



Επιστημονικό Σωματείο,  
Έτος Ίδρυσης 1982, έδρα:  
Κάνιγγος 27, 106 82 Αθήνα  
(Ένωση Ελλήνων Χημικών)  
<http://archaeometry.org.gr>

**ΔΟΙΚΗΤΙΚΟ  
ΣΥΜΒΟΥΛΙΟ:**

Γ. Φακορέλλης (πρόεδρος),  
Ι. Μπασιάκος (αντιπρόεδρος),  
Ε. Φιλιπάκη (γενική  
γραμματέας),  
Α. Οικονόμου (ταμίας),  
Μ. Παπαγεωργίου (ειδική  
γραμματέας),  
Μ. Καπαρού (μέλος),  
Ε. Κουλουμπή (μέλος)

**Πληροφορίες:**

Γ. Φακορέλλης (σύνταξη,  
επιλογή ύλης)

**E-mail:** [yfacorel@uniwa.gr](mailto:yfacorel@uniwa.gr)

Scientific Association, Year  
of Establishment 1982,  
Headquarters: Kaniggos 27,  
106 82 Athens (Association  
of Greek Chemists)  
<http://archaeometry.org.gr>

**BOARD:**

Y. Facorellis (president),  
I. Bassiakos (vice-president),  
E. Philippaki (general  
secretary),  
A. Oikonomou (treasurer),  
M. Papageorgiou (special  
secretary),  
M. Kaparou (member),  
E. Kouloumbi (member)

**Information:**

Y. Facorellis (editor)

**E-mail:** [yfacorel@uniwa.gr](mailto:yfacorel@uniwa.gr)

# Πληροφοριακό Δελτίο της Ελληνικής Αρχαιομετρικής Εταιρείας

**- Μάιος 2021 -**

**Beauty is a short-lived tyranny.**

**(Socrates)**

## Newsletter of the Hellenic Society of Archaeometry

**- May 2021 -**

**Nr. 242**

## **ΠΙΝΑΚΑΣ ΠΕΡΙΕΧΟΜΕΝΩΝ – TABLE OF CONTENTS**

### **ΣΥΝΕΔΡΙΑ – CONFERENCES/WORKSHOPS**

IPERION HS 1<sup>st</sup> Doctoral Summer School, 13 - 16 July, 2021 ..... **page 3**

3<sup>rd</sup> International Radiocarbon in the Environment Conference (RIE III), 5<sup>th</sup> –  
9<sup>th</sup> July, 2021 ..... **page 5**

ΕΚΠΑΙΔΕΥΤΙΚΟ ΣΕΜΙΝΑΡΙΟ "Ημέρες Φασματοσκοπίας", Ινστιτούτο  
Νανοεπιστήμης και Νανοτεχνολογίας, Ε.Κ.Ε.Φ.Ε. "Δημόκριτος" ..... **page 6**

### **ΘΕΣΕΙΣ ΕΡΓΑΣΙΑΣ/ΥΠΟΤΡΟΦΙΕΣ – JOB VACANCIES/FELLOWSHIPS**

University of Crete and IESL-FORTH two (2) research posts ..... **page 8**

### **INTERNET SITES**

Archaeometallurgical and mining archaeological studies on Bronze Age  
metallurgy in the Western Balkans (FWF project P 32095) ..... **page 10**

Web portal MICHAEL ..... **page 12**

### **ΝΕΕΣ ΕΚΔΟΣΕΙΣ – NEW PUBLICATIONS**

Death in Mycenaean Lakonia: a silent place ..... **page 13**

Hellenistic astronomy: the science in its contexts ..... **page 18**

### **ΕΙΔΗΣΕΙΣ - NEWS RELEASE**

How old are the Dead Sea Scrolls? Carbon-dating project to offer answers, by  
Rossella Tercatin ..... **page 23**

Climate crises in Mesopotamia prompted the first stable forms of state ..... **page 25**

Artificial Intelligence Helps Identify Authors of Dead Sea Scrolls, by Ariel  
David ..... **page 27**

Turkey's ancient cities shed light on vast Mesopotamian history ..... **page 31**

Gladiator arena from Roman era unearthed in Turkey, by Laura Geggel ..... **page 33**

The alphabet may have been invented 500 years earlier than we thought, by  
Colin Barras ..... **page 35**

## ΣΥΝΕΔΡΙΑ - CONFERENCES/WORKSHOPS

### IPERION HS 1<sup>ST</sup> DOCTORAL SUMMER SCHOOL, 13 - 16 JULY, 2021

IPERION HS, a unique European Research Infrastructure on Heritage Science, **opens its 1<sup>st</sup> Doctoral Summer School to be held virtually from 13 July to 16 July 2021.**

The IPERION HS Doctoral Summer Schools HS-DSS are part of the IPERION HS-Academy IPHSA and provide a learning multidisciplinary interactive experience in the field of Heritage Science. Each year it will be organized by different institutions on different focuses. Theoretical and technical lectures will be imparted by a wide range of international experts in the field of Heritage Science. All lectures are intended to provide an overview of the state-of-the-art as well as specific details of their topic.

The 1<sup>st</sup> HS-DSS is aimed at providing examples of excellence in Heritage Science for conservation and collection care research and access. The 1<sup>st</sup> HS-DSS will be taught online and comprise four intensive days of lectures and virtual study visits, during which participants will become acquainted with the multidisciplinary skills of the IPERION HS consortium and knowledge accumulated by the partners.

Lectures and virtual study tours will be adapted to an interdisciplinary audience of learners by focusing more on problem-solving than on the specific adopted scientific methods/techniques. All sessions will be conducted in English.

The IPERION HS Doctoral Summer School is open to postgraduate and PhD students, post-docs, conservators-restorers and scientists working in conservation and restoration of cultural heritage. **Registration is open, [here](#).**

Please visit the site: <https://www.iperionhs.eu/doctoral-summer-school/>

.....

IPERION HS, μια μοναδική ευρωπαϊκή ερευνητική υποδομή στην επιστήμη της κληρονομιάς, **αναγγέλλει το πρώτο θερινό σχολείο που θα διεξαχθεί διαδικτυακά, από 13 έως 16 Ιουλίου 2021**

Τα θερινά σχολεία «IPERION HS Doctoral Summer Schools»-HS-DSS αποτελούν δράσεις της «Ακαδημίας IPERION HS» IPHSA, σε συνέχεια των θερινών σχολείων του IPERION CH, και παρέχουν μια πολυεπιστημονική διαδραστική εμπειρία μάθησης στον τομέα της Επιστήμης της Κληρονομιάς. Κάθε χρόνο, το HS-DSS θα οργανώνεται από διαφορετικά ιδρύματα με διαφορετικά θέματα. Θεωρητικές και τεχνικές διαλέξεις θα προσφέρονται από ένα ευρύ φάσμα εμπειρογνομόνων διεθνώς, στον τομέα της Επιστήμης της Κληρονομιάς, παρέχοντας μια επισκόπηση των πιο πρόσφατων εξελίξεων στο πεδίο έρευνας που εκπροσωπεί ο κάθε εμπειρογνώμονας.

Το 1<sup>ο</sup> HS-DSS θα περιλαμβάνει τέσσερις ημέρες εντατικού προγράμματος διαλέξεων και εικονικών περιηγήσεων μελέτης, κατά τη διάρκεια των οποίων οι συμμετέχοντες θα εξοικειωθούν με τις πολυεπιστημονικές δεξιότητες και την εξειδικευμένη γνώση στην

έρευνα, συντήρηση και προστασία συλλογών πολιτιστικής κληρονομιάς, των εταίρων της κοινοπραξίας IPERION HS. Οι διαλέξεις θα προσαρμοστούν στο ευρύ διεπιστημονικό κοινό των φοιτητών, εστιάζοντας περισσότερο στην επίλυση προβλημάτων παρά στις συγκεκριμένες επιστημονικές μεθόδους / τεχνικές που θα παρουσιαστούν. Όλες οι συνεδρίες θα διεξαχθούν στα Αγγλικά.

Το θερινό σχολείο απευθύνεται σε μεταπτυχιακούς και διδακτορικούς φοιτητές, μεταδιδακτορικούς ερευνητές, συντηρητές και επιστήμονες που δραστηριοποιούνται στην έρευνα, συντήρηση και αποκατάσταση της πολιτιστικής κληρονομιάς.

**Η περίοδος εγγραφών έχει ανοίξει, [εδώ](#). Οι θέσεις είναι περιορισμένες.**

Για περισσότερες πληροφορίες, επισκεφθείτε την ιστοσελίδα:  
<https://www.iperionhs.eu/doctoral-summer-school/>

---

## **3<sup>RD</sup> INTERNATIONAL RADIOCARBON IN THE ENVIRONMENT CONFERENCE (RIE III), 5<sup>TH</sup> - 9<sup>TH</sup> JULY, 2021**

The 3<sup>rd</sup> International Radiocarbon in the Environment Conference (RIE III) will take place, from Monday 5<sup>th</sup> to Friday 9<sup>th</sup> of July 2021.

On behalf of the Organizing Committee and the Gliwice Radiocarbon Laboratory Team, we would like to invite you to participate in the Conference.

The Conference will take place only in the Internet (zoom.us meetings, YouTube transmission). Due to the COVID-19 threat subsides, the hybrid Conference, is no longer possible.

The deadline for abstract submission has been extended and is due May 4<sup>th</sup>, 2021.

The RIE III website ([c14env.polsl.pl](http://c14env.polsl.pl)) is open. All relevant information (deadlines, registration, abstract submission, etc.) will be updated soon on the web site. Due to the lower organizing costs of the meeting the new conference fee is under consideration and will be announced soon.

### **RIE III Organizing Committee**

Andrzej Z. Rakowski (Conference Chairperson), Sławomira Pawełczyk, Jacek Pawlyta, Konrad Tudyka, Barbara Sensuła, Danuta J. Michczyńska, Grzegorz Kazanowski, Aneta Jachimowicz

\*\*\*\*\*

Find us on:

Facebook - [fb.com/c14env](https://www.facebook.com/c14env)

Tweeter - [twitter.com/c14env](https://twitter.com/c14env)

\*\*\*\*\*

---

**ΕΚΠΑΙΔΕΥΤΙΚΟ ΣΕΜΙΝΑΡΙΟ "ΗΜΕΡΕΣ  
ΦΑΣΜΑΤΟΣΚΟΠΙΑΣ", ΙΝΣΤΙΤΟΥΤΟ  
ΝΑΝΟΕΠΙΣΤΗΜΗΣ ΚΑΙ  
ΝΑΝΟΤΕΧΝΟΛΟΓΙΑΣ, Ε.Κ.Ε.Φ.Ε.  
"ΔΗΜΟΚΡΙΤΟΣ"**

Αγαπητοί συνάδελφοι,

σας προωθώ το πρόγραμμα του εκπαιδευτικού σεμιναρίου που διοργανώνει η Επιτροπή Εκπαίδευσης του Ινστιτούτου Νανοεπιστήμης και Νανοτεχνολογίας του Ε.Κ.Ε.Φ.Ε. "Δημόκριτος", με τίτλο **"Ημέρες Φασματοσκοπίας"** μέσω της διαδικτυακής πλατφόρμας zoom, σύμφωνα με το παρακάτω πρόγραμμα.

Μπορείτε να προωθήσετε το πρόγραμμα στους φοιτητές και σε όσους πιστεύετε πως θα ενδιαφερόταν.

Με φιλικούς χαιρετισμούς,

Γιάννης

**ΕΚΠΑΙΔΕΥΤΙΚΟ ΣΕΜΙΝΑΡΙΟ "Ημέρες Φασματοσκοπίας"**

**Πέμπτη 6/5/2021**

10:00-10:45 "Φασματοσκοπία NMR σε Χαμηλές Θερμοκρασίες" (Μ. Φαρδής, INN, ΕΚΕΦΕ "Δ")

11:00-11:45 "Προχωρημένες Τεχνικές Πυρηνικού Μαγνητικού Συντονισμού (NMR) Στερεάς Κατάστασης" (Γ. Παπαβασιλείου, INN, ΕΚΕΦΕ "Δ")

12:00-12:45 "Φασματοσκοπία NMR Υψηλής Ανάλυσης στο Διάλυμα: Βασικά Στοιχεία - Μελέτες Περιπτώσεων Μοριακών Δομών" (Κ. Γιαννακοπούλου, INN, ΕΚΕΦΕ "Δ")

**Πέμπτη 13/5/2021**

10:00-11:15 "Δονητική φασματοσκοπία: Φασματοσκοπία Υπερύθρου" (Γ. Χρυσικός, ΙΘΦΧ, ΕΙΕ)

11:30-12:45 "Δονητική Φασματοσκοπία: Φασματοσκοπία Raman" (Α. Παϊπέτης, Τμ. Μηχ. Επιστ. Υλικών, Παν/μιο Ιωαννίνων)

**Πέμπτη 20/5/2021**

10:00-10:45 "Φασματοσκοπία Mössbauer: Βασικές αρχές και Εφαρμογές" (Ε. Devlin, INN, ΕΚΕΦΕ "Δ")

11:00-11:45 "Φασματοσκοπία EPR Συνεχούς Ακτινοβολήσης: Βασικές Αρχές και Εφαρμογές" (Γ. Σανάκης, INN, ΕΚΕΦΕ "Δ")

12:00-12:45 "Φασματοσκοπία Παλμικού EPR" (Γ. Μήτρικας, INN, ΕΚΕΦΕ "Δ")

**Πέμπτη 27/5/2021**

10:00-10:45 "Φασματοσκοπία Φθορισμού και Απορρόφησης Ακτίνων Χ" (Α. Καρύδας,

ΠΠΣΦ, ΕΚΕΦΕ "Δ")

11:00-11:45 "Ιοντικές Τεχνικές Ανάλυσης" (Α. Λαγογιάννης, ΠΠΣΦ, ΕΚΕΦΕ "Δ")

12:00-12:45 "Βασικές Αρχές Φασματοσκοπίας Φωτοηλεκτρονίων (XPS/ARPES)" (Α. Δημουλάς, INN, ΕΚΕΦΕ "Δ")

### Πέμπτη 3/6/2021

10:00-10:45 "Βασικές Αρχές Περίθλασης Ακτίνων Χ από Πολυκρυσταλλικά Δείγματα. Μέθοδος Rietveld" (Β. Ψυχάρης, INN, ΕΚΕΦΕ "Δ")

11:00-11:45 "Η Μέθοδος Rietveld στην Πράξη - Προγράμματα Fullprof, Profex" (Β. Ψυχάρης, INN, ΕΚΕΦΕ "Δ")

12:00-12:45 "Κρυσταλλογραφία Υγρών Κρυστάλλων" (Μ. Αρκάς, INN, ΕΚΕΦΕ "Δ")

Για την αποτελεσματικότερη οργάνωση των σεμιναρίων και διαχείριση των συμμετοχών, παρακαλούμε να μας γνωστοποιήσετε την πρόθεση συμμετοχής σας δηλώνοντας τα στοιχεία σας (ονοματεπώνυμο, ειδικευση/ιδιότητα, ηλεκτρονική διεύθυνση) μέχρι την Μεγ. Πέμπτη 29 Απριλίου 2021, στην ηλεκτρονική διεύθυνση [edu@inn.demokritos.gr](mailto:edu@inn.demokritos.gr)

Με εκτίμηση

Επιτροπή Εκπαίδευσης του INN, ΕΚΕΦΕ "Δ"

\*\*\*\*\*

**Ioannis Karatasios**

Researcher | Archaeological and Building Materials Lab

[Ceramics and Composite Materials research group](#)

Institute of Nanoscience and Nanotechnology  
National Centre for Scientific Research "Demokritos"  
Agia Paraskevi, 15310, Athens – Greece

t: +30 210 6503326 (office), 6503353 (Lab)



\*\*\*\*\*

---

## ΘΕΣΕΙΣ ΕΡΓΑΣΙΑΣ/ΥΠΟΤΡΟΦΙΕΣ – JOB VACANCIES/FELLOWSHIPS



### UNIVERSITY OF CRETE AND IESL-FORTH TWO (2) RESEARCH POSTS

In the context of project [SpArch](#), the Department of Chemistry, University of Crete and IESL-FORTH are soliciting expressions of interest for two (2) research posts:

- i. a **Post-doctoral researcher appointment** (18 months) and
- ii. a **PhD research assistantship** (24 months)

We are looking for young, motivated individuals with strong team spirit, enthusiastic for carrying out competitive research and capable of developing new ideas and collaborations in a highly cross-disciplinary environment.

SpArch (Spectrochemical Analysis of Archaeological Bio-Organic Residues), funded by HFRI, aims to develop protocols for the high-throughput analysis of archaeological bio-organic residues based on the combination of several spectrochemical methods including Fluorescence, Raman, FT-IR and NMR spectroscopies.

PhD candidates will need to have a strong background in Chemistry, Materials Science, Biology or Chemical Engineering with knowledge and skills relevant to the analysis and/or characterization of (bio)organic materials.

Post-doc candidates are required to hold a PhD in Sciences or Engineering and have a proven research experience in relevance to the objectives of the SpArch project. Important will be their ability to function in a cross-disciplinary environment and design and conduct demanding experimental projects. Acquaintance with archaeological materials / conservation issues of historical objects will be positively considered.

Formal announcements for the two posts are expected during the summer of 2021.

For further information, please contact  
[Demetrios Anglos](mailto:anglos@uoc.gr) ([anglos@uoc.gr](mailto:anglos@uoc.gr); [anglos@iesl.forth.gr](mailto:anglos@iesl.forth.gr))



[Apostolos Spyros \(aspyos@uoc.gr\)](mailto:aspyos@uoc.gr)

---

---

## *INTERNET SITES*

### **ARCHAEOLOGICAL AND MINING ARCHAEOLOGICAL STUDIES ON BRONZE AGE METALLURGY IN THE WESTERN BALKANS (FWF PROJECT P 32095)**

The aim of this archaeometric research is to gain new and further knowledge about the Late Bronze Age metal cycles and exchange systems in the western and central Balkans. This is of particular interest in terms of its possible intermediary role between Central Europe, respectively the Urnfield culture and the Mediterranean area. With the aid of various scientific analysis methods - such as ore microscopy, trace element and lead isotope analyses - systematic detailed analyses, providing further knowledge about the above mentioned topics, are carried out. Of particular interest is the potential use and development of local (copper) ore resources and their integration into local and supra-regional production cycles.

A review of the previously published literature shows that the current level of knowledge is in part more based on assumptions than on exact results. Extensive systematic series of studies, using trace element and lead isotope analyses, which focus on late Bronze Age dated metal objects and their relation to ore deposits, are largely missing so far. This circumstance is all the more surprising, since archaeological evidence in several regions with detectable copper ore deposits (e.g. Central Bosnia, Eastern Serbia) indicates a veritable upswing in metallurgical activity, especially for the Late Bronze Age. Some of the assumed production centers could have produced not only for the purpose of local demand but also for supra-regional needs.

The main question is whether this rise in bronze production, which can be seen in the archaeological find material, can be traced back to the use of domestic resources, or whether the metal demand was covered resorting to a large-scale European supply network, for example the north-adjacent Alpine regions. (Research already carried out within another project has shown that the southern Alps played a prominent role in the metal supply of (northern) Italy during the Late Bronze Age.) The majority of the analysed non-ferrous metal objects originate from the distinctive spectrum of shapes that characterises the entire cycle of the Urnfield culture, reaching its southern main distribution in the regions to be examined. Thus, the studies on the material, which have already been carried out, as well as the planned material analyses also make a significant contribution to the hitherto poorly studied metallurgy of Urnfield culture in Central and Southeastern Europe.

Thanks to the cooperation between the OREA - Institute for Oriental and European Archeology, Austrian Academy of Sciences, the VIAS - Vienna Institute of Archaeological Science, University of Vienna, and the Regional Museums in Travnik and Doboj (Bosnia - Herzegovina), a first successful pilot phase of the project has been conducted in 2015 and 2016. A total of approximately 100 samples of objects dating to the period between the 13th and the 9th century B.C. (Ha A1-Ha B3) were taken. In addition to the finished products, local copper ores as well as Late Bronze Age semi-

finished products (ingots) were investigated, by which the analysis includes the complete technology chain. The selection of the sampled finds involves forms with a regional as well as a national distribution pattern in Central and Southeastern Europe.

The first analyses carried out by the VIAS with a scanning electron microscope provided an overview of the used alloy composition (copper, bronze, lead bronze). This step also serves to make a selection of the meaningful samples. In particular, care was taken to select drill samples for subsequent trace element and lead isotope analyses with a geochemical fingerprint that did not appear to be altered by intentional or non-intentional melting processes. In the further course, the basis for the analyses will now be expanded considerably with finds, ores and ingots from the entire region of Southeastern Europe.

### Literature

M. Gavranović, M. Mehofer (with contributions from A. Jašarević and A. Sejfuli), Local forms and regional distributions – metallurgical analysis of the Late Bronze Age objects from Bosnia, *Archaeologia Austriaca* 100, 2016, 87–107.

### Project partner

[Dr. Mario Gavranović](#), OREA, ÖAW

### Links

<https://www.orea.oeaw.ac.at/en/research/urnfield-culture-networks/late-bronze-age-metallurgy-in-the-western-and-central-balkans/>

### Cooperation partners

- Institute of Archaeology Belgrade, Serbia
- Natural History Museum Vienna, Department of Prehistory
- National Museum of Bosnia and Herzegovina in Sarajevo, Bosnia-Herzegovina
- Faculty of Mining, Geology and Petroleum Engineering in Zagreb, Croatia
- Museum of Mining and Metallurgy in Bor, Serbia
- Museum of Krajina in Negotin, Serbia
- Regional Museum Travnik, Bosnia-Herzegovina
- Regional Museum Doboj, Bosnia-Herzegovina
- Regional Museum Zenica, Bosnia-Herzegovina
- Curt-Engelhorn-Zentrum für Archäometrie Mannheim

Please visit the site: <https://vias.univie.ac.at/en/research/archaeometallurgy-and-archaeometry/projects/archaeometallurgical-and-mining-archaeological-studies-on-late-bronze-age-metallurgy-in-the-western-balkans/>

---

## **WEB PORTAL MICHAEL**

Michael is a multilingual online service providing quick and simple access to the digital collections of museums, libraries, archives of European institutions

Please visit the site: <http://www.michael-culture.org>

---

## ***ΝΕΕΣ ΕΚΔΟΣΕΙΣ – NEW PUBLICATIONS***

### **DEATH IN MYCENAEAN LAKONIA: A SILENT PLACE**

BMCR 2021.04.26

Chrysanthi Gallou. Oxford:  
Oxbow Books, 2019. Pp. 296. ISBN 9781789252422 £48.00.

Review by Kate Harrell, Virginia Museum of Natural History.  
[katherinemharrell@googlemail.com](mailto:katherinemharrell@googlemail.com)

Mycenaean archaeology outside of the Argolid is rapidly expanding.

Chrysanthi Gallou's new (2020) volume, *Death in Mycenaean Laconia*, is the first published monograph on a region once thought to be on the fringes of the Mycenaean world, but now understood to be firmly within it. The first section of the Introduction, “Κοίλη Λακεδαίμονα κητώεσσα”: the topographical and geological setting”, takes an interdisciplinary approach. The author describes the salient features of the landscape drawn from geological studies (e.g., the various types of rock of the Parnon and Taygetos mountain ranges) with reference to how the area is also likely to be experienced (the high winds of Cape Malea); this section also inherently frames the author's own area of study. The second section, “Epidavros Limera: Introducing a case study”, addresses this area by bringing in previous historical accounts of the local geography and the etymology of the place name.

The author gives an overview of the archaeology of this site, beginning with the earliest evidence of habitation, dated to the Final Neolithic, and ending with the Archaic period. What is not clear in this section, however, is how Epidavros Limera will be utilized as a case study, although in subsequent chapters this becomes more apparent. The Introduction would have been greatly assisted by maps and charts with some of the salient geographic features picked out, including changes in the ancient and modern coastline. The first, and indeed only, map comes in chapter 1. Equally importantly, Gallou does not discuss routes of overland travel, and sea travel is only mentioned with reference to how dangerous Cape Malea is to mariners; thus, the routes that Laconian Mycenaeans may have navigated to access sites outside the region are not discussed. Gallou's approach of seeing this region in isolation is noticeable from the Introduction.

The first chapter, “Graves and burial contexts”, will doubtless prove to have lasting utility to the discipline because it presents such a complete index of tombs in the region. Gallou presents a gazetteer that combines historical records with excavation and survey reports as well as her own fieldwork and explorations. The chapter is arranged by tomb type (tholoi, chamber tombs, built chamber tombs, simple graves, unspecified and possible Mycenaean graves, graves reported but not excavated) and then by region. The catalog entries present a brief overview of the site, followed by the pertinent details of each tomb, including the excavator of the monument; its publication; location; setting; orientation; dimensions; architectural description; description of burials and finds;

chronology; additional comments; and bibliography. There are many photographs of the tombs, typically of the dromoi and/or stomia, but also of some of the chambers. As a stand-alone report on the archaeology of the tombs of this region, this chapter will doubtless be consulted for many decades to come.

Nevertheless, researchers looking to read up on a particular cemetery will be forced to move around chapter 1 repeatedly in order to find all the various types of graves. The choice to arrange chapter 1 by tomb type and then by area, rather than the other way around, presents a de facto evolutionary development and hierarchical structure of Mycenaean tomb styles that carries over into subsequent chapters.

Chapter 2, “Burial architecture”, divides Mycenaean graves into simple forms (pit, cist, shaft grave, pit-shaft) and complex forms (tholos, chamber tomb, built chamber tomb), and then analyzes these two groups by location, orientation, construction methods, and chronology. Here again, maps locating these graves, or visuals showing the dates that these graves were active, would have been helpful. When discussing simple graves, Gallou’s adoption of the concept of intracommunal and extracommunal burial (as put forth by Christesen 2018[1] for the historical period), in place of the terms intramural/extramural, is a useful confrontation of the problematic nature of the prehistoric evidence; a hodge-podge of survey data, robbed tomb remains, undated material, and emergency excavations mean that applying intramural or extramural to characterize the juxtaposition of Mycenaean mortuary and settlement evidence may be little more than guesswork. By contrast, the concept of intra- and extracommunal approaches the settlement and mortuary domains from a perspective that allows landscape archaeology to be relevant; her lead should be followed by other Aegean prehistorians. In discussing complex tomb types, Gallou grapples with the question of the development of the chamber tomb, whether it was a local development or if it had been imported wholesale from outside the mainland, and here she draws on the Epidavros Limera cemetery evidence to argue that chamber tombs “were the result of independent evolution rather than of the derivation of a single source of inspiration” (p. 96).

The approach taken in chapter 3, “Burial customs and rites”, is becoming familiar in studies of Mycenaean funerary ritual.[2] Here Gallou presents a temporal outline of each phase of burial, with “entering the tomb”, “funerary offerings in primary burials”, and “second funeral rites” sections. While the phenomenological approach that Gallou adopts is becoming widely used, it is noticeable that Gallou sticks to mostly referencing primary excavation reports rather than referring to thematic papers that problematize many of the social activities which she seeks to contextualize. For example, when discussing grave offerings that appear to be intentionally destroyed, Gallou consistently refers to these objects as “killed” (p. 128, p. 144) and “ritually ‘killed’” (p. 143), with the quotation marks suggesting that she feels uneasy with this terminology. Yet she does not engage with published scholarship on this practice. Moreover, she does not associate these objects with secondary funerary rites, which is a missed opportunity, because Gallou’s discussion of *disiecta membra*, bodies without skulls, and the retention of skulls, is extensive. Similarly, Gallou consistently uses the term warrior burial rather than the less overtly-Homeric phrase burial with weapons that has been consistently championed in the literature for some decades.

Indeed, there is little attempt in the volume to pick apart social identity through burial practice.

Chapter 4, “Pottery”, is a catalog of pottery, mostly unpublished, from the chamber tombs at Epidavros Limera. One strength of this volume is Gallou’s willingness to address and rectify mislabeled earlier finds in museums or misidentifications in various reports. For example, “for some—yet unknown—reason, whoever catalogued the pottery from Christou’s excavation confused the toponym ‘Palaiokastro’ at Epidavros Limera with that of Palaiokastro Gortynias and as a result, the file records of the Archaeological Museum of Sparta include false information of the provenance of a number of vases” (p. 148), which Gallou then lists by number. Pottery is arranged by date and then type. Chapters 1 and 4, both catalogs, serve to bookend the middle two chapters.

The way that the epilogue is titled, “Epilogue—Breaking the tomb’s silence”, vastly undersells what this section offers. Typically, epilogues are used to push temporal boundaries (linking the archaeological evidence to later periods and/or historical memory), or to reference the wider contemporary world, in order to narrate a more encompassing perspective on the evidence that has been heretofore meticulously laid out. Gallou’s epilogue does not do this. Instead, the epilogue combines the mortuary data presented in the four chapters with all of the known published settlement data and analysis in order to offer a synthetic historical overview of the region from MH III through Submycenaean-Early Protogeometric, with each chronological horizon (13 in total) systematically discussed. This section presents vast quantities of new data to which Gallou adds her own synthesis about the rise and fall of local sites. One would have thought that Epidavros Limera as the case study would be the focus of this section, but instead no special attention is paid to this site. As such, most of the pottery presented in chapter 4 goes undiscussed. As a whole, the epilogue effectively outlines a comprehensive political geography of Laconia for the whole Late Bronze Age, which to my mind exceeds the limits of the epilogue form. This epilogue should be a full chapter, despite the fact that it is shorter than the others.[3]

Gallou’s approach in the epilogue is problematic in two ways: firstly, as in chapter 3, Gallou mostly cites primary excavation reports that offer—by definition—interpretations that are both initial and limited, whereas the questions Gallou is seeking to answer in this section are much deeper, such as why there is no palace at Ayios Stephanos. Her method for addressing these questions is to suture together settlement datasets with the mortuary evidence she has previously presented, as if the one directly and completely informs and indexes the other. This leads to the second problem with this section; that is, there is now burgeoning scholarship on the political geography of Mycenaean Laconia, with which Gallou for the most part does not engage.[4] Other scholars are already looking to draw comparisons between Laconia and the other Mycenaean palatial geographies in order to highlight similarities or to emphasize an autochthonous form of social complexity.[5] The outcome of these debates has an effect outside of our understanding of Laconia—these same questions are being asked of areas such as Thessaly, Boeotia, and Achaia, where new research and excavations are allowing us to test older models.

Throughout the text, there are some minor proofreading errors regarding in-text citations and in the bibliography, such as names being misspelled, and names omitted from author lists (e.g. Danforth and Tsiaras 1982). For the most part, these mistakes are minor, although in others, it is not clear to which source Gallou is referring. Equally problematic are references completely missing from the bibliography, such as Kardamaki 2017[6] and



Cavanagh 2010-2011.[7]Confusing too is the choice to cite articles in Πρακτικά της Εν Αθήναις Αρχαιολογικής Εταιρείας (ΠΑΕ) as if they are book chapters rather than journal articles. ΠΑΕ references are listed by the year of their publication without mentioning the actual volume that the article is in (ΠΑΕ 2013 was published in 2015, so this volume is cited in the bibliography as 2015, with no mention of it being the 2013 volume). More problematic is that two ΠΑΕ volumes were published in 2015 (2012 and 2013), so in the instance of the references to Vasilogamvrou 2015a and Vasilogamvrou 2015b, it is incumbent on the reader to ascertain that these publications are to be found in two different ΠΑΕ volumes. By way of contrast, Gallou does not cite Αρχαιολογική Εφημερίς (ΑΕ) volumes this way. Anyone needing to Interlibrary Loan ΠΑΕ articles will likely encounter a headache.

Overall, the lack of an overarching thematic narrative in this volume is evident from the fact that the four chapters could have just as easily been arranged in reverse order (Pottery, Burial customs and rites, Burial architecture, Graves and burial contexts), presenting the activities of burial in a loose chronological sequence. While this volume succeeds in presenting a thorough literature review on the cemeteries of Mycenaean Laconia, and publishing for the first time much of the pottery from the tombs at Epidavros Limera, this volume looks back at past scholarship more than it looks forward toward new ideas.

\*\*\*\*\*

#### Notes

[1] Christesen, Paul. 2018. “The Typology and Topography of Spartan Burials from the Protogeometric to the Hellenistic Period: Rethinking Spartan Exceptionalism and the Ostensible Cessation of Adult Intramural Burials in the Greek World”. *Annual of the British School at Athens* 113: 307-363.

[2] See, for example: Boyd, Michael J. 2014. “The materiality of performance in Mycenaean funerary practices”. *World Archaeology* 46(2): 192-205.

[3] Perhaps a typo, but suggestive of the author’s ambivalence towards how to frame this section, the Epilogue is referred to as chapter 5 in the Introduction (p. 1).

[4] For example, Adamantia Vasilogamvrou’s (2016) talk, “Power centralization in LH IIIA Laconia: The Palace at Ayios Vasileios, near Sparta”, given at the British School at Athens, as well as the 2019 Netherlands Institute of Athens conference, “Middle and Late Helladic Laconia: Competing Principalities?” at which Gallou co-presented a paper.

[5] Cf. Sofia Voutsaki’s (2019) presentation, “The political geography of Mycenaean Laconia”, at the Netherlands Institute of Athens conference.

[6] This citation is presumably for Kardamaki, Eleftheria. 2017. “The Late Helladic IIB to IIIA2 Pottery Sequence from the Mycenaean Palace at Ayios Vasileios, Laconia”. *Archaeologia austriaca* 101: 73-142.

[7] This source is unclear; nothing is listed on Nestor.

\*\*\*\*\*



Please visit the site: <https://bmcr.brynmawr.edu/2021/2021.04.26>

---

---

## **HELLENISTIC ASTRONOMY: THE SCIENCE IN ITS CONTEXTS**

BMCR 2021.04.23

Alan Bowen, Francesca Rochberg, Brill's companions in classical studies. Leiden; Boston: Brill, 2020. Pp. xxxii, 751. ISBN 9789004400566 €197,00.

Review by Ulla Koch, Copenhagen University. [aribu@protonmail.com](mailto:aribu@protonmail.com) [Authors and titles are listed below.]

This is an absolutely wonderful book, well-written and a pleasure to read. It is generally based on the most recent research and very informative without being inaccessible to the layman. That the field of ancient astronomy is under rapid development is evident from the bibliography alone. Most of the cited works are from the last couple of decades and many new insights are here presented to a wider scholarly audience. It is generously supplied with interesting and relevant illustrations and its structure and composition take the reader by the hand so that it can be read easily from cover to cover.

The individual chapters can also be read on their own, and the “Historical Glossary” and indices make it an excellent handbook as well. It provides a status quaestionis in a way which is at the same time accessible to the interested layman and contains a brilliant survey and much new to be learnt for the specialist in any parts of the vast topic covered as well. The title could lead one to expect a much narrower focus both on the subject and time period than is the case. Even though the title just refers to astronomy, the scope of the volume also covers the various forms of astrology current in the period under discussion. Astronomy and astrology were part and parcel in antiquity—and the two disciplines are sometimes in modern research referred to collectively as “astral sciences”—and the volume accordingly gives equal consideration to both. The period under discussion stretches from ca. 300 BCE to 750 CE, which is not covered by any existing label of historical periods but rather by terms such as Late Antiquity, Byzantine, Greco-Roman period, and so forth. The editors chose the term Hellenistic since this particular form of astronomy/astrology emerged in the cultural crucible of the Hellenistic Period (standard definition 323-31 BCE) and remained fundamentally unchanged until the advent of the world of Islamic scholarship in the 8th century CE. “Hellenistic Astronomy” is a meta-concept which refers to a certain set of principles, an overarching framework for understanding celestial phenomena, almost a mentality. “Hellenistic” is thus a conceptual label rather than a historical one.[1] The geographical and cultural sphere is large, spanning traditions from Babylonia, Egypt, Greece, and Rome, and Christian, Judean, Mandaean, Stoic, and Hermetic perspectives.

The book is divided into three thematic parts forming a logical sequence. Part A, “Technical Requirements”, is devoted to the basic principles and descriptive tools used in Hellenistic Astronomy. It introduces the principles of geocentric astronomy and gives the reader the necessary background knowledge to understand the fundamentals of Hellenistic astronomical theories, hypotheses, and concepts. For instance, the chapter “Methods of Reckoning Time” by Robert Hannah explains in clear terms both concepts

and some of the practical tools, such as the armillary spheres and the fascinating Antikythera Mechanism which was salvaged from an ancient shipwreck and has been reconstructed.[2] Part B, “Observations, Instruments, and Issues”, covers the observational foundations of Hellenistic Astronomy and the instruments used by ancient astronomers. It also deals with some thematic issues concerning the aims of Egyptian, Babylonian, and Greco-Roman astronomy. Part C, “Contexts”, makes up half the tome and is devoted to contexts in the widest sense—the cultural, religious, and philosophical settings, the practitioners, astrology, and horoscopes. In chapter 9.1 “The Sundial and the Calendar”, Robert Hannah quotes a comic playwright (perhaps Plautus) ranting against the tyranny of sundials which determines when it is time to eat so that people shrivel up in hunger rather than eat before the appointed time.

In antiquity just as today, technological changes have never met with universal appreciation.

The attempt to paint an interconnected picture of Hellenistic Astronomy across the chosen time and cultures is quite successful.

However, the reader should be aware that the cross-referencing is sometimes lacking, and there are some inconsistencies between chapters.[3] As an Assyriologist, I am especially pleased with the many references to Babylonian astral sciences and culture. The wonderful Babylonian sources are unfortunately still mostly known only to a small group of experts, and this volume will play an important part in putting them on the map. As far as we know, Babylonian astronomy did not evolve further after about 330 BCE, coinciding with the very beginning of the Hellenistic Period, but it continued to be practiced, and the texts were copied by scholars from Babylon, Uruk, and Nippur up into the 1st millennium CE. These scientific circles clearly were important contributors to the development of Hellenistic Astronomy.[4] This is made evident both by the chapters devoted to Babylonian astral sciences and by the frequent references in chapters dealing with other aspects of Hellenistic astronomy and their historical links to Babylonian observation, tradition, and innovation.

Sometimes the unfamiliarity with the Mesopotamian material shines through, and the editors could have straightened some misconceptions out. For instance, the formulation on p. 241 that various events and phenomena, including the study of the exta of sacrificial animals, “formed complex signs from which one could predict important events that were relevant to kings, the state, and sometimes the individual”.[5] This is an oversimplification and somewhat of a misrepresentation of Babylonian divination. According to Diodorus of Sicily, whose descriptions of the world of Babylonian scholarship are wondrously precise and in accordance with what we know today from the archeological and textual record, the branch of divination in which the Babylonians were known to be particularly proficient was extispicy.[6] Extispicy and other forms of induced/artificial divination were primarily performed for individuals.[7] Indeed, astrology as practiced in the tradition of the omen-series *Enūma Anu Enlil* is special among Mesopotamian divination practices as it served only the king and the nation and dealt with events like famine, flood, rebellion, and war, which necessitated ritual action by the ruler to prevent.

In general, if anything could be desired from this generous book, it is the context of magical and divinatory practices more broadly.

Another example is the discussion in chapter 9.3 “Hellenistic Astronomy in Medicine,” by Dorian Gieseler Greenbaum, of the Babylonian experts involved in medicine, the *āšīpu*, the *asû*, and the *bārû*. The position of JoAnn Scurlock is cited uncritically without regard for the wide discussion on the subject that points to different understandings of their functions. These experts relied on magical remedies, and the diagnosis made by the *āšīpu* and the etiology of illness was entirely religious rather than empirical. Further, the *bārû* (“seer”) could be consulted about recovery, but he would not “use every means available for curing disease” (p. 353); that was entirely out of his remit. On p. 354, the case of a star being appealed to by a sufferer to “judge his case” is mentioned as uncommon. In fact, the trope of the gods, also in their celestial aspect, as divine judges deciding cases put before them by suffering mankind is an absolute staple in Babylonian religion and magic, including divination. But these are minor issues. The Babylonian medical-magical corpora are huge and difficult to access, so any attempt to include them in a discussion of Hellenistic astronomy is praiseworthy. This is a book which deserves a wide readership.

### **Authors and titles**

Preface Acknowledgments List of Illustrations and Tables List of Abbreviations  
Prolegomena to the Study of Hellenistic Astronomy Alan C. Bowen and Francesca  
Rochberg

### **Part A Technical Requirements:**

1. The Celestial Sphere Clemency Montelle
2. Methods of Reckoning Time Robert Hannah
3. Quantitative Tools
- 3.1 Techniques of Measurement and Computation Mathieu Ossendrijver
- 3.2 Planar and Spherical Trigonometry Glen Van Brummelen
4. Theory of the Sun, Moon, and Planets
- 4.1 Fundamentals of Planetary Theory Nathan Sidoli
- 4.2 Hypothesis in Greco-Roman Astronomy Alan C. Bowen
- 4.3 Some Early Hypotheses in Greco-Roman Astronomy Alan C. Bowen
- 4.4 The Ptolemaic Planetary Hypotheses James C. Evans
- 4.5 The Hellenistic Theory of Eclipses Clemency Montelle
- 4.6 Hellenistic Babylonian Planetary Theory Mathieu Ossendrijver
- 4.7 The Babylonian Contribution to Greco-Roman Astronomy Francesca Rochberg
- 4.8 Hellenistic Egyptian Planetary Theory Micah T. Ross

### **Part B Observations, Instruments, and Issues:**

5. Observational Foundations
- 5.1 The Observational Foundations of Babylonian Astronomy Lis Brack-Bernsen
- 5.2 Experience and Observation in Hellenistic Astronomy Richard L. Kremer
6. Astronomical Instruments
- 6.1 Hellenistic Surveying Instruments Tracey E. Rihll
- 6.2 Hellenistic Maps and Lists of Places Klaus Geus
- 6.3 Star-Lists from the Babylonians to Ptolemy Gerd Graßhoff
- 6.4 Ptolemy’s Instruments Dennis W. Duke
7. Thematic Questions
- 7.1 Issues in Hellenistic Egyptian Astronomical Writings Anthony Spalinger
- 7.2 The Texts and Aims of Babylonian Astronomy Hermann Hunger
- 7.3 Issues in Greco-Roman Astronomy of the Hellenistic Period Alan C. Bowen

### Part C Contexts

8. The Professional *ἀστρολόγος* Wolfgang Hübner 9. Hellenistic Astronomy in Public Service
- 9.1 The Sundial and the Calendar Robert Hannah
- 9.2 The Antikythera Mechanism James C. Evans
- 9.3 Hellenistic Astronomy in Medicine Dorian Gieseler Greenbaum 10. Hellenistic Astronomy in Literature
- 10.1 Aratus and the Popularization of Hellenistic Astronomy Stamatina Mastorakou
- 10.2 The Authority of the Roman Heavens Alfred Schmid 11. Hellenistic Astronomy in the Training and Work of Priests
- 11.1 Hellenistic Astronomy and the Egyptian Priest Alexandra von Lieven
- 11.2 Hellenistic Astronomy and the Babylonian Scribal Families Mathieu Ossendrijver
12. Astral Divination and Natal Astrology
- 12.1 The Hellenistic Horoscope Dorian Gieseler Greenbaum
- 12.2 Hellenistic Babylonian Astral Divination and Nativities Francesca Rochberg
- 12.3 Hellenistic Horoscopes in Greek and Latin: Contexts and Uses Stephan Heilen
- 12.4 Demotic Horoscopes Micah T. Ross
13. Theological Contexts
- 13.1 Hellenistic Astronomy in Early Judaic Writings James C. VanderKam
- 13.2 Astral Divination in the Dead Sea Scrolls Helen R. Jacobus
- 13.3 Hellenistic Astronomy in Early Christianities Nicola Denzey Lewis
- 13.4 Cosmology in Mandaean Texts Siam Bhayro
- 13.5 Astral Discourse in the Philosophical Hermetica (Corpus Hermeticum) Christian Wildberg
14. Hellenistic Astronomy in the Philosophical Schools
- 14.1 Astronomy and Divination in Stoic Philosophy Giuseppe Cambiano
- 14.2 Plotinus on the Motion of the Stars James Wilberding
- Historical Glossary of Important Terms in Hellenistic Astronomy Bibliography Index of Passages Index of Names Index of Subjects

\*\*\*\*\*

### Notes

[1] However, not all the authors adhere to this terminology and other labels abound throughout the volume. This kind of astral science could also be called “papyrus-astrology” or “-astronomy” after the medium on which a large part of it was first written.

[2] See chapter 2, for the instruments, see also Chapter 6.4 “Ptolemy’s Instruments” by Dennis W. Duke and chapter 9.2 “The Antikythera Mechanism” by James C Evans.

[3]E.g., Chapter 8, “The Professional *Ἀστρολόγος*,” by Wolfgang Hübner (p. 314-315) describes the instruments used by astrologers without cross-reference to the chapters where they are depicted and described in the volume.

[4] Chapter 11.2 “Hellenistic Astronomy and the Babylonian Scribal Families” by Mathieu Ossendrijver.

[5] Chapter 6.3 “Star-Lists from the Babylonians to Ptolemy” by Gerd Grasshoff.

[6] The passage mentioning that “they also show marked ability in making divinations from the observation of the entrails of animals, deeming that in this branch they are eminently successful” is cited on p. 437 in chapter 11.2 ”Hellenistic Astronomy and the Babylonian Scribal Families” by Mathieu Ossendrijver.

[7] Induced/artificial/provoked divination includes all methods where the supernatural is asked a question before an experiment is conducted and interpreted as their answer. In contrast, the supernatural sends signs unasked for in deductive divination.

\*\*\*\*\*

**Please visit the site:** <https://bmcr.brynmawr.edu/2021/2021.04.23/>

---

---

## **EΙΔΗΣΕΙΣ - NEWS RELEASE**

# **HOW OLD ARE THE DEAD SEA SCROLLS? CARBON-DATING PROJECT TO OFFER ANSWERS, BY ROSSELLA TERCATIN**

The project and some preliminary results were presented at a conference at the university last week: while in many instances, some scrolls might be more ancient than previously thought.

A new project combining carbon-14 dating and digital paleography might soon solve the riddle of the age of the Dead Sea Scrolls.

The initiative, carried out at the University of Groningen in the Netherlands, marks the first time in decades that a significant number of Dead Sea Scrolls fragments have undergone radiocarbon dating.

The scholars are still working on publishing their findings in an academic journal, but the project and some preliminary results were presented at a conference at the university last week.

In many instances, the new model confirmed the assessment of earlier researchers that some scrolls might be more ancient than previously thought.

The Dead Sea Scrolls are a corpus of some 25,000 fragments unearthed in caves on the shores of the Dead Sea in the 1940s and 1950s. The artifacts include some of the most ancient manuscripts of the Bible, other religious texts that were not accepted in the canon and nonreligious writings.

Carbon-14, or radiocarbon, dating is a method of age determination that depends upon the decay to nitrogen of radiocarbon (carbon-14).

Because of the destructive nature of the analysis, which requires sacrificing a sliver of the parchment, the Antiquities Authority (IAA) has been very hesitant to allow this kind of research. The IAA is tasked with preserving the fragments.

Over the past few years, major technological advances have significantly reduced the impact of certain kinds of analysis on the physical preservations of the scrolls. As a result, the IAA, whose mission is to find the right balance between new research and the preservation of the scrolls for posterity, has allowed scholars to perform new work.

Some 30 scrolls have been subjected to the University of Groningen's project. The results of 25 of them have been used to train a specific algorithm carrying out the paleographic analysis of the collection.

Paleography is the study of ancient or antiquated writings and inscriptions. In the case of the Dead Sea Scrolls, it has been crucial to date the artifacts, which according to most scholars, date between the third century BCE and the first century CE.

However, several uncertainties have remained.

“When it comes to dating the manuscripts, there is the problem that for most of the period, we have no internally dated manuscripts, and the few that we have date from the outer ends of the timescale,” Prof. Mladen Popović, the head of Groningen’s Qumran Institute and the leader of the project, said at the conference.

During the course of their research, the scholars discovered that some of the manuscripts they had already considered were more ancient than previously thought. The development might have major implications for the field.

They also realized that the scribal practices developed in a less-standardized and consistent manner than earlier experts had envisioned.

“With regard to dating the manuscripts, the data from our model shows that there was not a nice continuous progression and development of characters, but rather that sometimes there was a lot of development and sometimes not so much,” Popović said. “The characters were not developing in a linear homogeneous manner throughout these periods.”

“Our paleographers will say that they can date Dead Sea Scrolls with a precision of 25 to 50 years’ date range, and [the research] is yet to substantiate their model,” he said. “Pending new data in the future, we dare say that we have a model that works consistently and is able to date manuscripts with an empirically based precision that was not possible before. This is a huge advance for the field.”

**Please visit the site: <https://www.jpost.com/archaeology/how-old-are-the-dead-sea-scrolls-carbon-dating-project-to-offer-answers-666302>**

---

---



## **CLIMATE CRISES IN MESOPOTAMIA PROMPTED THE FIRST STABLE FORMS OF STATE**

During the Bronze Age, Mesopotamia was witness to several climate crises. In the long run, these crises prompted the development of stable forms of state and therefore elicited cooperation between political elites and non-elites. This is the main finding of a study published in the journal PNAS and authored by two scholars from the University of Bologna (Italy) and Eberhard Karls Universität Tübingen (Germany).

This study investigated the impact of climate shocks in Mesopotamia between 3100 and 1750 BC. The two scholars looked at these issues through the lenses of economics and adopted a game-theory approach.

They applied this approach to the first detailed database on climate and institutional evolution of the 44 most important states of Mesopotamia.

"Severe and prolonged droughts pushed elites of landowners to grant political and property rights to the non-elites, who had the skills and tools to stem the damages brought by climate change. Elites did so to persuade non-elites that a sufficient part of the crops would be shared through the production of public goods," explains Carmine Guerriero, a professor at the Department of Economics at the University of Bologna and one of the authors of this study. "On their end, non-elites promoted institutional changes, embracing a culture of cooperation to persuade elites of their commitment to future cooperations."

Three severe droughts seem to confirm these intuitions. In the last stages of the Urban Revolution (3800-3300 BC), religious groups stepped in and eventually coordinated the effort of building the first human-made canals. Then, during the Protodynastic Period (3100-2550 BC), the Palatine military promoted the cooperation between farmers, granting them protection and the resources of the military enlistment.

During the Imperial Period (2350-1750 BC), a valuable and climate shock-independent alternative to agricultural activities was put forward by corporations of merchants that had increasingly taken hold.

Conversely, periods of milder climate promoted the cooperation between non-elites and elites while elites were not forced to give up their power and non-elites were not obliged to adopt a culture of intense cooperation.

"Because of their primarily agricultural economic systems, some developing countries are experiencing climate change in a way that resembles that of Mesopotamian States, and they will also experience politically relevant consequences," adds Guerriero. "On the one hand, unfavorable climate shocks can promote cooperation between normally contrasting parties by granting more rights to non-elites. On the other hand, favorable climate conditions allow for the cooperation between elites and non-elites through less inclusive social orders and with some degree of cultural accumulation. Therefore, two

major objectives in this sense are spreading a strong culture of cooperation and avoiding the random transfer of more inclusive social orders in developing countries."

All in all, analyzing events concerning lost civilizations can offer useful insights to understand and solve issues of present times. "The past offers a more encouraging perspective against which we can measure the gravity of today's crises including the pandemic," suggests Guerriero. "Moreover, the past shows the importance of an interdisciplinary approach involving social and natural sciences to obtain a more precise evaluation of short-, medium- and long-term effects of climate change."

This paper appeared in the journal PNAS with the title "Climate Change and State Evolution."

**Please visit the site: <https://phys.org/news/2021-04-climate-crises-mesopotamia-prompted-stable.html>**

---

## **ARTIFICIAL INTELLIGENCE HELPS IDENTIFY AUTHORS OF DEAD SEA SCROLLS, BY ARIEL DAVID**

Algorithms deduce that the Great Isaiah Scroll was written by two scribes, showing AI can help unravel the mystery of who penned the oldest known manuscripts of the Hebrew Bible

Among the biggest open questions about the Dead Sea Scrolls are who wrote them, and where.

Were these 2,000-year-old manuscripts penned by a single group in the Judean desert, perhaps the enigmatic sect known as the Essenes? Or did they originate in different places and within various Jewish religious streams?

The simple answer is that we don't know, since the biblical scribes of antiquity didn't sign their work, cite their allegiance, or give us many clues about their identity. But now Dutch researchers have enlisted artificial intelligence to analyze the handwriting on the scrolls and determine how many different scribes were behind each text.

The team of biblical scholars and computer scientists from the University of Groningen tested their analysis on the so-called Great Isaiah Scroll. The study, published Wednesday in the journal PLOS ONE, confirmed that the scroll, which contains the text of the biblical Book of Isaiah, was penned by two different hands.

### **Suddenly, a different handwriting**

What difference does it make how many scribes wrote an ancient manuscript? Actually it opens the door for a completely different approach to studying the Dead Sea Scrolls, explains Mladen Popovic, a professor of Hebrew Bible and Ancient Judaism and the lead researcher on the team.

Ever since their discovery, experts have been focusing on the content of the manuscripts, looking for patterns in style, word usage or ideology to glean some knowledge about the people behind the scrolls, Popovic explains. While content analysis will continue to be important, the new AI-supported method will give researchers physical evidence to connect different manuscripts that were written by the same hand, he says.

The method that was road-tested on the Isaiah scroll involved algorithms designed by PhD candidate Maruf Dhali and Lambert Schomaker, professor of Computer Science and Artificial Intelligence at Groningen. Their artificial neural networks were taught to first distinguish the ink traces from the background parchment and then to find statistically significant patterns in the styling of the characters, including the changing curvature and shapes of different elements within single letters.

The advantage of using computers for the job is that, unlike the human eye, a machine can compare hundreds or thousands of different character features at the same time. For

example it can look at the 5,000 occurrences of the letter “aleph” (the first letter in the Hebrew alphabet) in the Great Isaiah Scroll and find patterns of similarities and differences at the microlevel between those thousands of repetitions.

“The human eye is amazing and presumably takes these levels into account too, but that is often not a transparent process,” Popovic says. “And we also find it difficult to process when there is much data.”

The data from the Isaiah Scroll show that roughly midway through the manuscript there is a subtle but significant change in the handwriting, which is best explained by postulating the existence of two different scribes.

The fact that the styles are so close that only a computer could distinguish them is already an important piece of information for researchers. It suggests that the two scribes had learned how to mimic each other’s handwriting, possibly pointing to a common origin or shared training, Popovic says.

“That is so exciting, because this opens a new window on the ancient world that can reveal much more intricate connections between the scribes that produced the scrolls,” he says.

### **Essenes? We hardly knew ye**

The first seven scrolls, including the Isaiah manuscript that was the focus of the new study, were found in 1947 by Bedouin shepherds in a cave near the ancient settlement of Qumran, located on the shores of the Dead Sea in the modern-day West Bank. Thousands more fragmentary texts emerged in the following decades near Qumran and at other sites across the surrounding Judean desert – with the latest find announced by Israeli archaeologists in March.

The Qumran scrolls range in date from the third century B.C.E. to the first century C.E., before the destruction of the Second Temple by the Romans in 70 C.E. at the end of the First Jewish Revolt. They include not just biblical manuscripts but also additional religious texts such as commentaries, apocalyptic prophecies, prayers, rules on community life and much more.

The scrolls have revolutionized our knowledge of Second Temple Judaism and the many groups and sects from which rabbinical Judaism and Christianity eventually emerged. But who exactly wrote them remains a mystery.

Traditionally, scholars have linked the scrolls and the isolated settlement of Qumran to the Essene movement, described by some ancient historians like Josephus Flavius. This ascetic sect, which embraced voluntary poverty and communal life, was one of the three main streams in which Judaism was divided in the late Second Temple Period.

Recent scholarship however has moved away from linking Qumran and the scrolls found in its vicinity exclusively to the Essenes. In part this is because, as mentioned, the scrolls are never signed by a specific person or group, and because there are significant ideological differences between what we know about the Essenes from ancient historians and what emerges in some of the sectarian texts from Qumran.

“Today most scholars speak more generally of the ‘Qumran community,’” says Joe Uziel, head of the Dead Sea Scrolls Unit at the Israel Antiquities Authority. “But beyond that you have other scrolls that may have arrived in the caves after being written elsewhere.”

That’s why the possibility of identifying different writing styles and tracing the hand of a specific scribe in multiple texts is so important, as it promises to highlight new connections between scrolls and give insight into their authors.

### **Puzzle pieces**

Another advantage of the AI-driven approach is that it makes it easier to figure out when a text was written, Popovic tells Haaretz. The Great Isaiah Scroll, for example, has been radiocarbon dated to the second century B.C.E. Using their algorithms, the researchers can now identify other manuscripts from the same period by matching the writing styles, without need to sacrifice precious ancient parchment to carbon dating, he says.

The study of the Isaiah scroll is merely the first major breakthrough for the project by Popovic and colleagues, titled “The Hands that Wrote the Bible” and financed to the tune of 1.5 million euros (US\$ 1.8 million) by the European Research Council.

It should be noted that the Isaiah scroll, measuring some seven meters in length, is one of the largest and most complete of the Dead Sea manuscripts. Most of the other 900 or so known scrolls have reached us in the form of around 25,000, often confetti-sized, fragments that have had to be painstakingly pieced together. Fortunately, the handwriting identification analysis is already showing good results even if it is run on short texts of just around 100 characters, Popovic tells Haaretz.

This suggests another application of the new method, in that the handwriting analysis may tell us whether certain fragments should indeed be attributed to the same scroll or whether they belong to two different manuscripts, says the IAA’s Uziel.

“This is a great example of how new avenues of research can be used to understand new things about the scrolls, well beyond the specific discovery of the two writers of the Isaiah manuscript,” Uziel tells Haaretz.

### **Space tech and cow DNA**

The Dutch project is by far not the only recent application of cutting-edge scientific methods to the study of the scrolls. Aided by NASA technology, the IAA has produced high-resolution multispectral images of the scrolls, which make the texts more readable and have even revealed sections of script that are invisible to the naked eye. (In fact, these highly detailed images were also used to train the neural networks used in the Dutch study.)

Meanwhile, an international team of scientists has been perfecting a method to use particle accelerators and advanced imaging techniques to read scrolls that are too damaged to be unrolled. And finally, recent research at Tel Aviv University has

succeeded in extracting from some scroll fragments the DNA of the animals whose skin was used to make the parchment.

This project has the closest synergies with the handwriting analysis developed by Popovic and colleagues, because it too promises to find patterns and connections between different texts and fragments of scrolls. Instead of matching or differentiating manuscripts according to the handwriting, this method accomplishes the goal by looking at DNA.

So, for example, the presence of fragments written on parchment genetically traced to a cow, an animal not usually raised in the Judean desert, has already given more weight to the idea that at least some of the scrolls did not originate within the Qumran community.

In fact, in the future it should be possible to correlate the data gathered through the handwriting identification and the genetic analysis to see if they match and to glean even more knowledge about the anonymous hands that wrote the Dead Sea Scrolls, Popovic notes.

“We will never know their names,” he says. “But after seventy years of study, this feels as if we can finally shake hands with them through their handwriting.”

**Please visit the site: <https://www.haaretz.com/archaeology/.premium-artificial-intelligence-helps-identify-authors-of-dead-sea-scrolls-1.9732803> [Go there for pix]  
[See also <https://apple.news/A48kRjvVfQbOlqPV3tdt12A>]**

---

## **TURKEY'S ANCIENT CITIES SHED LIGHT ON VAST MESOPOTAMIAN HISTORY**

Konya's 9,000-year-old Çatalhöyük, Çorum's Hittite ruins and its cultural and artistic center Alacahöyük, Anatolia's first executive military center, and Kayseri's Kültepe, home to thousands of clay tablets, are ancient sites included in Turkey's vast heritage, shedding light on thousands of years of Anatolian and Mesopotamian history.

### **Çatalhöyük**

The ancient Çatalhöyük site – located in the Çumra district of central Turkey's Konya – is one of the first urbanization models in Mesopotamia's history. It is on the UNESCO World Heritage List, and it is one of the clearest windows into the 9,000-year-old Anatolian lifestyle.

Archaeologist Numan Arslan, from the Çatalhöyük excavation project team, explained that the site was discovered in 1958, with the first excavations starting in 1961, and that the site was dated to the Neolithic period 9,000 years ago.

"Çatalhöyük has offered very intriguing data to the world of archeology. The art, symbolism, their complex societal structure, these kinds of settlements were known to exist in the Near East but not in Central Anatolia," Arslan told Anadolu Agency (AA).

Arslan then stated that the transition from hunting and gathering to the first urban model occurred in Çatalhöyük. "We now live in metropolises. We have to follow the urban culture given by those crowded metropolises, but the people of Çatalhöyük first tried out an urban city culture here, 9,000 years ago," he said.

Arslan also noted their societal system. "There was a completely egalitarian social structure. There were no public spaces, no common meeting areas. Lots of houses. It shows us the importance of working together and supporting each other."

### **Hattusas and Alacahöyük**

Çorum is home to many Anatolia "firsts" thanks to its vast ancient history with its ruins of Hattusas, which served as the capital of the Hittite civilization for 450 years, and Alacahöyük, which was the cultural and artistic center of the Hittites and the first administrative-military center in Anatolia, all located within the borders of the northern Anatolian province.

The ancient city of Hattusas, located in the district of Boğazkale and host to the cultural heritage of the Hittites, is the only ancient city in the world to be considered both a UNESCO World Heritage List site and also a part of the Memory of the World Program.

Hattusas is also home to the first known written treaty in history in the form of a cease-fire agreement between the Hittites and Egyptians, called the Kadesh Peace Treaty.



The city is the source of many historical artifacts obtained in the archaeological excavations that have been going on for more than a century in the region, with most being exhibited in the Boğazkale Museum.

The Hittite Sphinx, a special kind of statue belonging to the royal family dating back to 1,300 B.C., could be considered the crowning jewel of the museum's exhibitions.

The limestone sphinx – 258 centimeters (101.5 inches) long, 175 centimeters wide and about 1,700 kilograms (3,747 pounds) in weight – greets its visitors at the entrance of the Boğazkale Museum.

The Ministry of Culture and Tourism brought it back to its homeland in 2011 after 94 years from Germany, where it was taken to be restored in 1917.

### **Kültepe**

Finally, there is Kültepe – also known as Kanesh – which helped unearth history from a different angle with its thousands of clay tablets enlightening the trade and culture in Anatolia, a mere 4,000 years ago.

The first scientific excavations at the site began in 1948 under the leadership of Tahsin Özgüç. They have been ongoing for 73 years about 25 kilometers (15 miles) from the city center of central Turkey's Kayseri.

The cuneiform clay tablets unearthed in Kültepe – and exhibited in Ankara, Kayseri and Istanbul – present a history of Assyrian merchants traveling from around Mosul to Anatolia and accepting Kayseri as their capital, thus introducing the Anatolian people to trade and writing 4,000 years ago.

"The Assyrian merchants made trade in the region stretching from Eskişehir to Kütahya, from the lakes region to Samsun," Ankara University's Fikri Kulakoğlu said. He emphasized that the center established in Kayseri played an important role in opening Anatolia to the world.

"The Assyrians paid a part of the profits they earned from their trade here as a tax and ensured the development of local cities. The Assyrians enabled the Anatolian people to meet the global world of those times. At the end of this period, the Hittite Kingdom, which was the first state of Anatolia, was established," Kulakoğlu noted.

**Please visit the site: <https://www.dailysabah.com/arts/turkeys-ancient-cities-shed-light-on-vast-mesopotamianhistory/news>**



## **GLADIATOR ARENA FROM ROMAN ERA** **UNEARTHED IN TURKEY,** **BY LAURA GEGGEL**

Spectators likely bet on the arena's wild animal fights and gladiator battles.

Archaeologists in Turkey have discovered the remains of a "magnificent" Roman-era arena, where up to 20,000 spectators likely cheered and jeered as they watched gladiator matches and wild animal fights, the excavators said.

The 1,800-year-old arena was discovered on the rolling hills of the ancient city of Mastaura, in Turkey's western Aydın Province. Its large central area, where "bloody shows" once took place, has since filled with earth and vegetation over the centuries.

"Most of the amphitheater is under the ground," and the part that is visible is largely covered by "shrubs and wild trees," Mehmet Umut Tuncer, the Aydın Culture and Tourism provincial director and project survey leader Sedat Akkurnaz, an archaeologist at Adnan Menderes University in Turkey, told Live Science in a translated email.

Archaeologists found the arena in the summer of 2020, after they received permission from the Turkish Ministry of Culture and Tourism to conduct archaeological research in the ancient city. After finding immense stonework rising out of the ground, the team immediately began clearing and studying the site. From October to December 2020, they "cut down all the bushes and wild trees," Akkurnaz and Tuncer said.

"We started to protect the building against the destruction of nature."

It soon became clear that the arena was old, dating to about A.D. 200, meaning it was built during the Severan Dynasty, which included five emperors who successively ruled from A.D. 193 to 235, they said.

"During this dynasty, the city of Mastaura was very developed and rich," as Roman administrators helped the city grow economically, which led to new stonework and masonry dating to that dynasty, Akkurnaz and Tuncer said. "There is a great increase and variety of Mastaura coins during this period," they added.

Much of the arena's underground structure is well-preserved. "It is solid, as if it was just built," Akkurnaz and Tuncer said. Many of the structures above ground have crumbled over the years, but it's still possible to find "some of the rows of seats, the arena where gladiators fought and the supporting walls outside the building," they said.

Between 15,000 and 20,000 people could fit into the arena, making it smaller than the famous Colosseum in Rome, which held about 50,000 people, Akkurnaz and Tuncer said. The Colosseum, which was built in about A.D. 70, was larger overall — its outer walls still stand about 157 feet (48 meters) compared with the Mastaura arena's 82-foot-tall (25 m) walls; and the Colosseum's central arena was roughly 285 feet by 180 feet (87 by 55 m), compared with Mastaura's smaller arena of about 131 feet by 98 feet (40 by 30 m), Akkurnaz and Tuncer said.

Mastaura arena's gladiator battles and wild animal fights, which people bet on, however, were likely just as bloody as those at the Colosseum, Akkurnaz and Tuncer said. The arena also had specialized areas, including gladiator waiting rooms and entertainment rooms for private spectators, the archaeologists found.

"There is no previous example of such an amphitheater in Anatolia [also known as Asia Minor] and its immediate surroundings," the researchers said. The arena likely attracted spectators from all over, including from the ancient Western Anatolian cities of Aphrodisias, Ephesus, Magnesia, Miletus and Priene, they said.

"People from neighboring cities were coming to Mastaura town to watch the big events in this building, specially designed for bloody shows," they said.

Going forward, the team is working with the Aydın Archaeological Museum and the Nazilli Municipality, which encompasses Mastaura, to clean and preserve the arena. They plan to address "cracks in the walls of the building" and masonry stones that are falling off the ancient structure. The team has already conserved one of the arena's walls and has started doing laser scans of the structure so they can make a virtual 3D image of it.

After that's done, likely in May, the archaeologists plan to do geophysical surveys above the building so they can "understand what the underground parts of the building are like," Akkurnaz and Tuncer said.

**Please visit the site: <https://www.livescience.com/roman-era-arena-discovered-in-turkey.html> [Go there for many pix]**

---

## **THE ALPHABET MAY HAVE BEEN INVENTED 500 YEARS EARLIER THAN WE THOUGHT, BY COLIN BARRAS**

The early history of the alphabet may require rewriting. Four clay artefacts found at an ancient site in Syria are incised with what is potentially the earliest alphabetic writing ever found. The discovery suggests that the alphabet emerged 500 years earlier than we thought, and undermines leading ideas about how it was invented.

A popular idea is that the alphabet first appeared in Egypt about 3800 years ago, when 20 or so Egyptian hieroglyphs were repurposed as the first alphabet's letters. The script was then used to write down words in one or more of the ancient languages spoken in southwest Asia at the time.

But a discovery at the roughly 4300-year-old site of Umm el-Marra in Syria challenges this narrative. During excavations there in 2004, Glenn Schwartz at Johns Hopkins University in Maryland and his colleagues found four lumps of clay each the size and shape of a human finger. The clay fingers are each inscribed with between one and five symbols, and Schwartz has spent the past 17 years trying to understand them.

Please visit the site: <https://www.newscientist.com/article/2274831-the-alphabet-may-have-been-invented-500-years-earlier-than-we-thought/> is posted this firewalled article: [Go there for one pict and to subscribe or purchase]

---