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# Studying Stone Extraction in Antiquity: Methods and Current Challenges

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*Cipollino marble quarries near Styra, Euboea (©ESAG)*

International Workshop, October 17–19,  
2025, Athens – Euboea

# Workshop Overview

The study of ancient quarries relies on the analysis of the traces left by their exploitation. Identifying extraction techniques, understanding their evolution and transmission, and precisely dating these processes represent significant challenges in the study of these sites. Addressing these issues requires a multidisciplinary approach combining archaeology and geology.

This workshop aims to bring together researchers to share recent advances and ongoing studies on these topics. The discussions will focus on two main aspects: first, the various methods used to examine ancient quarries (mapping, surveys, geological studies, technical analyses, experimental archaeology); and second, the methodological challenges and the interpretation of extraction marks. Beyond technical aspects, the workshop also seeks to refine our understanding of the organization and operation of quarries over time.



This event is intended as a platform for dialogue and the comparison of approaches, bringing together researchers working on quarries from across the Mediterranean basin. The goal is to present and discuss specific research challenges, illustrated by concrete case studies. Rather than simply showcasing finalized results, we encourage contributions that present ongoing analyses and reflections, openly addressing difficulties and uncertainties inherent to these studies. In this way, we hope to create a space for fruitful discussions and debates among research teams.

# Programme de la journée — *Daily programm*

## Matinée — *Morning*

08.40-09.00	Accueil — <i>Welcome</i>
09.00-09.10	Introduction <i>Jérôme André</i> (Universités de Lausanne et Lyon II), <i>Chloé Chezeaux</i> (Université de Lausanne), <i>Chloé Damay</i> (UMR 6566 CReAAH), <i>Yvan Maligorne</i> (Centre de recherche bretonne et celtique, Université de Bretagne Occidentale)
09.15-09.50	Interpreting Context from the Written Evidence for Egyptian Quarry Development <i>Simon J. Barker</i> (University of Warsaw), <i>J. Clayton Fant</i> (University of Akron)
09.55-10.30	La carrière antique de calcaire de la Corderie à Marseille (France) <i>Philippe Mellinand</i> (Inrap, Aix Marseille Université, CNRS)
10.30-10.45	Pause café — <i>Coffee break</i>
10.45-11.20	Une enquête sur les carrières antiques de la périphérie de Dougga : les techniques d'extraction, leur datation et le problème de l'évacuation de la production <i>Yvan Maligorne</i> (École Normale Supérieure, Paris) <i>Chloé Damay</i> (UMR 6566 CReAAH)
11.25-12.00	Les carrières antiques de calcaire en Grèce : état de l'art, problématiques et limites <i>Marilou De Vals</i> (Sorbonne Université)
12.05-12.40	The Great Unknown: The Asomata Quarries Case <i>Angeliki Koukouvou</i> (Archaeological Museum of Thessaloniki)
12.40-13.40	Pause de midi — <i>Lunch break</i>

## Après-midi — *Afternoon*

13.40-14.15	An Overview of Granite Quarries in the Aegean World from Prehistory to the 19th c. CE <i>Athina Boleti</i> (Leiden University)
14.20-14.55	Errances sur l'île errante. L'étude des carrières de Délos : un regard rétrospectif et critique <i>Jean-Charles Moretti</i> , <i>Stéphanie Zugmeyer</i> (Institut de recherche sur l'architecture antique)
15.00-15.35	Methodological Approach to the Geological Study of a Stone Quarry: The Example of the Delian Marbles <i>Tommy Vettor</i> (Muséum National d'Histoire Naturelle)
15.35-15.55	Pause café — <i>Coffee break</i>
15.55-16.30	Exploring the Diachronic History of Tinian Marble <i>Vassiliki Anevlavi</i> (Austrian Archaeological Institute)
16.35-17.10	Millstone Extraction in Lemnos Island during Antiquity <i>Eirini Poupaki</i> (Hellenic Ministry of Culture)
17.15-17.50	Geoarchaeological Context of a Multi-lithological Quarriescape around the Archaic sanctuary of Despotiko (Cyclades, Greece) <i>Erich Draganits</i> (University of Vienna)
18.00-18.45	Discussion générale — <i>General discussion</i> <i>Georgia Kokkorou-Alevras</i> (National and Kapodistrian University of Athens)
20.30	Souper pour les participant·e·s — <i>Conference dinner</i>

# Programme de l'excursion — *Excursion programm*

## Samedi — *Saturday*

- 08.30** Départ pour Aghia Marina — *Departure for Aghia Marina*  
**10.30** Ferry Agia Marina - Nea Styra — *Ferry crossing to Nea Styra*  
**11.30** Pause café à Styra — *Coffee break in Styra*  
**12.00** Visit of the *drakospita* of Palli Lakka and adjacent quarries  
*Jérôme André, Chloé Chezeaux* (Université de Lausanne)



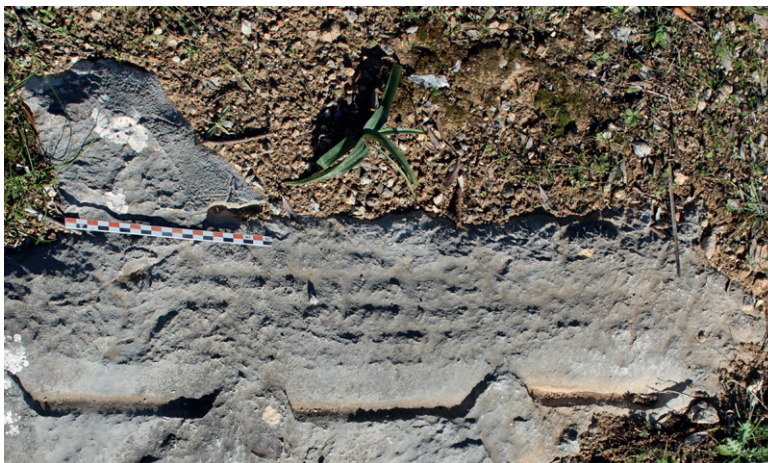
- 14.00** Pause de midi à Styra — *Lunch break in Styra*  
**15.30** Continuation of the tour of the quarries in Styra  
*Jérôme André, Chloé Chezeaux* (Université de Lausanne), *T. Vettor*, (Muséum National d'Histoire Naturelle)



- 18.30-19.00** Arrivée à Éréttrie, maison de fouille — *Arrival in Eretria, excavation house*  
**20.30** Dîner de groupe à la Cubana (Éréttrie) — *Group dinner at La Cubana (Eretria)*

## Dimanche — Sunday

- 09.30** The City of Eretria and its Quarries  
*Chloé Chezeaux, Jérôme André* (Université de Lausanne)
- 10.15** Visit to the Eretria Museum
- 11.00** Visit to the Acropolis and the Acropolis Quarries



- 13.00** Visit to the *Fior di Pesco* Quarries and surroundings
- 13.30** Pause de midi — *Lunch break*
- 14.30** Discussion générale — *General discussion*
- 16.00** Départ pour Athènes — *Departure for Athens*
- 18.00** Arrivée à l'aéroport d'Athènes — *Arrival at the airport of Athens*

Organisation du workshop : *Jérôme André* (Universités de Lausanne et Lyon II), *Chloé Chezeaux* (Université de Lausanne), *Chloé Damay* (UMR 6566 CReAAH), *Yvan Maligorne* (Centre de recherche bretonne et celtique, Université de Bretagne Occidentale)

## Résumés des communications — *Presentation Abstracts*

### ***Interpreting Context from the Written Evidence for Egyptian Quarry Development***

**Simon J. Baker** (University of Warsaw), **J. Clayton Fant** (University of Akron)

#### **Résumé — Abstract**

While epigraphic evidence has traditionally been used to study ancient quarrying in an attempt to cut through ambiguities, this material also has significant pitfalls. Our paper examines the epigraphic evidence for the first decades of quarry development in the Eastern Desert of Egypt (the Augustan period) alongside logistical concerns related to the establishment and organisation of these quarries. We focus on three specific cases: graffiti and more formal dedications at the quarries of bekhen stone in Wadi Hammamat (Keyser 1993); the so-called “curator” inscription of AD 11 at Mons Ophiates (I. *Pan.* 51); and the Leugas dedication of AD 18 at Porphyrites (AE 1995, 1615). This will allow us to refine our understanding of ancient quarrying in the Eastern Desert.

An example of this can be seen at Wadi Hammamat. Here, most texts come from the late Augustan period; however, if we look at the archaeological evidence from the quarry village which had to be built *ex nihilo* (Cuvigny 2003, 283), the presence of architects at the site, and the fact that water had to be fetched from a well at Wadi Fawakhir, we can expect work on this infrastructure to have begun some years earlier than the written evidence attests. Likewise, does the “curator” inscription of AD 11, which shows a large group of Roman functionaries at the site for the dedication of a Paneion mark the beginning of operations there or, more likely, a capstone of some years of development?

At Porphyrites, Cominius Leugas’ boast of discovering a variety of stones is also telling: he lists some stones by name but claims “the *metalla*” of purple and black porphyry. That the Greek inscription uses the Latin term *metallum* is striking because it signifies not just a known outcrop or deposit, but a working quarry operation, its administration, and its labour force, later notorious for condemned criminals (Cuvigny 2018, 74; Salerno 2003). Ostraka of the Trajanic period shows that Mons Claudianus was staffed at nearly 1,000 souls, members of the imperial phamelioi (members of the *familia*) and expert stone workers called *paganoi* (*pagan*). To attract the latter, who were well paid, an entirely new city, Kaine (Qena) was constructed at the Nile node of a new road system serving only the quarries. We have no dates for Kaine, but the whole enterprise must have taken decades. Even a pilot effort sufficient to get the Porphyrites operation up and running must have taken many years of effort. By contrast, exotic stones coming in smaller units from less massive deposits, transportable by single animals along undeveloped tracks, required little improvement to existing tracks and were within the capabilities of small private operations (Barker and Fant 2024). But to make a suitable imperial impression, very large products were needed, requiring large infrastructure investments. This takes the beginning of the program well back into the Augustan era and reveals that emperor as its grand architect.

#### **References**

- Barker, S. J. and J. Clayton Fant. 2024. “Early Egyptian Stone Imports to Campania: The Case of Stones from Four Small, Roman Quarries from Egypt’s Eastern Desert.” *Memoirs of the American Academy in Rome* 69: 122–173.
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- Cuvigny, H. 2018. “A Survey of Place-Names in the Egyptian Eastern Desert during the Principate according to the Ostraca and the Inscriptions,” in Brun J-P., Th. Faucher, B. Redon, and S. Sidebotham (eds.), *The Eastern Desert of Egypt during the Greco-Roman Period: Archaeological Reports* 2018: 74.
- Keyser, F. 1993. “Nouvelles textes grecs du Ouadi Hammanat.” *ZPE* 98: 111–156.
- Salerno, F. 2003. <<Ad Metalla>> *Aspetti Giuridici del Lavoro in Miniera*. Napoli: Jovene.

## ***La carrière antique de calcaire de la Corderie à Marseille (France)***

***Philippe Mellinand*** (Inrap, Aix Marseille Univ, CNRS, CCJ, Aix-en-Provence)

### **Résumé — Abstract**

Une fouille archéologique préventive réalisée en 2017 boulevard de la Corderie à Marseille a permis de dévoiler les témoins d'une carrière antique d'exploitation de calcaire. Explorée sur environ 1200 m<sup>2</sup>, elle a offert l'opportunité de fouiller une exploitation active entre le VI<sup>e</sup> s. avant notre ère et la période romaine qui a connu trois temps d'exploitation.

Le premier se termine au premier quart du V<sup>e</sup> s. avant notre ère, marqué principalement par une production de cuves de sarcophages et de dalles. Cette carrière abandonnée est ensuite en partie réouverte aux IV<sup>e</sup>-III<sup>e</sup> s. avant notre ère dédiée à l'extraction de blocs de grand appareil utiles à la reprise des fondations de l'enceinte urbaine hellénistique. Après quelques siècles d'abandon, ce banc de calcaire sera de nouveau ponctuellement exploité durant la période romaine pour en extraire des moellons.

Ces trois temps d'exploitation, bien datés par les mobiliers céramiques permettent d'illustrer l'évolution de l'outillage des carriers pour l'extraction de cette roche tendre. Pic, escoude et marteau-taillant appartiennent à l'outillage classique des carriers, mais les coins utilisés pour détacher les blocs du socle rocheux ne semblent pas trouver de parallèles en Méditerranée occidentale.

Le cadre de fouille préventif et le calendrier contraint qui l'accompagne nous ont amenés à normaliser la collecte des données au moyen de l'élaboration d'une fiche d'enregistrement spécifique. Les prises de vues photogrammétriques ont été systématisées et les tirages des ortho-images au 1/50<sup>e</sup> ont été utilisés comme supports de relevés des différents secteurs.

## ***An investigation into the ancient quarries on the outskirts of Dougga: extraction techniques, their dating and the problem of disposing of their production***

**Yvan Maligorne** (Centre de recherche bretonne et celtique, Université de Bretagne Occidentale), **Chloé Damay** (UMR 6566 CReAAH)

### **Résumé — Abstract**

The town of Dougga, which has a long history marked by several monumental phases between the 4th century BC and the 6th century AD, is built on a limestone outcrop in which numerous, often extensive, extraction sites have been identified. Their study is the natural extension of two surveys carried out since 2017, one of which focuses on the architectural decoration of the city's monuments, and the other on figurative sculpture. Its first aims were to determine the origin of the limestone used in the monuments and for the sculptures, to gather clues on the formation of the technical heritage of craftsmen and, more globally, to understand the role and importance of stone work within the urban framework and its surroundings. Two geologists, François Fournier and Philippe Bromblet, have carried out petrographic analyses and found indications of a relative specialisation of extraction sites according to period and type of use; they intend to publish the results of their investigations, and our talk will rather focus on strictly technical matters and on one quarry district.

The outcrop closest to the town extends over 500 m long and is particularly interesting, since the extraction, which left abundant and easily accessible traces, has coexisted with or succeeded to other activities: the site was home to a prehistoric necropolis, characterised by hastily built stone chambers, a Punic and then Numidian necropolis, a Roman necropolis which lies upon quarries, and finally a hippodrome, which was initially basic and restricted to the field extending south of the quarries, which means that the slopes formed by extraction were used as seating facilities for the public, but received stone structures during the Severan period, its history being well known thanks to a series of inscriptions. The outcrop thus contains numerous traces associated with one or other of these activities, all of which are intertwined.

Examination of the evidence of extraction must therefore be extended by a study of the phasing of the different sectors of the outcrop, making it possible to propose a chronology, both relative and (sometimes) absolute. This approach has been extended by looking for traces of extraction on blocks used in monuments firmly dated by epigraphy: the survey was fruitful and has provided a number of precise benchmarks.

We now understand the overall extraction strategy, its progress, and are able to formulate hypotheses about the routes used to evacuate the blocks, routes which had to be modified after the circus was built. We have reference points for certain technical procedures, and can formulate hypotheses about how they were introduced into the town in the mid-second century. On the other hand, some traces seem very unusual and cannot be dated.

The paper will therefore present an overview of our thinking, without overlooking the gaps and unresolved questions.

### **References**

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## ***Les carrières antiques de calcaire en Grèce : état de l'art, problématiques et limites***

**Marilou De Vals** (Sorbonne Université)

### **Résumé — Abstract**

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### **References**

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## ***The Great Unknown: Ancient quarries of common building stone - The Asomata quarries case***

**Angeliki Koukouvou** (Archaeological Museum of Thessaloniki)

### **Résumé — Abstract**

The Asomata quarries were unearthed during a rescue excavation near Beroia (Macedonia, Greece) in 1999-2002. My research in the following years focused on the quarries of soft building stone, called poros stone or porolith in ancient sources and archaeological literature, the building material used in ancient architecture. In spite of the significant progress made in the study of ancient quarries, the common building stone quarries remain the great unknown. The quarries of Asomata constitute an excellent case study, providing significant insights into ancient quarrying in general and, more specifically, into extraction techniques, dating, management of works and interdisciplinary research. Moreover, as monuments with the value of multiple historical, social and economic testimonies, they offer a way to link them to their historical environment.

### **Topics for discussion**

1. Ancient quarries of common building stone: the great unknown.
2. Extraction marks as evidence of extraction techniques and tools
3. Quarry excavations: a valuable source of data for stone extraction, dating, process and management of works.
4. Ancient sources as evidence of quarrying activity.
5. Quarries and major construction programs: a close relationship in both directions.
6. Archaeometric research in ancient quarries (destination - provenance).

## ***An Overview of Granite Quarries in the Aegean World from Prehistory to the 19th c. CE***

***Athina Boleti*** (Leiden University)

### **Résumé — Abstract**

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## ***Errances sur l'île errante. L'étude des carrières de Délos: un regard rétrospectif et critique***

**Jean-Charles Moretti, Stéphanie Zugmeyer** (Institut de Recherche sur l'Architecture Antique)

### **Résumé — Abstract**

Dans le cadre du programme géologie et architecture à Délos soutenu par l'Agence nationale pour la recherche entre 2018 et 2023, une étude des carrières antiques et modernes de l'île a été réalisée. Nous évoquerons dans notre communication les difficultés que nous avons rencontrées à chaque étape de cette étude et les manières dont nous avons tenté de les résoudre. Nous esquisserons des bilans critiques de nos méthodes et, dans certains cas, évoquerons d'autres méthodes qui auraient pu être suivies. Les thèmes suivants seront abordés :

- l'identification des carrières : carrières, lieux d'extractions ponctuelles, extractions associées à des aménagements préalables à des construction ;
- la caractérisation des roches extraites : approche géologique et approche archéologique ;
- le relevé des carrières et des traces d'outils : question d'échelles et de nombre ;
- des traces d'extraction à la restitution de la forme des outils utilisés et à celle des modes d'exploitation des carrières ;
- l'évaluation sans fouille des volumes extraits dans les carrières ;
- la datation sans fouille des périodes d'activité des carrières ;
- la propriété des carrières ;
- de la carrière au monument : les transports ;
- traces d'extraction et traces de débit sur les blocs en œuvre.

## ***Methodological Approach to the Geological Study of a Stone Quarry: The Example of the Delian Marbles***

**Tommy Vettor** (Muséum national d'Histoire naturelle)

### **Résumé — Abstract**

Over the past two centuries, numerous projects have demonstrated the value of studying ancient stone quarries to enhance our understanding of ancient civilisations. Such research necessitates the integration of several scientific approaches, with geology playing a central role. The geological context of a quarry, along with the general characteristics of its stones, can influence how the blocks were extracted, as well as the quantity and quality of material available. Moreover, the petrographic and geochemical properties of the stones enable their identification among the artefacts and architectural elements.

The ancient quarries of Delos Island offer an excellent case study for such geological investigations, particularly in the case of marble, which has been the subject of a detailed study from fieldwork to laboratory analyses. Delos hosts three marble outcrops, two of which are located within the ancient city itself. Geological mapping, combined with geological cross-sections, has allowed for an estimation of the volume of marble available in antiquity. A reference lithothèque has been created through systematic sampling of the four marble types present on the island. Petrographic examination and geochemical analysis of these samples have provided their “identity profile”, which, by comparison with archaeological material, have made possible to trace Delian marble in the ancient architecture, thereby allowing the quarries to be dated and shedding light on the use of local marble on Delos Island.

## ***Une enquête sur les carrières antiques de la périphérie de Dougga : les techniques d'extraction, leur datation et le problème de l'évacuation de la production***

**Vassiliki Anevlavi** (Austrian Archaeological Institute)

### **Résumé — Abstract**

Through a close examination of extraction traces, including tool marks, unfinished products, quarry debris, and inscriptions on the parent rock, ancient quarry sites provide a valuable record of stone-working techniques, organization of labor, and the broader cultural and economic frameworks in which they operated. This study adopts an intra-cross-craft perspective to explore the full chaîne opératoire of marble exploitation, from initial extraction to the various stages of transformation and use.

Focusing on the quarrying landscapes of Tinos Island, this research brings together case studies from the sites of Ras, Vathi, and Karika—each offering distinct evidence of ancient quarrying and/or pre-industrial activity. By combining traditional archaeological observation with digital documentation techniques such as photogrammetry and drone-based survey, the study maps and analyzes surface features, tool mark typologies, and spatial organization within each quarry.

These findings are further contextualized through geological and archaeometric insights, contributing to an integrated understanding of marble production in the Cyclades. The research illuminates the diachronic use of Tinos' marble resources, revealing patterns of resource management, technical choices, and artisanal knowledge transmission. Ultimately, this work contributes to broader discussions on the material and social dimensions of quarrying in ancient island environments.

## ***Millstone Extraction in Lemnos Island during Antiquity***

***Eirini Poupaki*** (Hellenic Ministry of Culture)

### **Résumé — Abstract**

The coastal quarry of Hephaistia, in the Klas peninsula, known as the Cape of 100 Heads, was known until recently as the source of the building material used in ancient times for the construction of the nearby buildings, as well as for other sites on the island. However, a closer study of the extraction marks has allowed us to realize that there was an intensive quarrying of circular blocks for the carving of rotary querns, which must be dated to modern times, with some traces probably dating to the late Roman and Byzantine periods. The material extracted is known as «poros», a sedimentary conglomerate rock with a fine texture. It is probable that the extracted rock was transported by sea. The rocky outcrops of the southwestern part of the island, between Thanos and Kontias, provided a gray volcanic rock, which is attested to the ancient stone artifacts of everyday use, such as the querns.

The study, which is still in progress, aims to shed light on an unknown sector of stone carving in the North Aegean region, where the tradition of stone quarrying was well established since antiquity, as evidenced by the famous marble quarries of Lesvos and the processing of the volcanic rocks of the island for architectural elements and sarcophagi. However, stone quarrying in Lemnos remains obscure to this day and deserves further investigation.

## **Geoarchaeological Context of a Multi-lithological Quarrryscape around the Archaic sanctuary of Despotiko (Cyclades, Greece)**

**Erich Draganits** (University of Vienna)

### **Résumé — Abstract**

The Aegean islands are literally stone-rich and rocks are easily accessible in many areas. Therefore, the use of building stones has a long — and still ongoing — history, which has attracted scientific research since long. However, most of these studies focus on (white) marble from a few large quarry locations — while other rock types and less important quarry areas are understudied.

Draganits *et al.* (2009) and Draganits (2023) studied the building stones of the important Archaic sanctuary and related buildings on Despotiko Island, southwest of Antiparos (Kourayos 2020, Alexandridou *et al.* 2023).

In total, ten different rock types have been recorded so far. The main lithologies are: medium grained white calcitic marble, coarse white calcitic marble, white mylonitic gneiss, grey orthogneiss and calcrete represent the most important lithologies; furthermore, grey banded calcite marble, dolomitic marble, rhyolite, Pleistocene eolianite and mica schist occur.

Despotiko has been geologically mapped in detail and with exception of the coarse white calcite marble, all rock types can be found on island and therefore it is not surprising that five quarry areas with 16 quarries/rock extractions have been documented. Excluding two small eolianite quarries in the south of Despotiko, at Livádi, as well as the four small white mylonitic gneiss quarries southeast of Panagía church, which probably were not associated with the sanctuary, all others are within 420 to 900 m distance from the sanctuary. The latter quarries are generally found at higher altitudes than the sanctuary, except the large eolianite quarry on Tsimintiri. Unambiguous quarrying traces have been found only in the medium grained white calcite marble quarry at Kontis Hill and in the eolianite quarry on Tsimintiri, probably in all other cases rocks have been loosened along tectonic fractures, without leaving clear traces. This study shows that with exception of the large building stones, e.g. thresholds, columns, architraves, which are made from coarse white calcite marble, all other building stones have derive from nearby, local sources.

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