missing, course of the northern base (Kourouniotis 1904b, 175). There must have been, however, some more secure means of affixing the column, such as a central dowel cutting in the upper surface. Near the northern base, Kourouniotis uncovered the foundations for a base that he suggested would be suitable for an important statue (cult image?) of a seated Zeus such as that depicted on the Arcadian League coinage (Kourouniotis 1904b, 189), but these foundations are no longer visible at the site, and it is not certain that the image on the coins depicts a statue.

## Conclusion

This study of the monument bases at Mt. Lykaion is still in its preliminary phase and will continue with complete documentation of all of the bases, their topographical setting, relationship to the local geology, their use, typology and chronology. Despite the paucity of preserved monuments associated with the bases, this

study has been valuable in providing insights into the character of the Sanctuary of Zeus and its cult activity, as well as into the use of local limestones in the monumentalization of the most important sanctuary of the Arcadians. Comparisons of this corpus with monument bases from nearby sites, such as at Megalopolis and Lykosoura, will provide still more information about practices in Arcadia, as well as about the relationship between the Arcadian geological framework and the monument landscape.

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