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Πληροφοριακό Δελτίο της Ελληνικής Αρχαιομετρικής Εταιρείας

- Οκτώβριος 2019 -

**Wise leaders generally have wise counselors because it
takes a wise person themselves to distinguish them.**

(Diogenes)

Newsletter of the Hellenic Society of Archaeometry

- October 2019 -

Nr. 223

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ΣΥΝΕΔΡΙΑ - CONFERENCES/WORKSHOPS

CULTURAL AND NATURAL HERITAGE WORKSHOP AT ESRF-EBS (MARINE COTTE), GRENOBLE, FRANCE, 22-24 JANUARY, 2020

Dear Colleagues,

In 2020, the ESRF will resume its user operation with a revolutionary X-ray source, the Extremely Brilliant Source (EBS). The ESRF has set up a series of workshops to explore the new scientific opportunities offered by EBS, with the User community.

In this context, we are pleased to invite you to participate in the Cultural and Natural Heritage workshop <<https://www.esrf.eu/heritage-workshop>>, which will take place at the ESRF, Grenoble, France, on the *22-24 January 2020*.

This workshop aims to:

- Highlight recent achievements and discoveries made at synchrotron facilities in palaeontology, archaeology and art science,
- Present and discuss the emerging new opportunities and challenges related to the ESRF-EBS X-ray source as well as the improved and imminent beamlines.

In addition to lectures, posters and discussions, the program will include an optional introduction for the non-expert public, two tutorials on data analysis (PyMca and XRD), a practical on tomography as well as a social programme.

Please note two important deadlines:

- deadline for *submission of abstracts*: *Thursday, 31 October, 2019*
- deadline for *registration*: *Sunday, 15 December, 2019*

We hope that the workshop will be a forum of discussion and exchange between ESRF staff and both expert and new users. In this respect, we would be extremely grateful if you could forward this email to your contacts and encourage those who have never been to the ESRF to take this opportunity for a first visit. We would also highly appreciate if you could print the attached flyer and display it at your institute.

In the unlikely event that you do not want to receive further announcements related to this event, please inform us.

We encourage your participation and look forward to seeing you!

Best regards,

The Organizing Committee,

Marine Cotte,
Pierre-Olivier Autran,
Camille Berruyer,
Nils Blanc,
Catherine Dejoie,
Paul Tafforeau

Contact: heritage-eps@esrf.fr

ΔΙΕΘΝΗΣ ΕΠΙΣΤΗΜΟΝΙΚΗ ΣΥΝΑΝΤΗΣΗ
“ΕΚΘΕΣΗ ΚΑΙ ΕΡΜΗΝΕΙΑ ΑΝΘΡΩΠΙΝΩΝ
ΚΑΤΑΛΟΙΠΩΝ ΣΤΑ ΑΡΧΑΙΟΛΟΓΙΚΑ
ΜΟΥΣΕΙΑ”, 31 ΟΚΤΩΒΡΙΟΥ-1 ΝΟΕΜΒΡΙΟΥ
2019, ΑΜΦΙΘΕΑΤΡΟ ΜΟΥΣΕΙΟΥ ΤΗΣ
ΑΚΡΟΠΟΛΗΣ

Σας ενημερώνουμε ότι η Διεύθυνση Αρχαιολογικών Μουσείων, Εκθέσεων και Εκπαιδευτικών Προγραμμάτων του Υπουργείου Πολιτισμού και Αθλητισμού διοργανώνει **Διεθνή Επιστημονική Συνάντηση** με θέμα την **έκθεση και ερμηνεία ανθρωπίνων καταλοίπων στα αρχαιολογικά μουσεία**, στις **31 Οκτωβρίου-1 Νοεμβρίου 2019** στο Αμφιθέατρο του Μουσείου της Ακρόπολης.

Η έκθεση και ερμηνεία των ανθρωπίνων καταλοίπων αποτελεί μία από τις πτυχές του πολυσυζητημένου ζητήματος της διαχείρισης αυτού του τόσο ιδιαίτερου και φορτισμένου με ηθικές και ιδεολογικές συνιστώσες υλικού.

Η υπό οργάνωση επιστημονική συνάντηση στόχο έχει να μεταφέρει στην ελληνική αρχαιολογική κοινότητα και στους επαγγελματίες των μουσείων τον διάλογο που έχει αναπτυχθεί διεθνώς και τους σημαντικότερους προβληματισμούς σχετικά με την πρόεπουσα έκθεση των ανθρωπίνων καταλοίπων στο μουσειακό περιβάλλον. Ταυτόχρονα, όμως, επιχειρεί να φέρει στο προσκήνιο ζητήματα που άπτονται της ελληνικής πραγματικότητας και σχετίζονται με τη διαχείριση του υλικού των ανθρωπίνων καταλοίπων.

Στη συνάντηση θα συμμετάσχουν με ομιλίες μέλη της Ελληνικής Αρχαιολογικής Υπηρεσίας και των ξένων Αρχαιολογικών Σχολών, πανεπιστημιακοί, βιοαρχαιολόγοι, επιμελητές και διευθυντές μουσείων, καθώς και αρχιτέκτονες-μουσειογράφοι από την Ελλάδα και το εξωτερικό.

Θα ακολουθήσει ενημέρωση για το πρόγραμμα του συνεδρίου καθώς και πρόσκληση. Υπουργείο Πολιτισμού και Αθλητισμού

Γενική Διεύθυνση Αρχαιοτήτων και Πολιτιστικής Κληρονομιάς

Διεύθυνση Αρχαιολογικών Μουσείων, Εκθέσεων και Εκπαιδευτικών Προγραμμάτων

HISTORICAL METALLURGY CONFERENCE **- ACCIDENTAL AND EXPERIMENTAL** **ARCHAEOLOGICAL 2.0, ANCIENT** **TECHNOLOGY CENTRE, DORSET, JUNE** **2020**

To celebrate the 10th anniversary of the hugely successful experimental conference at West Dean in 2010, and the subsequent volume of the same name, the Historical Metallurgy Society would like to invite submissions for both practical metallurgical experiments and oral presentations to be held over a two-and-a-half-day event at the Ancient Technology Centre, Dorset (<https://ancienttechnologycentre.com/>) in June 2020.

We would welcome submissions from smelters, casters, smiths and related craftspeople.

Accommodation will be provided on site with the rare opportunity to sleep in a Viking Age longhouse. There will also be an area to camp close to the activities. There are additional accommodation/pubs and eateries available in the local village. Transport from the train station can also be arranged. A 'conference dinner' will be available on-site and from 12pm on the Sunday, our activities will be open to visitors.

At this initial stage, please send your proposals for experimentation (with clear details of your experiment and its requirements) to: Vanessa Castagnino (vrc505@york.ac.uk).

Experimentation Proposal Deadline: 1st November 2019.

Call of Papers (oral presentations) will follow on shortly. For more details email vrc505@york.ac.uk or go to <http://hist-met.org/meetings/experimental-archaeometallurgy-agm.html>

52ND PUBLIC LECTURE SERIES,
ARCHAEOLOGICAL RESEARCH UNIT,
UNIVERSITY OF CYPRUS - WINTER
SEMESTER 2019

Lectures take place every Monday, 19:30-21:00, 12 Gladstone Str., Nicosia 1095

October 7th

Dr Craig Barker

Director of the Paphos Theatre Archaeological Project, The University of Sydney
Theatre architecture in Cyprus: The evidence from the excavations of the Nea Paphos theatre

October 14th

Dr Jelena Živković

Post-Doctoral Fellow, STARC, The Cyprus Institute
The Archaeology of Ottomanisation in the Balkans: Belgrade between the 15th-17th centuries

October 21st

Dr Petroula Hadjittofi

Special Research Scientist, Archaeological Research Unit, University of Cyprus
«...ένα ολοζώντανο νομισματοφυλάκιο της ομορφιάς»: Κοσμήματα από νομίσματα στην Κύπρο (19ος-20ός αιώνας)

November 1st-2nd

The Materiality of Purple Dye Production and Use in Cyprus and the Aegean from Prehistory to the Late Roman Period

Research Workshop, Archaeological Research Unit, University of Cyprus

November 4th

Dr Pavlos Triantaphyllides

Director of the Lesbos Archaeological Service, Ministry of Culture and Sports, Greece
Το παρροδιακό ιερό του Αταβυρίου Διός στη Ρόδο

November 11th

Dr Nicoletta Demetriou

European Commission Widening Fellow, Department of Education, University of Cyprus
Ο Κύπριος βιολάρης: Η προφορική ιστορία μιας επαγγελματικής τάξης που χάνεται

November 18th

Dr Giorgos Papantoniou
Senior Research Fellow, UnSaLa CY Project (EXCELLENCE/1216/0362),
Archaeological Research Unit, University of Cyprus
Prof. Demetrios Michaelides
Professor Emeritus, Archaeological Research Unit, University of Cyprus
Dr Maria Dikomitou-Eliadou
Post-Doctoral Fellow, Institute of Archaeology, University College London
Public Lecture: *Terracottas in a domestic context: The case of the House of Orpheus in Nea Paphos, Cyprus*
And presentation of the volume: *Hellenistic and Roman Terracottas*, G. Papantoniou, D. Michaelides and M. Dikomitou-Eliadou (eds), 2019. Leiden: Brill, Monumenta Graeca et Romana 23

November 20th

Prof. Emer. David Holton
Faculty of Classics, University of Cambridge
The Cypriot dialect in the context of the Grammar of Medieval and Early Modern Greek
Public Seminar-Lecture in the framework of the “Colloquium of the Interdepartmental Postgraduate Programme in Byzantine Studies and the Latin East” and in collaboration with the “Byzantinists’ Society of Cyprus”

November 25th

Dr Theodora Moutsiou
Postdoctoral Researcher, PLEICY Project (POST-DOC/0916/0185), Archaeological Research Unit, University of Cyprus
The consumption of exotic raw materials in the early prehistory of Cyprus

December 2nd

Dr Artemios Oikonomou
Post-Doctoral Fellow, STARC, The Cyprus Institute
Reaching to the core: An in depth analysis of core formed glass

December 9th

Documentary film show: “The Venetian walls of Nicosia. Chandax-Nicosia-Palmanova: a common origin” (in Greek) in memory of Maro Theodosiadou
Script and director: Maro Theodosiadou. Production: 2010
Funded by: Ministry of Education and Culture (Cyprus) and Alpha Bank

Dr Giorgos Papantoniou
Senior Research Fellow, University of Cyprus
Visiting Research Fellow, Trinity College Dublin
<http://www.ucy.ac.cy/en/people/giorgosp>

Archaeological Research Unit, Department of History and Archaeology

University of Cyprus
P.O.Box 20537, Nicosia 1678
Cyprus

Unlocking Sacred Landscapes Network (funded by the Cyprus Research and Innovation Foundation; Project: EXCELLENCE/1216/0362):

<http://www.ucy.ac.cy/unsala/>

ΘΕΣΕΙΣ ΕΡΓΑΣΙΑΣ/ΥΠΟΤΡΟΦΙΕΣ –
JOB VACANCIES/FELLOWSHIPS

ASCSA NATIONAL ENDOWMENT FOR THE
HUMANITIES FELLOWSHIPS

Deadline: October 31, 2019

Founded in 1881, the American School of Classical Studies at Athens (ASCSA) is the most significant resource in Greece for American scholars in the fields of Greek language, literature, history, archaeology, philosophy, and art, from pre-Hellenic times to the present. It offers two major research libraries: the Blegen, with over 113,000 volumes dedicated to the ancient Mediterranean world; and the Gennadius, with over 146,000 volumes and archives devoted to post-classical Hellenic civilization and, more broadly, the Balkans and the eastern Mediterranean. The School also provides centers for advanced research in archaeological and related topics at its excavations in the Athenian Agora and Corinth, and houses an archaeological sciences laboratory at the main campus in Athens. By agreement with the Greek government, the ASCSA is authorized to serve as liaison with the Hellenic Ministry of Culture and Sports on behalf of American students and scholars for the acquisition of permits to conduct archaeological work and to study collections.

Since its inception in 1994, the National Endowment for the Humanities (NEH) Fellowship program at the ASCSA has demonstrated its effectiveness by supporting projects for 60 scholars with distinguished research and teaching careers in the humanities.

Eligibility: Postdoctoral scholars and professionals in all fields relevant to the mission of the ASCSA who are US citizens, or foreign nationals who have lived in the US for the three years immediately preceding the application deadline. Applicants must already hold their Ph.D. or have completed all requirements, except for the actual conferral of the degree, by the application deadline.

Terms: Two to four fellows will be selected for awards of 4, 5, or 9 months duration. The monthly stipend per fellow is \$4,200 allocated from a total pool of \$75,600 per year. Applicants should indicate their preference for the length and dates of tenure of the award to coincide with the American School's academic year: 9 months, Sept. 2020-beginning of June 2021; 4 months, Sept. - Dec.; 5 months, January to the beginning of June. School fees are waived, and the award provides lunches at Loring Hall five days per week. The NEH Fellow will pay for travel costs, housing, residence permit, and other living expenses from the stipend. A final report is due at the end of the award period, and the ASCSA expects that copies of all publications that result from research conducted as a Fellow of the ASCSA will be contributed to the relevant library of the School. The NEH Fellow is also required to send one copy of all books and electronic copies of articles directly to the NEH.

NEH Fellows should use the American School of Classical Studies at Athens as their primary research base, but research may be carried out throughout Greece.

Application: Submit Senior “Associate Membership with Fellowship” Application online on the ASCSA web site by October 31. Link to application: <https://ascsa.submittable.com/submit/115299/associate-membership-with-fellowship-application>

The following items should be included in the application submitted online on the ASCSA web site:

1. Short abstract of the project (up to 300 words).
2. A statement of the project (up to five pages, single spaced), including desired number of months in Greece, a timetable, explicit goals, a selected bibliography, the importance of the work, the methodologies involved (where applicable), and the reasons it should occur at the ASCSA.
3. Current curriculum vitae. If not a US citizen, state US visa status /date of residence.
4. Names of three recommenders who are individuals familiar with applicant’s work and field of interest. Include a list of names, positions, and addresses of the referees. Instructions for recommenders to submit letters will be sent through the application portal. Please make sure your recommenders have submitted their letters by November 4. These letters should comment on the feasibility of the project and the applicant's ability to carry it out successfully.

The following criteria will be used by the Selection Committee when considering applications.

1. Are the objectives and approaches clearly stated and coherent?
2. Will the project result in an important and original contribution?
3. Are the research perspectives and methodologies appropriate?
4. Is the projected timetable reasonable for the tenure of the fellowship?
5. What resources are necessary? Does the ASCSA provide resources that are not available at the home institution?
6. Will residence in Greece contribute substantially to the success of the project?

Web site: www.ascsa.edu.gr or <https://www.ascsa.edu.gr/apply/fellowships-and-grants/postdoctoral-and-senior-scholars>

E-mail: application@ascsa.org

The awards will be announced during February. Awardees will be expected to accept the award within two weeks of notification of funding, but no later than March 1.

The American School of Classical Studies at Athens does not discriminate on the basis of race, age, sex, sexual orientation, color, religion, ethnic origin, or disability when considering admission to any form of membership or application for employment.

ΑΝΑΚΟΙΝΩΣΕΙΣ - ANNOUNCEMENTS

ΠΡΟΓΡΑΜΜΑ ΕΚΔΗΛΩΣΕΩΝ 2019-Β (ΦΘΙΝΟΠΩΡΙΝΟ) ΕΤΑΙΡΕΙΑΣ ΔΙΕΡΕΥΝΗΣΗΣ ΑΡΧΑΙΟΕΛΛΗΝΙΚΗΣ ΚΑΙ ΒΥΖΑΝΤΙΝΗΣ ΤΕΧΝΟΛΟΓΙΑΣ

ΟΚΤΩΒΡΙΟΣ 2019

Δευτέρα 7 Οκτωβρίου, Αικατερίνη Κυπαρίσση-Αποστολικά, Δρ. αρχαιολόγος, (Επίτ. Δ/ντρια της Εφορείας Παλαιοανθρωπολογίας και Σπηλαιολογίας του ΥΠΠΟ): *«Τεχνολογικές Καινοτομίες του Προϊστορικού Πληθυσμού του σπηλαίου Θεόπετρας 130.000 έτη πριν (έως το 4.000 π.Χ.)».*

Δευτέρα 22 Οκτωβρίου, Χαρίλαος Τσέλιος, Δρ. Αρχαιολόγος, (Υπουργείο Πολιτισμού & Αθλητισμού, Γενική Διεύθυνση Αρχαιοτήτων & Πολιτιστικής Κληρονομιάς): *«Λαύριο -Σίφνος-Κρήτη-Μυκίνες. Η παραγωγή και η διακίνηση του αργύρου στο Αιγαίο της Υστερης Εποχής του Χαλκού».*

ΝΟΕΜΒΡΙΟΣ 2019

Δευτέρα 4 Νοεμβρίου, Ευστράτιος Γρ. Ανδριάνης, τ. επιστημονικός συνεργάτης ΕΜΠ, Πολ. Μηχανικός, Λιμενολόγος, *«Ο βυθισμένος λιμένας της Απολλωνίας στη Λιβύη».*

Τετάρτη 20 Νοεμβρίου, Πανηγυρική Τελετή ανακήρυξης επιτίμων Μελών της ΕΔΑΒΥΤ των κ.κ. Γεωργίου Βαρουφάκη και Δημήτρη Καλλιγερόπουλου.

Δευτέρα 25 Νοεμβρίου, Ηλίας Μαμαλάκης, Χημικός, *«Αρχαία Ελληνική μαγειρική τεχνική».*

ΔΕΚΕΜΒΡΙΟΣ 2019

Δευτέρα 2 Δεκεμβρίου, Σοφία Βακιρτζή, Δρ. Αρχαιολόγος, *«Ξετυλίγοντας τον μίτο της προϊστορικής κλωστοϋφαντουργίας : από τις τεχνικές στις τέχνες».*

Δευτέρα 9 Δεκεμβρίου, Γεώργιος Παπαδημητρίου, Δρ. Μηχανικός Μεταλλείων-Μεταλλουργός Ομ. Καθηγητής ΕΜΠ, *«Από τους μπρούτζους αρσενικού στους μπρούτζους κασσιτέρου: εξελικτική πορεία και τομές στον ελλαδικό χώρο, βεβαιότητες και ερωτήματα».*

Η είσοδος είναι ελεύθερη για το κοινό. Η παρουσία Μελών και Φίλων της ΕΔΑΒΥΤ είναι χαρά για όλους-μας, ανεβάζει δε και τη στάθμη των παραγωγικών συζητήσεων που επακολουθούν κάθε ομιλίας.

Οι διαλέξεις φιλοξενούνται ευγενώς στην αίθουσα του Συλλόγου των Αθηναίων (Κέκροπος 10, 10558 Πλάκα). **Ώρα έναρξης: 18:30.**

ΝΕΕΣ ΕΚΔΟΣΕΙΣ – NEW PUBLICATIONS

RADIOCARBON, NEW ARTICLE(S) **AVAILABLE**

Conference Paper

[RADIOCARBON CALIBRATION AROUND AD 1900 FROM SCOTS PINE \(*PINUS SYLVESTRIS*\) TREE RINGS FROM NORTHERN NORWAY](#)

Helene Svarva, Pieter Grootes, Martin Seiler, Terje Thun, Einar Værnes, Marie-Josée Nadeau

[Radiocarbon](#)

doi: 10.1017/RDC.2019.99, 10 pages. Published Online on 9 September 2019

[TESTING SEALED-TUBE GRAPHITIZATION AT THE NERC RADIOCARBON FACILITY, EAST KILBRIDE](#)

Luz Maria Cisneros-Dozal, Xiaomei Xu, Sheng Xu

[Radiocarbon](#)

doi: 10.1017/RDC.2019.102, 10 pages. Published Online on 9 September 2019

[THE 1953–1965 RISE IN ATMOSPHERIC BOMB ¹⁴C IN CENTRAL NORWAY](#)

Helene Svarva, Pieter Grootes, Martin Seiler, Sølvi Stene, Terje Thun, Einar Værnes, Marie-Josée Nadeau

[Radiocarbon](#)

doi: 10.1017/RDC.2019.98, 10 pages. Published Online on 9 September 2019

Research article

[RADIOCARBON DATING AT GRONINGEN: NEW AND UPDATED CHEMICAL PRETREATMENT PROCEDURES](#)

M W Dee, S W L Palstra, A Th Aerts-Bijma, M O Bleeker, S de Bruijn, F Ghebru, H G Jansen, M Kuitens, D Paul, R R Richie, J J Spriensma, A Scifo, D van Zonneveld, B M A A Verstappen-Dumoulin, P Wietzes-Land, H A J Meijer

[Radiocarbon](#)

doi: 10.1017/RDC.2019.101, 12 pages. Published Online on 9 September 2019

THE OXFORD HANDBOOK OF SCIENCE AND MEDICINE IN THE CLASSICAL WORLD

Paul T. Keyser, John Scarborough (ed.), Oxford; New York: Oxford University Press, 2018. Pp. xv, 1045. ISBN 9780199734146. \$175.00.

Bryn Mawr Classical Review 2019.08.58

Reviewed by Jane Draycott, University of Glasgow (Jane.Draycott@Glasgow.ac.uk)

Preview

[Authors and titles are listed at the end of the review.]

The ancient history of STEMM can be a challenging subject to pursue at an undergraduate or postgraduate level, and even experienced classicists or ancient historians can struggle to engage with the more obscure and arcane corners of the myriad fields involved. For starters, many of the relevant ancient texts are not easily accessible; most have yet to be translated into English, let alone made readily available as a volume through the Loeb Classical Library or any other entry-level imprint such as Penguin Classics or Oxford World Classics, although a translation and commentary may be available in another modern language. Looking beyond translations and commentaries, in-depth scholarly treatments of these texts are not abundant, at least in comparison with more canonical authors and their works, and a scholarly consensus regarding the question of how to treat them has not yet been satisfactorily reached.¹ Thankfully, over the last decade there has been a concerted effort to attempt to render this sub-discipline of Classics more accessible, despite these ongoing significant impediments to the enterprise. As of 2014, the Oxford Bibliographies Online initiative now includes entries on Greek and Roman Science, and Greek and Roman Technology. Wiley Blackwell now offers *A Companion to Science, Technology, and Medicine in Ancient Greece and Rome* in two volumes (published in 2016). Oxford University Press first brought out the *Oxford Handbook of Engineering and Technology in the Classical World* (published in 2008), and now seeks to complement it with the *Oxford Handbook of Science and Medicine in the Classical World* (published in 2018).

The *Oxford Handbook of Science and Medicine in the Classical World* showcases the work of forty-six scholars from around the world, and comprises an Introduction followed by forty-nine chapters, and concluded with a general index. Each individual chapter is followed by an often quite extensive bibliography featuring multilingual academic work published up to 2016. In the review that follows, due to the large number of chapters, I shall not attempt to cover each one individually but rather focus on particular points of interest.

The volume's stated aim is to appraise science and scientific thinking across thirteen centuries, approximately 650 BCE to 650 CE, although individual chapters, particularly those in the first part of the volume, cover much broader time periods than that. It takes a rather different approach to the subject than its predecessors (and competitors) and in doing so carves out a substantial niche for itself in this newly crowded marketplace: despite the chronological and geographical parameters imposed by its title, it covers the

theory and practice of science and medicine far beyond the borders of ancient Greece and Rome and makes a concerted effort throughout the volume to trace the spread of ideas between neighbouring civilisations and their development through time. A brief introductory chapter (Keyser) sets out the scope of the volume and offers a series of justifications for the approach taken, starting from the position that there is such a thing as science in classical antiquity and it is not anachronistic to approach it as such, and seeks to be inclusive regarding its coverage of anything that might reasonably be classed as a science or science-adjacent (e.g. geography, philosophy in respect of Epicureanism and Stoicism and ideas about nature).

The first part of the volume – Ancient Scientific Traditions beyond Greece and Rome – comprises four sections that focus on Mesopotamia (three chapters – Hoyrup; Rochberg; Scurlock), Egypt (three chapters – Imhausen; Quack; David), India (two chapters – Knudsen; Yamashita) and China (two chapters – Volkov; Fengxian). While the varied and problematic nature of the literary and documentary evidence that survives from these periods, and the consequential difficulty in attempting any sort of reconstruction is noted in each section and chapter, the continuity between the sciences of these civilisations and those of the classical ones is consistently highlighted. All of these chapters do a creditable job of synthesising their material and making it readily comprehensible for classicist or ancient historian readers venturing far outside their own disciplines, perhaps for the first time.

The second part – Early Greek Science – comprises four chapters (Gregory; Zhmud; Kaplan; Craik). The somewhat problematic tendency of both ancient and modern scholars working on ancient science to lump all early Greek scientific thinkers together, something particularly prevalent in contemporary narrative accounts of the development of ancient Greek science found in entry-level textbooks and sourcebooks, is flagged up immediately, and in an attempt to rectify this, the authors, their works, and the evidence for both that survives is presented systematically, with particularly significant and influential treatments of them (e.g. Littré's foundational work on the Hippocratic Corpus; Kennedy's recent theories regarding Plato's works) highlighted.

The third part – Hellenistic Greek Science – comprises sixteen chapters (Althoff; Tieleman; Acerbi; Bowen; Rihll; Cooper; Keyser; Geus and King; Hagel; Thibodeau; Webster) with four devoted to aspects of medicine (Stok; Scarborough; Grant; Bliquez). It is the most extensive section of the volume, and contains contributions that one would not necessarily expect to find included under such a section heading (e.g. agronomy, pharmacology, surgical instruments). The approaches taken by the chapters vary. For example, in one particularly successful chapter, astrology is comprehensively covered in a way that manages to include not just a general overview of the subject itself, but also the main surviving sources, a potted history which incorporates key episodes in which astrology was highly influential, ancient negative opinions of astrology and its veracity, and a detailed case study in the form of the emperor Hadrian's horoscope (Cooper). In the chapter focused on alchemy, the materials involved are the centre of attention, while in the chapter focused on agriculture, the practical application of the theory is foregrounded, and in the chapter focused on surgical instruments, the literary and archaeological evidence are presented in tandem.

The fourth part – Greco-Roman Science – comprises eleven chapters (Thibodeau; Gordon; Tieleman; Fraser; Leunissen; Evans; Keyser) with four devoted to aspects of

medicine (Caldwell; Beagon; Scarborough; Johnston). As with the second part, the fourth part opens by advising caution in approaching ancient and modern scholarly accounts of scientific thinking in this period and their presentation of Roman science as unoriginal, and highlighting the Roman tendency toward ‘inverse plagiarism’, which enabled Roman scientists to undertake innovative work while claiming an intellectual precedent for it. Attempts are made to undermine persistent stereotypes and provide more nuanced portrayals of ancient Roman thinkers (e.g. Epicureans, physicians).

The fifth and final part – Late Antique and Early Byzantine Science – comprises eight chapters (Siorvanes; Bernard; Griffin; Kuelzer; Viano; Slaveva-Griffin; Paniagua; Cilliers). This section focuses predominantly on the scholarship of the late antique period and the way that late antique scholars engaged with the works of their predecessors, such as through the reception of ancient theories and the production of commentaries on ancient texts. The chapter on Byzantine geography is particularly illuminating in its coverage of the expansion of geographical writing beyond the standard geographical treatises, such as exploration literature written by merchants, pilgrims, and missionaries, travel guides in the form of itineraries, periploi, and maps (Kuelzer), while the chapter on medical encyclopaedias opens with the note that to date medical encyclopaedias have not received much (or any) attention from scholars working in Byzantine studies, whereas they have received a considerable amount of attention from scholars working in the history of medicine, and then proceeds through a survey of the authors and their works, before concluding with a proposal of future directions for their study (Slaveva-Griffin).

While the volume seeks to be broadly consistent in its coverage, inevitably some types of science are better attested than others (e.g. mathematics, astronomy and astrology, medicine), both in particular historical periods and geographical locations, and across the period in its entirety. Perhaps unsurprisingly, different chapters take rather different approaches to their subjects—in some, certain significant individuals receive extensive coverage (e.g. Pythagoras, Plato, Hippocrates, Epicurus, Scribonius Largus, Galen); in others certain collections of texts are surveyed. Some chapters concentrate on particular individuals (e.g. Aristotle, Ptolemy). Some chapters are significantly more technical than others (e.g. several of those dealing with mathematics, astronomy, music, and optics go into considerable detail and incorporate explanatory case studies supplemented by a range of diagrams). There is also considerable variation in the breadth and depth of bibliographies that accompany each of the chapters; for example, Craik’s chapter on Hippocrates and early Greek medicine is prefaced by a useful bibliographic survey of work that has been undertaken on the Hippocratic Corpus, while Webster’s chapter on optics and vision is helpfully divided into sections. By noting this variety, I do not mean to criticise; the nature of the surviving evidence makes uniformity across all sections and chapters impossible, and the editors have done an excellent job producing as cohesive a volume as this which can be read in its entirety or dipped into as required.

It is clear that certain points of commonality can be observed running through the entire period of thirteen centuries, and these themes have been highlighted accordingly – for example, the interplay between theory and practice, or the importance of personal observation, or the role of methods of transmission. The importance of approaching and appreciating ancient science on its own terms, rather than attempting to judge it by contemporary standards with the inevitable result of finding it wanting (this is particularly pertinent in respect of types of ancient science, such as astrology or alchemy, that have fallen out of favour over the course of the centuries, and as a result been

unfairly maligned), is reiterated throughout, rightly and helpfully so, bearing in mind the potential undergraduate and postgraduate student users of this handbook. I shall certainly be adding this to the essential reading sections of the bibliographies of the courses on ancient science, technology, and medicine that I teach at the University of Glasgow, and I enthusiastically recommend that others in similar positions do the same.

Authors and titles

‘Introduction’ - Paul T. Keyser

Part One: Ancient Scientific Traditions beyond Greece and Rome A1. Mesopotamia ‘Mesopotamian Mathematics’ - Jens Høyrup ‘Astral Sciences of Ancient Mesopotamia’ - Francesca Rochberg ‘Mesopotamian Beginnings for Greek Science?’ - JoAnn Scurlock A2. Egypt ‘Mathematics in Egypt’ - Annette Imhausen ‘Astronomy in Ancient Egypt’ - Joachim Friedrich Quack ‘Egyptian Medicine’ - Rosalie David A3. India ‘Mathematics in India until 650 CE’ - Toke Lindegaard Knudsen ‘Sanskrit Medical Literature’ - Tsutomu Yamashita A4. China ‘Ancient Chinese Mathematics’ - Alexei Volkov ‘Astral Sciences in Ancient China’ - Xu Fengxian Part Two: Early Greek Science ‘Pythagoras and Plato’ - Andrew Gregory ‘Early Mathematics and Astronomy’ - Leonid Zhmud ‘Early Greek Geography’ - Philip G. Kaplan ‘Hippocrates and Early Greek Medicine’ - Elizabeth Craik Part Three: Hellenistic Greek Science ‘Aristotle, the Inventor of Natural Science’ - Jochen Althoff ‘Epicurus and His Circle: Philosophy, Medicine, and the Sciences’ - Teun Tieleman ‘Hellenistic Mathematics’ - Fabio Acerbi ‘Hellenistic Astronomy’ - Alan C. Bowen ‘Hellenistic Geography from Ephorus Through Strabo’ - Duane W. Roller ‘Mechanics and Pneumatics in the Classical World’ - T. E. Rihll ‘Medical Sects: Herophilus, Erasistratus, Empiricists’ - Fabio Stok ‘Astrology: The Science of Signs in the Heavens’ - Glen M. Cooper ‘The Longue Durée of Alchemy’ - Paul T. Keyser ‘Paradoxography’ - Klaus Geus and Colin Guthrie King ‘Music and Harmonic Theory’ - Stefan Hagel ‘Ancient Agronomy as a Literature of Best Practices’ - Philip Thibodeau ‘Optics and Vision’ - Colin Webster ‘Pharmacology in the Early Roman Empire: Dioscorides and His Multicultural Gleanings’ - John Scarborough ‘Dietetics: Regimen for Life and Health’ - Mark Grant ‘Greco-Roman Surgical Instruments: The Tools of the Trade’ - Lawrence J. Bliquez Part Four: Greco-Roman Science ‘Traditionalism and Originality in Roman Science’ - Philip Thibodeau ‘Science for Happiness: Epicureanism in Rome, the Bay of Naples, and Beyond’ - Pamela Gordon ‘Roman Medical Sects: The Asclepiadeans, the Methodists, and the Pneumatists’ - Lauren Caldwell ‘Science and Medicine in the Roman Encyclopedists: Patronage for Praxis’ - Mary Beagon ‘Stoicism and the Natural World: Philosophy and Science’ - Teun Tieleman ‘Scribonius Largus and Friends’ - John Scarborough ‘Distilling Nature’s Secrets: The Sacred Art of Alchemy’ - Kyle Fraser ‘Physiognomy’ - Mariska Leunissen ‘Galen and His System of Medicine’ - Ian Johnston ‘Ptolemy’ - James Evans ‘Science in the 2nd and 3rd Centuries CE: An Aporetic Age’ - Paul T. Keyser Part Five: Late Antique and Early Byzantine Science ‘Plotinus and Neoplatonism: The Creation of a New Synthesis’ - Lucas Siorvanes ‘Greek Mathematics and Astronomy in Late Antiquity’ - Alain Bernard ‘The Greek Neoplatonist Commentators on Aristotle’ - Michael Griffin ‘Byzantine Geography’ - Andreas Kuelzer ‘Byzantine Alchemy, or the Era of Systematization’ - Cristina Viano ‘Byzantine Medical Encyclopedias and Education’ - Svetla Slaveva-Griffin ‘Late Encyclopedic Approaches to Knowledge in Latin Literature’ - David Paniagua ‘Medical Writing in the Late Roman West’ - Louise Cilliers

Notes:

1. On the issue of how best to engage with ancient scientific writing, see most recently Liba Taub (2017) *Science Writing in Greco-Roman Antiquity* (Cambridge: Cambridge University Press), pp. 1-17.

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GLASS AND GLASS PRODUCTION IN THE NEAR EAST DURING THE IRON AGE PERIOD: EVIDENCE FROM OBJECTS, TEXTS AND CHEMICAL ANALYSIS

Bryn Mawr Classical Review 2019.09.55

Katharina Schmidt. Oxford: Archaeopress, 2019. Pp. viii, 312; 68 p. of plates. ISBN 9781789691542. £50.00.

Reviewed by Katherine A. Larson, Corning Museum of Glass (larsonka@cmog.org)

The professed goal of Katharina Schmidt’s new book, *Glass and Glass Production in the Near East during the Iron Age Period* is “to contribute to the history of glass and close the gap between the Late Bronze Age and the Hellenistic period” (1). The current volume is the first synthetic book-length treatment of Iron Age glass since the classic 1970 *Glass and Glassmaking in Ancient Mesopotamia*.¹ It makes a significant contribution to glass studies by being the first work by a single author that draws together the evidence from archaeology, texts, and archaeometry.

Chapters 1 and 2 provide background on the general framework of the book and the properties of glass and other vitreous materials, respectively. The core of the book is Chapters 3–7, which cover the archaeological (Ch. 3–5), textual (Ch. 6), and archaeometric (Ch. 7) evidence for glass in Iron Age Mesopotamia (ca. 1000–539 BCE), spanning the regions of Assyria, Babylonia, and the Levant. The conclusion in Chapter 8 summarizes the major findings of the study, with comments on the role of the palace institution in Neo-Assyrian glass production and the value of glass in the Iron Age. The end matter consists of a glossary of technical terms, a bibliography, a catalogue of objects arranged by archaeological site, the color plates, an edition of a cuneiform text recipe for blue glass, tables of chemical data, and an index.

While much of Schmidt’s evidence is well known among glass specialists, it has not previously been brought together in a systematic and cohesive way, and therein lies the real merit of the book. Schmidt examined most of the catalogued objects in person, and so was able to provide new, cohesive insights into manufacturing techniques; the identification and experimental recreation of three different methods for producing blue and white rosette inlays is especially informative (68–73). Of note within the newly published material are several glass objects from Hasanlu, now in the collection of the University of Pennsylvania Museum of Archaeology and Anthropology, and from Khorsabad, now at the Oriental Institute and the Musée du Louvre.

Schmidt identifies three major groups of Iron Age glass, distinguished primarily by manufacturing technique: mosaic, cast- and-cut, and core-form. This categorization in turn governs the interpretation of objects by typology, function, chronology, geographic distribution, and even within the ancient mind. While we might today group this variety of objects under the single material-based category of “glass”, Schmidt shows that the

meaning of glass was quite variable in the Iron Age mind, and “glass cannot be considered a uniform material” (157).

Schmidt’s emphasis on and attention to the archaeological data led her to several important conclusions and revisions to the established canon of the Iron Age Mesopotamian glass narrative.

1. Mosaic glass was probably not made during the Iron Age. Schmidt interprets the Iron Age examples, including the mosaic glass inlays set in the alabaster vessel from Hasanlu (now in Philadelphia), as reused Late Bronze Age fragments. Other examples, such as the mosaic bowls from Aššur, may have continued to be used into the Iron Age as heirlooms.
2. Major innovations in Assyrian glass production included transparent glass, the slumping and sagging technique, and the use of glass bowls in royal banqueting. The vast majority of cast-and-cut vessels and inlays come from palatial contexts in the Assyrian heartland. Although Nimrud heavily dominates this material, the lack of glass found in Assyrian domestic spaces helps validate this pattern as historical reality, not an artifact of differential archaeological recovery (103).
3. Not all glass carried the same symbolic value. While transparent bowls were closely attached to the palace at Nimrud, polychrome core-form perfume vessels were used outside the royal sphere, in religious, domestic, and funerary contexts. Core-form vessels largely seem to be a Babylonian phenomenon, and, unlike cast vessels, relate closely in shape and function to contemporaneous ceramic and stone vessels.

Another benefit of Schmidt’s approach is the consideration of the diversity of glass inlays produced during the Iron Age, including inlaid vessels, painted inlays, rosette inlays, small and large monochrome inlays, and attachments for statues. Although such artifacts generally fall into her “cast-and-cut” category, the technological variation in manufacturing methods for the rosettes alone is remarkable. Cast-and-cut inlays were also used in “Phoenician (style) ivories”, for which Schmidt again asserts the importance of the palace in their production rather than of any specific ethnic affiliation of the craftsmen.

Perhaps most astonishing is just how few glass objects (excluding beads, which Schmidt did not consider for this study) can be positively attributed to Iron Age Mesopotamia over a period of almost five centuries—a total of 389 objects in the catalogue, including 55 without archaeological provenience. More than half (199 catalogued items, plus over 250 uncatalogued fragments of cast vessels) come from Nimrud. Poor preservation must be a factor, as glass makers increasingly used natron soda rather than plant ash as a flux in the glass batch, resulting in an unstable, water-soluble mixture that may have been viable during its use-life but did not include enough stabilizing lime to survive two and a half millennia. The significant early-10th-century-BCE natron glass beakers from the burial of Nesikhons at Thebes, which are highly susceptible to moisture and deteriorating, may be emblematic of this sparsely populated chapter in glass history. 2

Chapter 6 provides a commentary and edition for one of the “Nineveh glass recipes”, a group of five cuneiform tablets from the 7th-century BCE library of Ashurbanipal related to the primary production of glass from raw ingredients. The recipe translated is the one for blue zagindurû glass, considered to be representative of the other recipes. Schmidt’s commentary makes clear that a multi-stage process of heating, crushing, and melting was necessary to produce a pure glass product. Schmidt considers the texts to be true recipes,

indicative of glassmaking processes from the 2nd millennium BCE, not the literary or administrative ‘lexical lists’ of Moorey (119).³ Remarkably, as was demonstrated almost 50 years ago, the recipe is comprehensible and produces a viable glass (130; see also Brill in Oppenheim et al 1970, 110-114), although the problem of circularity, by which modern glass chemistry is used to translate the more esoteric terms in the text, and the text in turn followed to produce recipes consistent with contemporary understanding of glassmaking processes, remains.

The final category of evidence is chemical analysis. In addition to helpful summary sections on raw glass ingredients and colorants (along with the worthy reminder that glass coloration is not strictly governed by additives, but also depends on furnace conditions, heating and cooling cycles, and impurities), Schmidt discusses previously published analyses of Iron Age glass from Hasanlu, Nimrud, Pella, and Gordion. Only 11 of the 183 objects subjected to chemical analysis also appear in the catalogue, a caution for correlating the two lines of inquiry. The main story of chemical composition in Iron Age glass is the introduction of natron as flux, a shift in raw ingredients which Schmidt considers to be gradual and not nearly as widespread or immediate as it is often claimed (142). However, the combined lack of chronological control, scarcity of analyzed material, and the instability of early natron glasses means that a model for the adoption of natron should still be considered an open question. Plant ash continued to be the primary flux used in Near Eastern glasses through the first millennium CE (e.g. in Sasanian glass⁴), in marked technological contrast to Roman natron glasses. The persistence of plant ash as a flux in Mesopotamia may reflect the absence of a local source of natron soda and/or a conservative manufacturing enterprise.

Schmidt leans heavily on evidence from the late Bronze Age to understand the Iron Age, even though an apparent gap in glass production during the 12th and 11th centuries calls the mechanics of continuity into question. In many cases, especially in chemical analysis, this is more indicative of the paucity of study and lack of evidence for Iron Age glass compared to the earlier period rather than of any oversight on Schmidt’s part. The compression is most pronounced, however, in the discussion of the Nineveh glass texts, which Schmidt understands to be copies of 2nd-millennium originals. Granted, the glass texts are the extent of written evidence about glass making from the Iron Age, but their relationship to actual glassmaking in the Iron Age could be further problematized. Also potentially misleading is the inclusion in the catalogue and plates of the mosaic bowls and inlays from Aššur and Hasanlu, which are dated by Schmidt to the Middle-Assyrian period

By contrast, Schmidt very seldom refers to material that postdates the end of the Neo-Babylonian empire in 539 BCE. Core-form kohl tubes and head pendants, characteristic objects which begin in the 6th century BCE, are not catalogued and only summarily discussed (116, fig. 5.3). Schmidt provides a brief excursus on the so-called “Achaemenid” glass bowls which are the successors to the Neo-Assyrian cast-and-cut bowls (63), but she does not mention the important work of Despina Ignatiadou, who has argued that the type is a product of the 4th century Greek world.⁵

Certainly, the information Schmidt has gathered is vast and diverse. But with 200-year gaps isolating the classical Iron Age from the Bronze Age and the Hellenistic period, it does leave open many outstanding questions about the role of Iron Age Mesopotamia in the historical arc of glass. Nevertheless, thanks to its updated and synthetic catalogue,

revised typology and chronology, functional analysis, and refined geographic distribution, Schmidt's work will help inscribe the major innovations of Iron Age Near East into a comprehensive history of glass.

Notes:

1. A. Leo Oppenheim, Robert H. Brill, Dan Barag, and Axel von Saldern. *Glass and Glassmaking in Ancient Mesopotamia: An Edition of the Cuneiform Texts Which Contain Instructions for Glassmakers: With a Catalogue of Surviving Objects*. Corning, NY: Corning Museum of Glass, 1970 (reprinted 1988).
2. Birgit Schlick-Nolte and Rainer Werthmann. "Glass Vessels from the Burial of Nesikhons." *Journal of Glass Studies* 45 (2003): 11–34.
3. P.R.S. Moorey, *Ancient Mesopotamian Materials and Industries: The Archaeological Evidence*. Oxford: Clarendon Press, 1994, pp. 210–211.
4. Robert H. Brill, "Appendix 2: Chemical Analyses of Some Sasanian Glasses from Iraq." In *Sasanian and Post-Sasanian Glass in the Corning Museum of Glass*, 65–88. Corning, NY: Corning Museum of Glass, 2005.
5. Despina Ignatiadou, "Achaemenid and Greek Colourless Glass." In *The World of Achaemenid Persia*, edited by J. Curtis and J. Simpson, 419–26. London: British Museum, 2010.

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EΙΔΗΣΕΙΣ - NEWS RELEASE

HOW TO MAKE A BOOK LAST FOR MILLENNIA - STUDY OF DEAD SEA SCROLL SHEDS LIGHT ON A LOST ANCIENT PARCHMENT-MAKING TECHNOLOGY, BY DAVID L. CHANDLER

First discovered in 1947 by Bedouin shepherds looking for a lost sheep, the ancient Hebrew texts known as the Dead Sea Scrolls are some of the most well-preserved ancient written materials ever found. Now, a study by researchers at MIT and elsewhere elucidates a unique ancient technology for parchment making and provides new insights into possible methods to better preserve these precious historical documents.

The study focused on one scroll in particular, known as the Temple Scroll, among the roughly 900 full or partial scrolls found in the years since that first discovery. The scrolls were found in jars hidden in 11 caves on the steep hillsides just north of the Dead Sea, in the region around the ancient settlement of Qumran, which was destroyed by the Romans about 2,000 years ago. It is thought that, to protect their religious and cultural heritage from the invaders, members of a sect called the Essenes hid their precious documents in the caves, often buried under a few feet of debris and bat guano to help foil looters.

The Temple Scroll is one of the largest (almost 25 feet long) and best-preserved of all the scrolls, even though its material is the thinnest of all of them (one-tenth of a millimeter, or roughly 1/250 of an inch thick). It also has the clearest, whitest writing surface of all the scrolls. These properties led Admir Masic, the Esther and Harold E. Edgerton Career Development Assistant Professor of Civil and Environmental Engineering and a Department of Materials Science and Engineering faculty fellow in archaeological materials, and his collaborators to wonder how the parchment was made.

The results of that study, carried out with former doctoral student Roman Schuetz (now at Israel's Weizmann Institute of Science), MIT graduate student Janille Maragh, James Weaver from the Wyss Institute at Harvard University, and Ira Rabin from the Federal Institute of Materials Research and Testing and Hamburg University in Germany, were published today in the journal *Science Advances*. They found that the parchment was processed in an unusual way, using a mixture of salts found in evaporites — the material left from the evaporation of brines — but one that was different from the typical composition found on other parchments.

“The Temple Scroll is probably the most beautiful and best-preserved scroll,” Masic says. “We had the privilege of studying fragments from the Israeli museum in Jerusalem called the Shrine of the Book,” which was built specifically to house the Dead Sea Scrolls. One relatively large fragment from that scroll was the main subject of the new paper.

The fragment, measuring about 2.5 centimeters (1 inch) across was investigated using a variety of specialized tools developed by researchers to map, in high resolution, the detailed chemical composition of relatively large objects under a microscope.

“We were able to perform large-area, submicron-scale, noninvasive characterization of the fragment,” Masic says — an integrated approach that he and Weaver have developed for the characterization of both biological and nonbiological materials. “These methods allow us to maintain the materials of interest under more environmentally friendly conditions, while we collect hundreds of thousands of different elemental and chemical spectra across the surface of the sample, mapping out its compositional variability in extreme detail,” Weaver says.

That fragment, which has escaped any treatment since its discovery that might have altered its properties, “allowed us to look deeply into its original composition, revealing the presence of some elements at completely unexpectedly high concentrations,” Masic says.

The elements they discovered included sulfur, sodium, and calcium in different proportions, spread across the surface of the parchment.

Parchment is made from animal skins that have had all hair and fatty residues removed by soaking them in a lime solution (from the Middle Ages onward) or through enzymatic and other treatments (in antiquity), scraping them clean, and then stretching them tight in a frame to dry.

When dried, sometimes the surface was further prepared by rubbing with salts, as was apparently the case with the Temple Scroll.

The team has not yet been able to assess where the unusual combination of salts on the Temple Scroll’s surface came from, Masic says. But it’s clear that this unusual coating, on which the text was written, helped to give this parchment its unusually bright white surface, and perhaps contributed to its state of preservation, he says. And the coating’s elemental composition does not match that of the Dead Sea water itself, so it must have been from an evaporite deposit found somewhere else — whether nearby or far away, the researchers can’t yet say.

The unique composition of that surface layer demonstrates that the production process for that parchment was significantly different from that of other scrolls in the region, Masic says: “This work exemplifies exactly what my lab is trying to do — to use modern analytical tools to uncover secrets of the ancient world.”

Understanding the details of this ancient technology could help provide insights into the culture and society of that time and place, which played a central role in the history of both Judaism and Christianity. Among other things, an understanding of the parchment production and its chemistry could also help to identify forgeries of supposedly ancient writings.

According to Rabin, an expert in Dead Sea Scroll materials, “This study has far-reaching implications beyond the Dead Sea Scrolls. For example, it shows that at the dawn of parchment making in the Middle East, several techniques were in use, which is in stark contrast to the single technique used in the Middle Ages. The study also shows how to

identify the initial treatments, thus providing historians and conservators with a new set of analytical tools for classification of the Dead Sea Scrolls and other ancient parchments.”

This information could indeed be crucial in guiding the development of new preservation strategies for these ancient manuscripts.

Unfortunately, it appears that much of the damage seen in the scrolls today arose not from their 2,000-plus years in the caves, but from efforts to soften the scrolls in order to unroll and read them immediately after their initial discovery, Masic says.

Adding to these existing concerns, the new data now clearly demonstrate that these unique mineral coatings are also highly hygroscopic — they readily absorb any moisture in the air, and then might quickly begin to degrade the underlying material. These new results thus further emphasize the need to store the parchments in a controlled humidity environment at all times. “There could be an unanticipated sensitivity to even small-scale changes in humidity,” he says. “The point is that we now have evidence for the presence of salts that might accelerate their degradation. ... These are aspects of preservation that must be taken into account.”

“For conservation issues and programs, this work is very important,” says Elisabetta Boaretto, director of the Kimmel Center for Archaeological Science at the Weizmann Institute of Science in Israel, who was not associated with this work. She says, “It indicates that you have to know very well the document needing to be preserved, and the preservation has to be tailored to the document’s chemistry and its physical state.”

Boaretto adds that this team’s study of the unusual mineral layer on the parchment “is fundamental for future work in preservation, but most importantly to understand how these documents have been prepared in antiquity. This work certainly sets a standard for other researchers in this field.”

The work was partly supported by DFG, the German Research Foundation.

[URLs and captions for the pictures accompanying the release.]

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A HOLE IN THE HEAD: A HISTORY OF TREPANATION, BY CHARLES G. GROSS

A survey of trepanation, or trephination, the oldest surgical procedure known to humanity..

[his essay is excerpted from Charles G. Gross’s book “A Hole in the Head: More Tales in the History of Neuroscience.”

In 1865, in the ancient Inca city of Cuzco, Ephraim George Squier, explorer, archeologist, ethnologist and U.S. charge d’affaires in Central America, received an unusual gift from his hostess, Señora Zentino, a woman known as the finest collector of art and antiquities in Peru. The gift was a skull from a vast nearby Inca burial ground. What was unusual about the skull was that a hole slightly larger than a half-inch square had been cut out of it. Squier’s judgment was that the skull hole was not an injury but was the result of a deliberate surgical operation known as trepanning and furthermore, that the individual had survived the surgery.

When the skull was presented to a meeting of the New York Academy of Medicine, the audience refused to believe that anyone could have survived a trephining operation carried out by a Peruvian Indian.

Aside from the racism characteristic of the time, the skepticism was fueled by the fact that in the very best hospitals of the day, the survival rate from trephining (and many other operations) rarely reached 10 percent, and thus the operation was viewed as one of the most perilous surgical procedures. The main reason for the low survival rate was the deadly infections then rampant in hospitals.

Another was that the operation was only attempted in very severe cases of head injury.

Squier then brought his Peruvian skull to Europe’s leading authority on the human skull, Paul Broca, professor of external pathology and of clinical surgery at the University of Paris and founder of the first anthropological society. Today, of course, Broca is best known for his localization of speech in the third frontal convolution, “Broca’s area,” the first example of cerebral localization of a psychological function, but at this time his fame seems to have been primarily for his craniometric and anthropological studies.

The trephined Inca skull given to Ephraim George Squier. It now resides in the American Museum of Natural History.

Broca and More Skulls

After examining the skull and consulting some of his surgical colleagues, Broca was certain that the hole in the skull was due to trephination and the patient had survived for a while. But when, in 1876, Broca reported these conclusions to the Anthropological Society of Paris, the audience, as in the United States, was dubious that Indians could have carried out this difficult surgery successfully.

Seven years later a discovery was made in central France that confirmed Broca’s interpretation of Squier’s skull, or at least demonstrated that “primitives,” indeed

Neolithic ones, could trephine successfully. A number of skulls in a Neolithic gravesite were found with roundish holes two or three inches wide. The skulls had scalloped edges as if they had been scraped with a sharp stone. Even more remarkable, discs of skull of the same size as the holes were found in these sites. Some of the discs had small holes bored in them, perhaps for stringing as amulets. Although a few of the discs had been chiseled out after death, in most cases it was clear from the scar formation at the wound's edge that the interval between surgery and death must have been years. Trephined skulls were found of both genders and of all ages. Virtually none of the skull holes in this sample were accidental, pathological, or traumatic. Furthermore very few of the skulls showed any sign of depressed fractures, a common indication for trephining in modern times.

Trephined skulls have been discovered in widespread locations in every part of the world, in sites dating from the late Paleolithic to this century.

These findings finally established that Neolithic man could carry out survival trephination but left unresolved the motivation for this operation. At first, Broca thought that the practice must have been some kind of religious ritual, but later he concluded that, at least in some cases, it must have had therapeutic significance. Broca actually wrote more papers on prehistoric trephination and its possible motivation than he did on the cortical localization of language. Since Broca's time thousands of trephined skulls have been found and almost as many papers written about them. They have been discovered in widespread locations in every part of the world in sites dating from the late Paleolithic to this century. The usual estimates for survival of different samples of trephined skulls range from 50 percent to 90 percent with most estimates on the higher side.

Methods of Trephining

Across time and space five main methods of trephination were used. The first was rectangular intersecting cuts as in Squier's skull. These were first made with obsidian, flint, or other hard stone knives and later with metal ones. Peruvian burial sites often contain a curved metal knife called a tumi, which would seem to be well suited for the job. (The tumi has been adopted by the Peruvian Academy of Surgery as its emblem.) In addition to Peru, skulls trephined with this procedure have been found in France, Israel, and Africa.

The second method was scraping with a flint as in skulls found in France and studied by Broca. Broca demonstrated that he could reproduce these openings by scraping with a piece of glass, although a very thick adult skull took him 50 minutes "counting the periods of rest due to fatigue of the hand." This was a particularly common method and persisted into the Renaissance in Italy.

Different methods of trephining: (1) scraping; (2) grooving; (3) boring and cutting; (4) rectangular intersecting cuts.

The third method was cutting a circular groove and then lifting off the disc of bone. This is another common and widespread method and was still in use, at least until recently, in Kenya.

The fourth method, the use of a circular trephine or crown saw, may have developed out of the third. The trephine is a hollow cylinder with a toothed lower edge. Its use was described in detail by Hippocrates. By the time of Celsus, a first-century Roman medical writer, it had a retractable central pin and a transverse handle. It looked almost identical to modern trephines including the one I used as a graduate student on monkeys.

The fifth method was to drill a circle of closely-spaced holes and then cut or chisel the bone between the holes. A bow may have been used for drilling or the drill simply rotated by hand. This method was recommended by Celsus, was adopted by the Arabs, and became a standard method in the Middle Ages. It is also reported to have been used in Peru and, until recently, in North Africa. It is essentially the same as the modern method for turning a large osteoplastic flap in which a Gigli saw (a sharp-edged wire) is used to saw between a set of small trephined or drilled holes. (I used this method as a graduate student, too.)

“Trepan” Versus “Trephine”

The relationship between the terms trepan and trephine is a curious one. The terms are now synonyms but have different origins and once had different meanings. In Hippocrates’ time the terms terebra and trepanon (from the Greek trupanon, a borer) were used for the instrument that is very similar to the modern trephine. In the 16th century, Fabricius ab Aquapendente invented a triangular instrument for boring holes in the skull. (He was Harvey’s teacher and the discoverer of venous valves.) It had three arms with different-shaped points. Each of the ends could be applied to the skull using the other two as handles. He called it a “tre fines” from the Latin for three ends, which became trafine and then trephine, and by 1656 it was used as a synonym for trepan, as a term for the older instrument. In another version of the etymology, a quite different triangular instrument for boring a hole in the skull was invented in 1639 by John Woodall, a London surgeon, who also called his instrument a tres fines, which became trefina and then trephineand, eventually, a synonym for trepan. More generally, in Renaissance times and later, trephination was a popular operation and a great variety of instruments for carrying it out were invented.

Why did so many cultures in different periods cut or drill holes in the skull? Since most trephined skulls come from vanished nonliterate cultures, the problem of reconstructing the motivations for trephining in these cultures is a difficult one. However, there is information about trephining in Western medicine from the fifth century BCE onward as well as about trephining in recent and contemporary non-Western medical systems. Both of these sources may throw light on the reasons for the practice in earlier times. In the following sections we consider trephination in Hippocratic medicine, in ancient Chinese medicine, in European medicine from the Renaissance onward, in contemporary non-Western medicine, and on the Internet today.

Greek Medicine

The earliest detailed account of trephining is in the Hippocratic corpus, the first large body of Western scientific or medical writing that has survived. Although there is no question that there was a famous physician called Hippocrates in the fifth century BCE, it

is not clear which of the Hippocratic works were written by him. The most extensive discussion of head injuries and the use of trephining in their treatment is in the Hippocratic work *On Wounds in the Head*.

A 17th-century naval surgeon's trephination kit.

This treatise describes five types of head wounds. Interestingly, however, the only type for which trephination is not advocated is in cases of depressed fractures. Even when there is not much sign of bruising, drilling a hole in the head is recommended. The trephining instrument was very similar to the modern trephine, except that it was turned between the hands or by a bow and string rather than by using a crosspiece. The Hippocratic writer stressed the importance of proceeding slowly and carefully in order to avoid injuring the [dural] membrane. Additional advice was to “plunge [the trephine] into cold water to avoid heating the bone . . . often examine the circular track of the saw with the probe. . . . [and] aim at to and fro movements.”

Trephining over a suture was to be studiously avoided.

The Hippocratic doctors believed that stagnant blood (like stagnant water) was bad. It could decay and turn into pus. Thus, the reason for trephining, or at least one reason, was to allow the blood to flow out before it spoiled.

Apparently the Hippocratic doctors expected bleeding from a head wound and the reason for drilling the hole in the skull was to allow the blood to escape (“let blood by perforating with a small trepan, keeping a look out [for the dura] at short intervals”). Since they presumably had no notion of intracerebral pressure, why did they want the blood to run out? Although the reasons for trephining are not discussed in “*On Wounds in the Head*,” they seem clear from other Hippocratic treatises such as “*On Wounds and On Diseases*.” The Hippocratic doctors believed that stagnant blood (like stagnant water) was bad. It could decay and turn into pus. Thus, the reason for trephining, or at least one reason, was to allow the blood to flow out before it spoiled. In cases of depressed fractures, there was no need to trephine since there were already passages in the fractured skull for the blood to escape.

By Galen's time (129–199) trephining was in standard use in treating skull fracture for relieving pressure, for gaining access to remove skull fragments that threatened the dura, and, as in Hippocratic medicine, for drainage. Galen discussed the techniques and instruments in detail and advocated practicing on animals, especially the Barbary “ape” (*Macaca sylvana*). He was well aware of avoiding damage or pressure on the dura and indeed carried out experiments on the effect of pressing on the dura in animals.

Trepanation in Ancient China

The possibility that trepanation was practiced in ancient China is suggested by the following story about Cao Cao and Hua Tuo, from a historical novel attributed to Luo Guanzhong, written in the Ming dynasty (1368–1644) and set in 168–280 at the end of the Later Han dynasty. Cao Cao was commander of the Han forces and posthumously Emperor of the Wei dynasty, and Hua Tuo was (and still is) a famous physician of the time.

Cao Cao screamed and awoke, his head throbbing unbearably. Physicians were sought, but none could bring relief. The court officials were depressed. Hua Xin submitted a proposal: “Your highness knows of the marvelous physician Hua Tuo? . . . Your highness should call for him.”

Hua Tuo was speedily summoned and ordered to examine the ailing king.

“Your Highness’s severe headaches are due to a humor that is active.

The root cause is in the skull, where trapped air and fluids are building up. Medicine won’t do any good. The method I would advise is this: after general anesthesia I will open your skull with a cleaver and remove the excess matter, only then can the root cause be removed.” “Are you trying to kill me?” Cao Cao protested angrily . . . [and] . . . ordered Hua Tuo imprisoned and interrogated.

Ten days later Hua Tuo died. His medical text was lost upon his death.

Western Medicine

From the Renaissance until the beginning of the 19th century trephining was widely advocated and practiced for the treatment of head wounds. The most common use was in the treatment of depressed fractures and penetrating head wounds. However, because of the high incidence of mortality particularly when the dura was penetrated, there was considerable debate in the medical literature throughout this long span about if and when to trephine. Besides trephining in cases of skull fracture, the Hippocratic practice of “prophylactic trephination” in the absence of fracture after head injury continued to persist. For example, in the 1800s Cornish miners “insisted on having their skulls bored” after head injuries, even when there was no sign of fracture.

The practice of trephination was so dangerous that the first requirement for the operation was said to be “that the wound surgeon himself must have fallen on his head.”

Until the early 19th century trephination was done in the home.

However, when the operation was moved to hospitals, the mortality was so high that trephination for any reason including treatment of fractures and other head injury declined precipitously. The practice was so dangerous that the first requirement for the operation was said to be “that the wound surgeon himself must have fallen on his head.”

Or as Sir Astley Cooper put it in 1839, “If you were to trephine you ought to be trephined in turn.” It was against this background that the discovery of Neolithic trephining was so unbelievable to the American and French medical communities in the middle of the 19th century. Eventually, the introduction of modern antisepsis and prophylaxis of infection at the end of the 19th century, as well as an increased understanding of the importance of intracerebral pressure in head injury, allowed trephination to return as a common procedure in the management of head trauma.

In modern neurosurgical practice, trephining is still an important procedure but it is no longer viewed as therapeutic in itself. It may be used for exploratory diagnosis, for relieving intracerebral pressure (as from an epidural or subdural hematoma), for debridement of a penetrating wound, and to gain access to the dura and thence the brain itself (for example, to provide a port through which a stereotactic probe can be introduced into the brain.)

Epilepsy and Mental Disease

In the European medical tradition, in addition to its use in treating head injury, trephining has been an important therapy for two other conditions, epilepsy and mental illness.

A 16th-century woodcut of a trephination in the home. Note the man warming a cloth dressing, the woman praying, and the cat catching a rat.

The tradition of trephining as a treatment for epilepsy begins as early as Aretaeus the Cappadocian (ca. 150), one of the most famous Greek clinicians, and lasted into the 18th century. The 13th-century surgical text “Quattuor magistri” recommended opening the skulls of epileptics so “that the humors and air may go out and evaporate.”

However, by the 17th century trephination for epilepsy was beginning to be viewed as an extreme measure, as in Riverius, “The Practice of Physick” (1655):

If all means fail the last remedy is to open the fore part of the Skull with a Trepan, at distance from the sutures, that the evil air may breath out. By this means many desperate Epilepsies have been cured, and it may be safely done if the Chyrurgeon be skilful.

One 13th-century text recommended opening the skulls of epileptics so “that the humors and air may go out and evaporate.”

By the 18th century the incidence of trephining for epilepsy had declined and its rationale changed. Now rather than the idea of allowing an exit for evil vapors and humors, the purpose was to remove some localized pathology. By the 19th century trephining for epilepsy was confined to the treatment of traumatic epilepsy, that is, cases associated with known head injury.

Another use of trephining was as a treatment for mental disease. In his “Practica Chirurgiae,” Roger of Parma (ca. 1170) wrote:

For mania or melancholy a cruciate incision is made in the top of the head and the cranium is penetrated, to permit the noxious material to exhale to the outside. The patient is held in chains and the wound is treated, as above, under treatment of wounds.

Robert Burton, in “Anatomy of Melancholy” (1652), also advocated boring a cranial hole for madness, as did the great Oxford neuroanatomist and physician Thomas Willis (1621–1675).

Hieronymus Bosch’s *The Cure for Madness (or Folly)*, also known as *The Stone Operation* shows a surgical incision being made in the scalp.

Probably the most famous depictions of apparent trephining for mental disease are in early Flemish Renaissance painting. Thus, Hieronymus Bosch’s *The Cure for Madness (or Folly)*, also known as *The Stone Operation*, shows a surgical incision being made in the scalp. The inscription has been translated in part “Master, dig out the stones of folly.” There are similar depictions of the removal of stones from the head by Peter Bruegel, Jan Steen, Pieter Huys, and other artists of the time.

By the 18th century, “most reputable and enlightened surgeons gave up the practice of . . . [trephination] . . . for psychiatric aberrations or headache without evidence of trauma. Thus, . . . the skull was never to be trephined for ‘internal disorders of the head.’”

Trephining in Africa

Herodotus describes the Libyans as cauterizing the heads of their children to “prevent them being plagued in their afterlives by a flow of rheum from the head.” And indeed, trephined skulls have been found among the people he was probably writing about, the Tuareg nomads.

An important source of information on the motivations for trephination is contemporary traditional practitioners and their patients. There are literally hundreds of 20th-century accounts of trephination, particularly in Oceanic and African cultures. Especially detailed and recent ones concern the Kisii of South Nyanza in Kenya and include photographs of the surgical instruments, practitioners, and patients; X-rays of the skulls of surviving patients; detailed interviews; and even a documentary film.

The ancient Greek historian Herodotus describes the Libyans as cauterizing the heads of their children to “prevent them being plagued in their afterlives by a flow of rheum from the head.”

Trephining among the Kisii is carried out primarily for the relief of headache after some kind of head injury. According to Margetts, it is not done for “psychosis, epilepsy, dizziness or spirit possession.”

The operation is carried out by general practitioners of medicine and takes a few hours. Restraint rather than anesthesia is used. The hole in the skull is usually made by scraping with a sharp knife with a curved tip to avoid injuring the dura. Various medicines are administered before, during, and after surgery but their nature does not seem to have been studied. Mortality, by one authority, is described as “low, perhaps 5 per cent.” The practitioners and patients seem to be quite satisfied with the results of the operation.

Although headache after head injury is the most prevalent reason given for trephining by contemporary practitioners of traditional medicine in Africa and elsewhere, other reasons are cited in the literature such as “to let out the evil spirits which were causing an intractable headache.”

Trephining on the Internet

Today, the practice of trephining is not confined to surgical suites or traditional medicine men. It is advocated by the International Trepanation Advocacy Group as a means of enlightenment and enhanced consciousness. Their general idea is that when the skull sutures close in childhood it “inhibits brain pulsations causing a loss of dreams, imagination and intense perceptions.” Trephining a small hole, they say, “restores the intracranial pulse pressure which leads to a permanent increase of the brain-blood volume which leads to accelerated brain metabolism and more areas of the brain functioning simultaneously” and “increased originality, creativity and...testosterone level.” Beyond such “physiological” arguments, the group supports the practice by pointing out its ancient, widespread, and continuing presence in other cultures. This particular form of alternative medicine recently gained considerable if not entirely

positive publicity: In November 1998 it was featured on ER, the television soap opera set in an emergency ward.

Much of the defense for alternative medicine treatments is that they must work because they have been around for such a long time, an apparently attractive argument for the increasing popularity of five-thousand-plus-year-old Chinese traditional medical practices.

However, the case of trephining suggests that just because a procedure is very old does not mean it is necessarily an effective one, at least for enhanced enlightenment and creativity.

Trepanation as an Empirical If Not a Rational Procedure

The most common view of the prehistoric and the non-Western practice of trephining, especially in the absence of a depressed fracture, was that it represented some kind of “superstition,” “primitive thinking,” “magic,” or “exorcism.” Yet an examination of the reasons for the practice among the Hippocratic and early European doctors as well as among contemporary Kenyan practitioners suggests a different view.

Trephining may have appeared, in these contexts and cultures, to have been an effective empirical approach to head injury and the headaches that often accompany them. Headaches after head injury often do feel like “a pounding” and “pressure” inside the head and thus the idea that a hole in the skull would relieve them is not necessarily magical or bizarre. Furthermore, epidural bleeding does sometimes accompany head injury, and in these cases trephining might have actually reduced intracranial pressure. Finally, the apparently excellent survival rate meant that the procedure, at least until it moved into a hospital setting, may have met the prime requirement of medicine, “do no harm.”

POSTSCRIPT

The first International Colloquium on Cranial Trepanation in Human History was held at the University of Birmingham in April 2000. Papers from this unique three-day meeting were published as Trepanation:

History, Discovery, Theory, which provides the most complete review of the subject to date. A major achievement of the meeting was the demonstration that trepanation was widespread in many regions of Europe, Asia, Africa, Oceania, and the Americas in both preliterate and literate periods. The volume also contains illustrations of trephined skulls from many cultures and of the great variety of instruments used.

Another interesting development was the return of E. L. Margetts to the Kisii of Kenya, whose trepanning practices he had studied 25 years earlier. He estimates that there may now be more than 100 surgeons carrying out the operation. Unlike in the past, they now use modern Western local anesthetics injected into the scalp prior to surgery.

However, the reasons for the very low rate of infections still have not been studied systematically.

Since my original article, there seems to have been an increase in Internet sites advocating trepanning and often self-trepanning for the treatment of, among other disorders, depression, chronic fatigue syndrome, and stress and to improve mental “energy and vigor.”

The British Medical Journal took these developments seriously enough to issue a warning of their dangers:

Doctors have warned about the dangers of trepanning after the launch of several websites promoting the “do it yourself ” surgery and the case of a Gloucestershire woman who drilled a 2 cm diameter hole in her skull. Concern has been expressed about the growing interest in trepanning for several conditions, including depression and chronic fatigue syndrome. Concern is also growing about the increasing promotion of trepanning, including videos, T-shirts, and a virtual trepanning shopping mall on the internet.

Trepanning received widespread publicity when the surgeon Stephen Maturin carried out the procedure on a sailor in view of the assembled crew in the film Master and Commander: The Far Side of the World, based on the Patrick O’Brian naval novels about the Napoleonic Wars.

Charles G. Gross was a pioneering neuroscientist who specialized in vision and the functions of the cerebral cortex. This essay is excerpted from his book “A Hole in the Head: More Tales in the History of Neuroscience.”

Please visit the site: <https://thereader.mitpress.mit.edu/hole-in-the-head-trepanation/> [Go there for pix]



HOW A LUNAR ECLIPSE DEFEATED A GREEK ARMY, BY KIONA N. SMITH

At the end of August in 413 BCE, the army of Athens was battered, tired, and ready to go home. The thousands of soldiers under the command of aristocratic general Nicias has spent the last two years campaigning against the Sicilian city-state of Syracuse, and things were starting to look pretty dire.

Their last encounters with the Syracusans had ended in defeat, with the loss of 7 ships and hundreds of soldiers, and now the army found itself camped next to a mosquito-infested marsh, which had left many of the soldiers (including their general) too sick and weak to fight anymore. On top of that, Spartan forces had just arrived to reinforce the Syracusans. Even the ambitious Nicias — who probably faced a criminal trial and public humiliation for his failures back home in Athens — admitted it was time to pack it in.

Working quickly and quietly (as much as such a large force could, anyway), the Athenians packed up their ships, hoping to sail out of the harbor at Syracuse before the enemy could realize they were slipping away. But the cosmos had other ideas.

The Better Part of Valor

The Athenians had landed on Sicily two years earlier, in the fall of 415 BCE, with a force of 100 ships and 5,000 soldiers. They had come to stop Syracuse from sending aid to the city-state of Sparta, whose Peloponnesian League was at war with Athens and its allies. That fall, the first battle with the Syracusans went reasonably well for Nicias and his troops, though it wasn't decisive enough to settle the conflict then and there.

The Athenians spent the following winter at Catania, a friendly port about 20 miles north of Syracuse, rethinking their strategy.

Meanwhile, Syracuse sent for aid from Sparta. When the fighting resumed in the spring of 414 BCE, the Athenians lost 7 ships in a failed naval attack against Syracuse, and many soldiers in a failed ground assault over the cliffs. By the fall of 413 BCE, Spartan forces under general Gylippus had arrived, and Athenian reinforcements weren't quite enough to turn the tide. Under pressure from his officers and advisers, Nicias decided to take his troops and his ships and head for home.

On the night of August 28, the moon over Sicily darkened to a dim blood-red. The sight reportedly terrified Nicias, who was already weary and anxious, not to mention sick — and who had a reputation as the superstitious type. He frantically consulted his priests for advice, and they, said that obviously, sailing under such a moon was a terrible idea, and the Athenians should wait around at Syracuse for another 27 days.

A General Panic

Looking back from the vantage point of the 21st century, it's easy to mock Nicias for being so frightened by something as predictable and easily explained as a lunar eclipse,

but in 413 BCE, no one understood yet what caused the Moon to darken at seemingly random intervals.

"The Moon itself to be darkened, how that could come about and how, on the sudden, a broad full Moon should lose her light and show such various colors, was not easy to be comprehended," wrote Greek historian Plutarch. "They concluded it to be ominous and a divine intimation of some heavy calamities."

The Athenian priests' conclusion turned out to be a self-fulfilling prophecy, though. Very quickly, the Syracusans realized two things: first, that the Athenians were trying to retreat; second, that they had stopped, and their 86 ships were sitting ducks in the harbor. Either the Syracusans were less superstitious than Nicias and his priests, or they had drawn a more encouraging conclusion from the dim and bloody Moon. They swooped in for the attack with 72 ships.

In the close quarters of the harbor, the Athenians had a tougher time maneuvering than their Syracusan enemies — and in a period when naval warfare was all about ramming the enemy's side with your ship's reinforced bow, maneuvering was everything. The attack drove most of the Athenian ships onto the beach, where the waiting Spartan reinforcements captured 18 ships, burned the rest, and slaughtered their crews. Waiting around had definitely been a great idea so far.

A joint force of Athenian and Etruscan soldiers came to the rescue, driving the Spartans back just enough to give the beleaguered Athenians some breathing room, but it didn't last. The Syracusans blockaded the harbor a few days later, trapping the Athenians. After a few days of being besieged the Athenians (having apparently decided to scrap the priests' advice) decided to try to fight their way out — and failed miserably.

Moral Of The Story

On September 13, still well short of the recommended 27-day wait, Nicias and his army broke camp, left the dead unburied and the wounded to fend for themselves, and fled westward, harried by Syracusan troops the whole way. The Athenians made it only a few miles — just far enough to cross the Anapo River and walk right into the waiting Spartan army.

About 7,000 Athenian soldiers survived the massacre at the Anapo, but very few of those survived the next few weeks as prisoners at a stone quarry just outside Syracuse. Most starved to death, or died of diseases contracted during their time camped in the marsh or in the crowded, dirty conditions at the quarry. Only a handful escaped to carry the story home to Athens.

Part of the story those few survivors brought home concerned the fate of their superstitious general, Nicias. The Syracusan army executed him shortly after the fight at the river; history doesn't record the date of Nicias' death, but it could plausibly have been about 27 days after the lunar eclipse.

Because this is a tale of ancient Greece, tradition demands a moral: It's bad luck to be superstitious.

Please visit the site: <https://www.forbes.com/sites/kionasmith/2019/08/27/how-a-lunar-eclipse-defeated-a-greek-army/#412081c29473>

NEW SANCTUARY DISCOVERED IN ANCIENT CITY OF TROY IN WESTERN TURKEY

Archaeologists have discovered a new sanctuary preceding the ancient city of Troy in Turkey's western Çanakkale province, which is expected to shed light on the details of ancient civilizations that inhabited the area.

Professor Rüstem Aslan from Çanakkale University's Faculty of Archaeology, who leads the excavations at Troy, told the Anadolu Agency that they found the third sanctuary in the 156th excavation period.

Excavations at Troy, located near the village of Tevfikiye, were launched by Frank Calvert for the first time in 1863, Professor Aslan said, noting that the discovery of the new sanctuary is exciting as it has significant implications in terms of the history of Troy and Anatolia.

"In this year's excavations we have come up with exciting results regarding the southern entrance to the ancient city of Troy," Aslan said and added: "We came to the conclusion that there was a new sanctuary area in Troy especially during the Hellenistic Roman periods."

Aslan said that the excavations prove the existence of a third sanctuary in the area.

The findings at Troy are expected to shed light on the relations of the city with the Anatolian and Hittite cultures, and its function in Western Anatolia.

Turkey's government declared 2018 the "Year of Troy" in honor the 20th anniversary of the ancient city's recognition as a UNESCO World Heritage Site. Hundreds of thousands of guests, including celebrities, have visited the site this year to visit the newly opened Troy Museum and take part in cultural and historical activities.

The 4,000-year-old ancient city of Troy is one of the most famous archeological sites in the world. First excavations at the ancient city were undertaken in 1870 by German businessman Heinrich Schliemann, who is now regarded among the pioneers of archeology.

The historic setting of the Greek Trojan War in which Spartan and Achaean warriors from Greece besieged the city in 13th century B.C. was immortalized by the Greek poet Homer in his epic poem The Illiad.

Please visit the site: <https://www.dailysabah.com/history/2019/08/26/new-sanctuary-discovered-in-ancient-city-of-troy-in-western-turkey>

PREHISTORIC BABIES DRANK ANIMAL MILK FROM BOTTLES, BY EMILY VAUGHN

Breast or bottle? Apparently, parents of infants have been pondering these options for thousands of years.

So suggests a new study released Wednesday by the journal *Nature*. The researchers report finding nonhuman milk residue inside a type of ancient spouted clay bowl that sometimes featured animal feet and heads. The earliest examples of this kind of vessel — which the researchers are calling prehistoric baby bottles — date back more than 7,000 years.

"I can just imagine a little prehistoric child being given one of these with milk in it and laughing," says the paper's lead author, archaeologist Julie Dunne of the University of Bristol. "They're just fun. They're like a little toy as well." She says the animal-shaped vessels seem to represent "mythical animals" rather than realistically depicting any particular type of creature.

The researchers say the milk molecules they identified, via chemical and isotopic analysis, came from the ruminant family, which includes sheep, goats and cows. "This is the first time that we've been able to identify the types of foods fed to prehistoric babies," says Dunne.

The vessels that Dunne and her team sampled were found in Bronze Age and Iron Age infant graves in Bavaria, Germany. She says they are a type of pottery that first appeared in the Neolithic period, at a time when Europeans were making the shift from hunter-gatherer societies to agrarian communities. "It's only when humans begin to domesticate animals that these foods become available to feed or wean infants," Dunne says.

The discovery may help explain what was behind a major prehistoric baby boom in that era, according to Siân Halcrow, a bioarchaeologist at the University of Otago, in New Zealand. Until now, scientists hadn't "recognized that the introduction of animal milk to infants' diets could have changed a woman's fertility," says Halcrow, who was not involved in the study. She wrote a commentary that appears in *Nature* alongside the new study to provide context.

"There's clinical evidence that when women are breastfeeding, they have a period of infertility," says Halcrow. "So if women aren't constantly suckling their young" — for example, because they're using animal milk to wean their children earlier — "they could actually have more babies during their lifetime, and it could result in an increase in population size."

"This could lead to some of the population changes that we see around the Neolithic [period], with the major demographic explosion," she says.

But this expanding population may have come at the expense of individual health. "Human breast milk is perfect for babies," Halcrow says. "In terms of macronutrients, micronutrients, immune cells. And cow's milk is obviously not as suitable a complete

infant food." She says it's possible that the prehistoric humans were adding animal milk to babies' diets slowly, but if babies were transitioned completely off human milk too early in their lives, "it could have been extremely detrimental" to their immune function and nutrition.

"And these bottles would have been so hard to clean," Halcrow adds. "Never mind them not having access to clean water in the first place. But getting into those tiny little spouts? These would have been really unsanitary to use and introduced all kinds of germs into the infant diet."

One of the vessels showed traces of multiple types of fat, one of which, the scientists say, could have been remnants of human breast milk. "There's no reason to suppose that women might not have expressed milk into one of these pots for use later, as we do today," Dunne says.

Previously, scientists had conjectured that pottery of this type — small, hollow vessels with long, narrow spouts — was used to feed the sick or elderly. As for why scientists are just now discovering that the vessels were used for infants, Dunne says, "Let's face it. Sometimes research on women tends to be a little bit marginalized compared to research on what the men in prehistoric times were doing out there — you know, fighting, or hunting and gathering, and all that kind of stuff. So you don't get perhaps so much about women and motherhood and children."

Halcrow agrees. "It wasn't really until the 1970s and 1980s that archaeologists started to become interested in where women were in the past, and from that they started to look, by extension, at infants and children. So it's only really been the last 15 to 20 years that there's sort of been an explosion of the study of children."

"Broadening our lens to include infants and children in the past is really important for a number of reasons," Halcrow says. "They made up a high proportion of past populations. And if their health and experience is poor, that's obviously detrimental to society's function."

"We originally went forward to find vessels in child graves, because that would absolutely confirm for us that they were children's feeding bottles," says Dunne. And her team got extra validation — albeit of a more anecdotal variety — from the child of a friend.

"When we gave a reconstructed one to [baby] Noah, it's very intuitive, so it fit just perfectly within a baby's cupped hands. And he loved it," Dunne says. "He started immediately sort of suckling from it. He was really happy, sitting there playing with it and suckling from it for ages."

Please visit the site:

<https://www.npr.org/sections/thesalt/2019/09/25/764243209/prehistoric-babies-drank-animal-milk-from-a-bottle>

WHAT'S IN A STYLE? MINOANIZING **PAINTINGS IN THE EASTERN** **MEDITERRANEAN,** **BY CONSTANCE VON RÜDEN**

What does it mean when a particular Aegean style of wall paintings is discovered far from home, from central Anatolia in the north to the Nile delta in the south? Mostly decorating palatial buildings of local “elites,” do these paintings represent similar tastes or do they express a desire to belong to a transregional network? Or do small details suggest the reality is more complicated still?

The Minoan culture of Crete became famous with the discovery of wall murals by Arthur Evans at the beginning of the 20th century. Dating to the Late Bronze Age in the mid-2nd millennium BCE, these fantastic paintings decorated the interior of an immense palace and depicted what were assumed to be characteristic Minoan scenes, such as mythological creatures, plants and animals, and the famous and still mysterious sport of ‘bull leaping.’

Famed British archaeologist Leonard Woolley found the first very fragmented murals in the palace of Alalakh Level VII in the northern Levant just after World War II. The discovery marked the beginning of what has been a long controversy. Woolley identified different floral motifs, a bull’s horn, architectural imitations and string impressions and immediately related them to examples long known from the Minoan world.

But rather than see the murals as being of Aegean origin, Woolley argued for travelling “Asian” craftspeople as the creators of the Aegean murals. His perspective was a classic example of the then current notion of *ex oriente lux*, the idea that ‘light from the orient’ diffused from east to west.

In the late 1980s, the discovery of wall and floor paintings in the Middle Bronze Age palace at Tel Kabri at the southern Levant led to a renewal of the discussion. Tiny fragments of a miniature landscape scene with obvious Aegean parallels were discovered under a threshold. Unluckily, their fragmentation does not allow anything substantial to be said about the painting’s composition.

Nonetheless, its reconstruction, based on the Miniature Fresco from Thera, shifted the origin of the murals into the Aegean as they were finally considered as the product of Minoan craftspeople. This interpretation was perfectly suited to the new dominant narrative about the Minoans, who were portrayed as successful traders and agents for progress.

But shortly afterwards, thousands of painted lime plaster fragments were discovered at Tell el-Dab’a/Avaris in the eastern Nile delta. The murals were dumped in large secondary deposits in front of a palatial district. Despite the poor preservation of the mural fragments, a broad range of subjects was identified.

In addition to the now famous bull-leaping scenes, small- and large-scale murals depict leopards, lions, griffins and hunters accompanied by dogs. It was particularly surprising that no Egyptian religious and political power symbols were included in the murals. The site's excavator, Manfred Bietak, suggested that an official meeting between Monians and Egyptians or even a political marriage could be a possible cause for the unique style.

Tell el-Dab'a also stands out for a stucco relief technique that previous was known primarily from Crete. Thus, these murals not only share decorative motifs with the Aegean paintings, but also complex technical knowledge. They are largely executed on wet lime with the help of string impressions, display similar surface treatments and thus mirror a very tight relationship to the Aegean craft traditions.

These new discoveries have raised the question of itinerant craftspeople and their possible Aegean ethnicity. In support of such a hypothesis many studies have referred to isolated technical details or iconographic characteristics. The focus on the Aegean impact has led to an artificial separation of these 'Minoanizing' paintings from other murals common in these regions. However, to adequately comprehend the murals, we need to contextualize the entire workflow of stylistic and technical decisions.

The new findings have led to a reconsideration of Woolley's Alalakh fragments. Remarkably, Barbara and Wolf-Dietrich Niemeier recognized a notched-plume-motif, typical for Aegean wing depictions, which gave reason to assume the representation was of a griffin or sphinx. Again this resulted in the reconstruction of unmistakably "Minoan griffin," and the same Minoan influence is seen in the reconstruction of the horn fragment as a bucranium with a highly hypothetical double axe.

Both reconstructions have visually brought the paintings closer to the Aegean, while any ambiguity or possibility of a hybrid combination of motifs has been erased. But other, local aspects of the Alalakh VII murals have until now been completely ignored, for instance the depictions of basalt orthostats, typical element of the local architecture, and the motif of a bicolored sequence of three horizontal ribbons, well-known from the palace of Mari at the Euphrates.

Both iconographic aspects clearly anchor the Alalakh paintings within a local, western Asian tradition. That the "Minoanized" paintings are not completely separated from the inner-Syrian paintings becomes also evident by another unexpected insight from Mari. A recently discovered string impression from Mari, framing a spiral motif, raises the question if this technique can be indeed considered as exclusively Aegean.

Finds from Late Bronze Age II Qatna in Syria have added further evidence regarding the murals. Many of the identified motifs, such as undulating landscapes, palm trees, or dolphins have their best parallels in Aegean images. But Qatna also demonstrates the methodological traps that await interpretations of these similarities. The hundreds of small mural fragments indeed join together, but the results include a quite unexpected visual syntax for previously well-understood single motifs.

For example, the restriction of spirals into trapezoid panels instead of a running frieze and the arrangement of a miniature landscape above a small frieze of two counter-rotating spirals are unusual from an Aegean point of view. Similar "deviations" can be observed in the less well-preserved seascape of the south wall.

Furthermore, the black dado zone with irregular white dots below the panels appears to imitate basalt orthostats, as at Alalakh. The similarities between the corpora of Alalakh and Qatna across about 300 years hint indeed to the existence of a local tradition, originally derived from Aegean but combined with local elements: another hybrid visual language that joins other well-known aspects of Levantine imagery.

While such an explanation cannot be easily transferred to the Tell el-Dab'a paintings, some characteristics of the few and mostly very small fragments from the upper city of Hittite Hattusha in central Anatolia might be explained in a similar way. Their fragmented state hardly allows a full understanding of the iconography, but it is clear that the rosette is a prominent motif.

The rosette is very common in Hittite as well as Aegean iconography, and it can be argued that this motif formed part of the headdresses of the local sphinx as well as being interpreted as an Aegean element.

All these new results reveal a far more complex web of interactions than previously thought. There is indeed a shared craft tradition, but there are also variations in its local execution. Craft specialists may have moved in all directions, mixing and matching 'Aegean' motifs and local details. Scholars have until now homogenized various cases with a model of single visits by itinerant craftspeople—irrespective of the diverse chronological, architectural, and social contexts of the paintings.

Only the painstaking and time-consuming reconstruction of the histories of individual paintings will allow us to shed light on the entanglement of the different craft traditions of the eastern Mediterranean. This emerging picture might be more difficult to define in a single marketable sentence, but it will help us grasp a unique period at the end of the second millennium when craftsmen, images, and technologies circulated around the Mediterranean as never before.

Constance von Rden is a faculty member at the Ruhr-University Bochum.

Please visit the site: <http://www.asor.org/onetoday/2019/09/Whats-in-a-Style-Minoanizing-Paintings> [Go there for pix and format]

ANCIENT DNA PUTS A FACE ON THE MYSTERIOUS DENISOVANS, EXTINCT COUSINS OF NEANDERTHALS, BY MICHAEL PRICE

Many of us can picture the face of a Neanderthal, with its low forehead, beetled brows, and big nose. But until now, even scientists could only guess at the features of the extinct Denisovans, who once thrived across Asia. For more than 10 years, these close cousins of Neanderthals have been identified only by their DNA in a handful of scrappy fossils.

Now, a new method has given the Denisovans a face. A recently developed way to glean clues about anatomy from ancient genomes enabled researchers to piece together a rough composite of a young girl who lived at Denisova Cave in Siberia in Russia 75,000 years ago.

The results suggest a broad-faced species that would have looked distinct from both humans and Neanderthals.

Ludovic Orlando, a molecular archaeologist at the University of Copenhagen who wasn't involved in the work, calls the approach "clever." But he and others caution against making specieswide generalizations based on a single individual.

Perhaps 600,000 years ago, the lineage that led to modern humans split from the one that led to Neanderthals and Denisovans. Then about 400,000 years ago, Denisovans and Neanderthals themselves split into separate branches. Denisovans ranged from Siberia to Southeast Asia and may have persisted until as recently as 30,000 years ago, based on their genetic legacy in living Southeast Asians.

Hundreds of Neanderthal skeletons, including intact skulls, have been found over the years. But the only fossils conclusively linked to Denisovans are a pinkie bone from the girl plus three teeth, all from Denisova Cave, and a recently identified lower jaw from China's Baishiya Karst Cave.

Then in 2014, researchers introduced a novel method based on epigenetics—a set of molecular knobs that can turn gene expression up or down—to analyze gene regulation in long-extinct hominins. One such knob is a chemical modification called methylation, which silences gene expression. In methylated DNA, one nucleotide, cytosine, degrades over thousands of years into a different end product than usual. By tracking that degradation in an ancient genome, scientists can create a methylation "map."

Liran Carmel and David Gokhman, geneticists at the Hebrew University of Jerusalem, and their colleagues applied this method to DNA in the girl's pinkie from Denisova Cave. They compared the girl's methylation map with similar maps of modern humans, Neanderthals, and chimpanzees, focusing on areas where the degree of methylation differed by more than 50%.

To find out how Denisovans' unique methylation patterns might have influenced their physical features, the researchers consulted the Human Phenotype Ontology database of genes known to cause specific anatomical changes in modern humans when they are missing or defective. Because methylated genes are "turned off," they may have effects comparable to those of the genes in the database, making it possible for researchers to infer Denisovan anatomy.

The method can't provide exact body measurements. "We can say [Denisovans had] longer fingers [than modern humans for example], but we cannot say 2 millimeters longer," Carmel explains. In total, the researchers discovered 56 Denisovan anatomical features that may have differed from humans or Neanderthals, 34 of them in the skull. As expected, the Denisovan girl looked fairly similar to a Neanderthal, with a similarly flat cranium, protruding lower jaw, and sloping forehead, the researchers report this week in Cell.

Yet she also had key differences. The reconstructed face was notably wider than that of a modern human or Neanderthal, and the arch of teeth along the jawbone was longer.

A test of the model came while Cell's editors reviewed the paper. Another team concluded based on ancient proteins in the Baishiya jawbone that it belonged to a Denisovan. Carmel and colleagues eagerly matched their model Denisovan to the real thing, and found a close fit: The jawbone was wider than that of either humans or Neanderthals, and there were hints that it protruded about as much as in Neanderthals but more than in modern humans. "It almost perfectly matched our predictions, which was very nice for us," Carmel says. The team's predictions also match skull fragments from Xuchang, China, that some argue belong to a Denisovan, he adds, and the method may help identify additional Denisovan specimens.

Because the current study is based on a single individual and the technique only returns relative measurements, researchers caution that it's an imperfect reflection of what the species looked like. Only more Denisovan fossils can confirm whether this portrait is accurate, says Gabriel Renaud, a bioinformatician at the University of Copenhagen, who adds that he wishes the authors had publicly released their computational methods so that others could replicate the findings.

"If you were to find a single Homo sapiens fossil and it's an NBA basketball player, then you might conclude that Homo sapiens were 7 feet tall," he says. "It's an interesting approach, but we can't verify the predictions until several Denisovan skeletons are found."

Michael Price is a science journalist in San Diego, California.

Please visit the site: <https://www.sciencemag.org/news/2019/09/ancient-dna-puts-face-mysterious-denisovans-extinct-cousins-neanderthals> [Go there for pict. Story heavily featured in the media]

DATING THE COPPER SCROLL - ANCIENT JEWISH SCROLL -- AND TREASURE MAP, BY MEGAN SAUTER

The Copper Scroll. Found in a cave near the Dead Sea, the Copper Scroll describes a vast treasure—hidden in locations throughout the Judean wilderness. Some think the scroll served as a map to the treasure from the Jerusalem Temple. Photo: Courtesy École Biblique et Archéologique Française de Jérusalem.

In 1952, archaeologists found the Copper Scroll in a cave at the site of Qumran near the Dead Sea. Made of copper, the scroll stood apart from the rest of the Dead Sea Scrolls, which were composed of parchment or papyrus. Once unrolled and deciphered, the Copper Scroll was confirmed as being further unique: It describes a vast treasure—hidden in locations throughout the Judean wilderness.

Immediately people began to wonder whether the Copper Scroll might be a map to treasure from the Jerusalem Temple.

Joan E. Taylor of King’s College London analyzes this enigmatic document in her article “Secrets of the Copper Scroll” published in the July/August/September/October 2019 issue of *Biblical Archaeology Review*. Since its discovery, the date of the Copper Scroll has been debated. Through studying the scroll’s contents and archaeological context, Taylor offers an answer to when the scroll was most likely written and hidden.

Inscribed on durable material and hidden in a secure location, the Copper Scroll—serving as a sort of treasure map—was meant to survive.

Burying a massive treasure, recording the burial locations on a virtually indestructible scroll, and then hiding that scroll show that someone anticipated that the treasure and treasure map would be seized. Moreover, someone went to great lengths to try to prevent that from happening.

Taylor explains why the magnitude and contents of the Copper Scroll treasure suggest it belonged to a temple:

The treasure is vast, far beyond what we could imagine would be the property of an individual or even a group, unless they were the rulers of a nation. ... If we look at the Copper Scroll closely in terms of its contents, this treasure seems to come from a temple—perhaps the Temple in Jerusalem—and was secreted away in 64 (or perhaps 61) locations, most of which are close to Jericho. The enormous size of the treasure, as well as the presence of cultic terminology (e.g., references to tithes, priestly vestments) included in the text, indicates the treasure’s sacred origin.

Although the religious terminology in the Copper Scroll indicates it came from a temple, the text does not specify which temple. However, the language of the Copper Scroll, Mishnaic Hebrew with some Greek loanwords, connects the scroll to a Jewish context.

Coupled with the proximity of the various hiding locations to Jerusalem, the Jerusalem Temple seems a likely point of origin.

If the Copper Scroll does indeed detail treasure from the Jerusalem Temple, when was it written and hidden? Many scholars think it dates to the First Jewish Revolt against Rome in the first century C.E. (c. 66–70 C.E.) and place it right before the Romans destroyed the Jerusalem Temple in 70 C.E. However, Taylor thinks it better fits the period of the Second Jewish Revolt against Rome (aka, the Bar-Kokhba Revolt) in the second century (c. 132–135 C.E.).

Toward the end of the Bar-Kokhba Revolt, Jewish refugees fled to the Judean wilderness and hid in caves—trying to escape the Romans’ wrath.

Archaeologists have found evidence that they took shelter at Qumran and caves near the one that held the Copper Scroll, thereby giving them an opportunity to hide the Copper Scroll. Even though there was no standing temple in Jerusalem during this period, Taylor explains this does not preclude the existence of Temple treasure:

It is not necessary to have a functioning temple in Jerusalem for there to be Temple treasure, because some form of cult could continue without a building. If your synagogue or church is destroyed, it doesn’t mean you give up on worship and religious practice. As [scroll scholar Manfred] Lehmann argued, this treasure may never have been in Jerusalem, but rather stored up in various safe localities over time.

Josephus describes everything to do with the Temple cult and Jewish law as still functioning through the end of the first century C.E., even though the Temple was destroyed in 70 C.E. While always referring in the past tense to the Temple as a building, Josephus refers to the continuation of sacrifices in the present (e.g., *Against Apion* 2.193–198).

The treasure described in the Copper Scroll may very well refer to Temple paraphernalia amassed between the two Jewish revolts and hidden at the end of the Bar-Kokhba Revolt. However, since no piece of this treasure has ever been found, we cannot know this definitively. It is possible the treasure was never actually buried. Some event—likely whatever prompted the creation of the scroll—may have prevented its concealment.

Learn more about the Copper Scroll and the Bar-Kokhba Revolt in Joan E. Taylor’s article “Secrets of the Copper Scroll” published in the July/August/September/October 2019 issue of *Biblical Archaeology Review*.

Please visit the site: <https://www.biblicalarchaeology.org/daily/biblical-artifacts/dead-sea-scrolls/dating-the-copper-scroll/>

THE DISCOVERY OF THE ANCIENT GREEK CITY OF TENEA, BY JESSICA BATEMAN

One of Greece's top archaeologists, Eleni Korka, recently made the biggest discovery of her 40-year career: the mythical city of Tenea, which was built by Trojan prisoners of war.

It was a baking hot summer's day and I was in a car driving through the dramatic hills and lush vegetation of the Peloponnese in Greece.

"Look at this whole plain," my driver, Eleni Korka, said, gesturing out the window. To our left was a huge, flat area, covered in olive trees and scrub bushes. Where it ended, the earth transformed sharply into forested mountains.

"The city of Tenea covered this whole place," she told me. "It's above sea level and there's a cool breeze, so the summer palace would probably have been built here." She pointed to a traditional restaurant tucked under a distinctive, almost square-shaped hill. "And this taverna is built under a watermill," she said.

Korka is one of the country's top archaeologists. A Greek American, she recently made the biggest discovery of her 40-year career. The lost city of Tenea, which is mentioned in multiple Greek myths and historical texts, such as the ancient legend of Oedipus, the mythical king of Thebes who unwittingly killed his father and married his mother, was uncovered by her and her team last October, buried under the fields we're now driving past.

According to myth, the city was founded by the Trojans sometime around 1100BC and built by prisoners of war. They chose this spot because it was on the road between Corinth and the ancient settlement of Mycenae.

Oedipus was said to have been raised here after being sent away as a baby. And it was one of the largest and most prosperous cities in the ancient region of Corinthia in the northern Peloponnese. Until now, however, no-one could work out exactly where it was – or why it disappeared.

The search for Tenea began in 1984. Korka was just five years into her career when she received a call from some local villagers digging a water channel. They had hit an ancient sarcophagus and broken it in half. Korka went to look. "The minute I saw it, I understood it was something unique," she said. "Sometimes, a find connects with someone.

It's almost spiritual." The vase-shaped coffin had delicate paintings of lions on the interior and contained a skeleton and offerings to the deceased. "We don't have another one with drawings like that," she explained. "We also do not know what ancient paintings looked like... We have no other sample from the Archaic period."

The minute I saw it, I understood it was something unique

Korka knew Tenea was thought to be in the area, based on ancient historians' writings, which stated it was somewhere between Corinth and Mycenae. But her young age, inexperience and a lack of further evidence made it impossible for her to get a licence for excavation.

"I did not have the confidence or ability to argue why this was so important – it was more intuition-lead," she said.

However, illicit antiquities smugglers had known about the site for years, and would often pay local farmers for vases and coins they came across. In 2010, Korka worked alongside the police and informants to intercept the illegal sale of two statues that had been looted nearby.

"The statues proved Tenea was a very prominent city with high levels of art," she said. She finally obtained permission to dig in the area, and in 2013 the excavation began.

We stopped in the nearby village of Chiliomodi for coffee and pastries. The oldest houses here were built here around 200 years ago, and Korka explained that many of them used ancient rocks, likely from Tenea ruins, that were lying around. The local church has a carving of the Ancient Greek god of winemaking and theatre, Dionysus, embedded in the wall. "We think it was part of an ancient theatre, which we're still searching for," she said.

Chiliomodi is a peaceful, pretty place, largely untouched by tourism.

The discovery of the ancient city nearby has brought energy and excitement to the community. In the bakery I noticed bottles of local olive oil named "Tenea", and there's a shop of the same name due to open nearby.

Korka and her colleagues Konstantinos Lagos and Antonio Corso, who were driving with us, told me that the project didn't go exactly to plan to start with. "We had a small team and very little funding," they said.

A geophysical survey of the area was carried out by a third party using technology. But when they started to dig, they found nothing – the shapes seen during the survey had been created by the limestone soil. "So we went back to where the first sarcophagus was found," she said. "Nearby we found about 40 others... they just kept coming out of the ground one after the other. It was like [the folk tale of] Ali Baba."

Next, they discovered part of an ancient road, which led the team to a Roman mausoleum from around 100BC in which several generations of a family were buried, plus a cistern that would have been used for rituals and sacrifices: "We knew this was outside of the city, so we decided to dig north instead." Last October, houses were discovered, and the team realised they had finally found the city itself. "Most of the surface level findings had already been taken by looters," Lagos said. "But most of the actual city is 2m or 3m below ground."

How to visit Tenea

The team is open to guiding visitors and organising educational events while the dig takes place in September and October. You can communicate with them through the Tenea Prjct Facebook account.

We stopped at a house in Chiliomodi that is being used as the conservation centre. The team excavates during September and October and spends the rest of year analysing artefacts and studying historical texts. Lagos told me that a huge number of coins have been found on the site, proving Tenea was a very wealthy place. “We’ve found around 200 – you normally only get these kinds of numbers after many years of excavations,” he said. He showed me gold leaf imitation coins that would have been buried with the deceased as a gift for the boatman in the underworld. “Most people [at the time] were buried with pennies,” he said. “But in Tenea they used gold.”

Other finds include exquisitely painted vases, engraved lanterns and metal tools used by athletes (to scrape off the oil they cleansed their bodies with), leading the team to believe there is a stadium they have yet to find.

This backs up what the team knew about the society from historical texts: “The people here were different – they were Trojans. They had their own identity,” said Korka. As well as being from a different place – the city of Troy was located in what is now Turkey, around 600km – the finds so far show they used different styles of ceramics and had different burial tradition to those living in nearby Corinth and Mycanae, such as placing the coin on the chest rather than in the mouth, as was common elsewhere in Ancient Greece.

Korka and her team have uncovered a huge number of coins at the Tenea site, as well as vases, lanterns and tools (Credit: Jessica Bateman)

But one of the biggest mysteries surrounding Tenea is why it disappeared. Most other major ancient Greek cities, such as Sparta, Athens and Corinth, remain inhabited to this day. It was unusual for a city as large as Tenea – there were probably around 100,000 inhabitants – to be completely abandoned, and no historical texts give a clue as to why.

We headed back to the car and drove up towards the mountains, as Lagos began to explain the team’s theory. “We know Alaric, who was king of the Visigoths, raided Greece in 397AD,” he said. Historians believe he destroyed cities partly to gain wealth, but also to spread Christianity. “We discovered a coin that was issued by Alaric’s people. We also found a house that had been destroyed by a cannonball from around that year.”

However, that wasn’t the end of the story for Tenea. “We have found evidence of inhabitation from 200 years later, but it appears Tenea had lost a lot of its wealth,” he continued, explaining that the finds from this period were not as grand or valuable as the earlier ones.

“But after that, there’s nothing.”

The car climbed up a winding road, giving us spectacular views over the mountains and the plain under which Tenea rests. We stopped at a beautiful, crumbling Byzantine-era monastery. “We know the Slavs invaded this area around that time. We believe the people of Tenea abandoned the city and fled to these hills here,” he said, gesturing around us. The Slavic tribes are known to have raided the area and violently clashed with local communities, so it seems Tenea’s residents judged the hills to be safer. There were many streams around the city, and with no-one to attend to them they covered the city in silt, which eventually turned to earth and covered the city.

It's like an iceberg and we're just hitting the tip

Tenea's discovery has answered many mysteries already, such as where the city was located and perhaps why it was abandoned. But for the team, the most exciting thing is what it still may hold. They are expecting to find more houses, temples, a theatre and a marketplace – known in Ancient Greek as an agora – over the coming years. “It's like an iceberg and we're just hitting the tip,” Lagos said. “It's going to keep giving interesting findings for the next 100 years.”

Please visit the site: <http://www.bbc.com/travel/story/20190915-the-discovery-of-the-ancient-greek-city-of-tenea> [Go there for pix]

GROUNDBREAKING STUDY: ANCIENT TIN INGOTS FOUND IN ISRAEL WERE MINED IN ENGLAND, BY AMANDA BORSCHEL-DAN

Enigma of origins of Bronze Age Levant's tin supply solved through isotope and chemical composition analysis that shows 13th–12th century BCE tin bars likely came from Cornwall

When the Bronze Age hit ancient Israel, the copper-rich region was able to quickly source seven of the eight ingredients needed to produce the alloy at Timna and other mines. But where tin — another one-eighth of the metal's recipe — came from has been a lingering mystery for scholars. A new paper from an international team of researchers proposes a surprisingly faraway source — Cornwall.

In a paper published in June on the open-access, peer-reviewed scientific journal PLOS One, the authors analyze 27 tin ingots, or blocks, from five sites bordering the eastern Mediterranean Sea. For decades, researchers have debated the origin of tin used in ubiquitous precious bronze throughout the Levant during the eponymous era, from the late fourth and third millennia BCE. Hypotheses have swung from close-by Turkey, central Asia, or far-flung France and Britain.

In their paper, “Isotope systematics and chemical composition of tin ingots from Mochlos (Crete) and other Late Bronze Age sites in the eastern Mediterranean Sea: An ultimate key to tin provenance?” a team of interdisciplinary scientists from Mannheim, Germany; Greensboro, North Carolina; Merano, Italy; and Haifa have what they call solid proof of where — and where not — the precious tin was likely mined.

“Bronze was used to make weapons, jewelry, and all types of daily objects, justifiably bequeathing its name to an entire epoch. The origin of tin has long been an enigma in archaeological research,” said Prof. Dr. Ernst Pernicka in a press release this week. Study co-author Pernicka, now retired, worked at both the Institute for Earth Sciences of Heidelberg University and the Curt Engelhorn Centre for Archaeometry.

The scholars used an earth-shattering approach to figure out the mine's locus. “By using a combined approach of tin and lead isotopes together with trace elements it is possible to narrow down the potential sources of tin for the first time,” they write.

The most logical source? According to the authors, the most likely suppliers of the 13th–12th century BCE tin ingots from Israel are tin mines from Cornwall and Devon.

“These results specifically identify the origin of tin metal for the first time and therefore give rise to new insights and questions for archaeological research,” said lead author Dr. Daniel Berger, a researcher at the Curt Engelhorn Centre for Archaeometry in Mannheim.

All in the timing

The scientists studied samples that were discovered in dives off the coasts of Mochlos, Crete, and Uluburun, Turkey, and in three locations off Haifa, Israel. The ingots discovered in the three sites off the coast of Israel set the “geological model age of the parental tin ores” at circa 291 million years ago (with an error margin of 17 million years).

Tin deposits on the Eurasian continent and distribution of tin finds in the area studied dating from 2500-1000 BCE. The arrow does not indicate the actual trade route but merely illustrates the assumed origin of the Israeli tin based on the data. (Credit: Berger et al. 2019; Prepared by Daniel Berger)

The “age” of the tin is important for excluding other previous leading mine contenders — tin deposits in Anatolia, central Asia and Egypt — “since they formed either much earlier or later,” write the authors.

Tin is moderately rare essential metal that is found sporadically in sites spread out around the globe. Having excluded the close-by sites through the tin’s age, with the new study of the tin isotope composition, the authors state that they were also able to exclude several of the European sources as the origin mine for the Israeli ingots. Interestingly, the tin ingots from coastal Crete and Turkey appear to have a different source.

Archaeologists have found evidence of tin mining in Cornwall and Devon as early as 2000 BCE and the last tin mine in Cornwall, South Crofty, was only closed in 1998. Other ancient methods of mining the metal, such as sifting river water, leave few or no artifacts, meaning the metal may have been harvested from these areas even earlier.

Dr. Ehud Galili of University of Haifa taking core samples from the newly excavated Neolithic well in Kfar Samir (Dr Jonathan Benjamin courtesy of Dr Ehud Galili, University of Haifa and Israel Antiquities Authority)

The story behind each of the Israeli ingot samples is as astounding as the new study’s results.

In 2014, a team of archaeologists including the study co-author, Haifa University’s Ehud Galili, discovered what media sensationally called a Neolithic “Atlantis” off the coast of Haifa in Kfar Samir. There, they found the remains of a 7,700-year-old sunken village. The village, located about 200 meters (218 yards) offshore under some 5 meters (16 feet) of seawater, yielded ancient evidence of olive oil production, some of the oldest wooden artifacts in the world, according to a 2014 Times of Israel article, and ancient tin.

An earlier find of a 13th-century BCE shipwreck at Hishuley Carmel in 2012 also was a source of the study’s tin ingots. That shipwreck, wrote Galili in a 2012 article in the International Journal of Nautical Archaeology, “provides direct evidence for marine transport of copper and tin along the Israeli coast and may indicate inland and maritime trade-routes of metals in the Mediterranean.” At that point, however, author Galili had not yet determined the source of the discovered tin.

The precious

Knowing the origin of the Israeli tin ingots points to a complicated and far-reaching ancient trade route.

“Tin objects and deposits are rare in Europe and Asia,” said Pernicka.

“The Eastern Mediterranean region, where some of the objects we studied originated, had practically none of its own deposits. So the raw material in this region must have been imported.”

According to a press release from Heidelberg University and the Curt Engelhorn Centre for Archaeometry in Mannheim about the study, other “highly appreciated raw materials” that would have passed along the trade route include amber, glass, and copper.

Originally, bronze was created by mixing copper with arsenic. The poisonous element, however, created toxic fumes that led to metallurgists’ early deaths. Tin was found to be more stable — and less lethal — but somewhat elusive.

Tin once held a value and strategic importance similar to that of oil, according to the research paper “Tin Deposits and the Early History of Bronze” by geologist R.J. Cathro. “Judging by how much effort went into finding it, the price of tin must have been extremely high,” writes Cathro.

“It became an indispensable commodity, worth scouring the world for and going to war over, and it occupies a special place in the history of mining, economic geology, agriculture, warfare, art, and human development,” writes Cathro. “Gold and silver could finance a war, but bronze could win it.”

Please visit the site: <https://www.timesofisrael.com/groundbreaking-study-ancient-tin-ingots-found-in-israel-were-mined-in-england/> [Go there for pix]

WE FINALLY KNOW WHAT ANCIENT GREEK MUSIC SOUNDED LIKE, BY YUKTA SINHA

Music was very much prevalent in the ancient Greek society: from marriages, funerals, and religious ceremonies to theater, folk music, and the ballad-like reciting of epic poetry. It thus played an integral role in the lives of ancient Greeks.

Even the word “Music” comes from the Greek word “Muses”, a reference to the nine daughters of Zeus (The King of Gods in ancient Greek religion).

The history of music in ancient Greece is so closely interwoven with Greek mythology and legend that it is often difficult to conclude what is historically true and what is myth.

Most of our understanding of ancient Greek music theory comes from the teachings of famous mathematicians and philosophers such as Pythagoras and Plato.

Over the years, musicologists have tried to rediscover this music. Still, problems relating to the interpretation of certain tones and chords in ancient Greek musical system arose, which they were not able to resolve.

But recently, researchers from Oxford found an answer to those problems and performed probably the most historically informed music from ancient Greece.

Let’s listen to what it sounded like and find out how they did it!

Please visit the site: <https://edtimes.in/watch-we-finally-know-what-ancient-greek-music-sounded-like/> [Go there for brief audio]

ARCHAEOLOGISTS STRIVE TO SOLVE MYSTERY OF GIANT ANCIENT GREEN ROCK IN CENTRAL TURKEY

A giant ancient green rock located in the capital of the Hittite Empire in central Turkey awaits visitors and archaeology enthusiasts to solve its centuries-old mystery.

Foreign and local tourists visiting Hattusa, the capital of the empire which lies near modern Boğazkale in Çorum province, are fascinated by the beauty of the rare rock.

Referred to as the "wish stone" among locals, the giant rock's mystery is yet to be solved.

Researchers are trying to figure out how the rock was carried to the ancient site and what it was used for, Anadolu Agency reported.

Associate Professor Andreas Schachner told AA that the rock is different from all others found at the site but does not have valuable properties.

"The stone could be a serpentine or a nephrite," the professor said, adding that they believe the stone was used by all civilizations after the Hittites.

Schachner added that they do not know the ancient cultural value of the stone.

The Hittite Empire in the Late Bronze Age was one of the civilizations that played an important role in the development of urban life.

Hattusa was the first national excavation site in Turkey, where excavations have been ongoing since over a century.

Please visit the site: <https://www.dailysabah.com/history/2019/09/27/archaeologists-strive-to-solve-mystery-of-giant-ancient-green-rock-in-central-turkey>

ANCIENT EGYPTIANS HUNTED, THEN **MUMMIFIED, CROCODILES,** **BY MEILAN SOLLY**

New scans of a 2,000-year-old crocodile specimen suggest the animal was hunted specifically for mummification

In ancient Egypt, mummified animals were prized as votive offerings, intermediaries between mortals and the gods, and incarnations of different deities. To ensure a steady supply of creatures for embalming, mummy makers relied on an array of collecting strategies:

among others, recovering the carcasses of wild animals or domesticated pets, breeding animals for the sole purpose of mummification, and trapping targets in their natural environment.

But a new study published in the *Journal of Archaeological Sciences* is the first to offer concrete evidence of hunting as a method of procurement. As researchers led by Stéphanie M. Porcier of France's Université Paul-Valéry Montpellier III report, synchrotron scanning conducted on a roughly 2,000-year-old mummy suggests a supplier obtained the specimen by sneaking up on an unsuspecting crocodile and delivering a deadly blow to the head.

“The most probable cause of death is a serious skull fracture on the top of [the] skull that caused a direct trauma to the brain,” Porcier and her colleagues write in the paper. “The size of the fracture as well as its direction and shape suggest that it was made by a single blow presumably with a ... thick wooden club, aimed at the posterior right side of the crocodile, probably when it was resting on the ground.”

According to the study, the supplier started the crocodile's mummification process “very rapidly after the death,” masking the dent in its skull before treating the body with oil and resins and, finally, wrapping it in layers of linen. As Michael E. Ruane reports for the *Washington Post*, the animal's last meal—featuring reptile eggs, insects, fish and a rodent—was still in its stomach at the time of embalming.

Per a press release, the team used advanced imaging technology to conduct a virtual autopsy of the mummy, which was discovered by archaeologists excavating the Upper Egyptian city of Kom Ombo during the early 20th century. Today, Ruane notes, the crocodile is one of some 2,500 animal mummies housed at the Musée des Confluences in Lyon, France. Based on the new analysis, the animal, a male juvenile measuring around 3.5 feet long, was 3 to 4 years old at the time of its death.

Although the scientists acknowledge that it is currently “impossible to establish” whether the hunted crocodile is an anomaly or the product of a widespread practice spurred by demand for votive mummies, they write that future studies yielding similar results could lead to a reconsideration of mummy suppliers' animal procurement processes.

The ancient Egyptians mummified millions of animals, including dogs, cats, baboons, horses, goats and birds, between the 1st millennium B.C. and the 4th century A.D. As Edward Bleiberg, a curator at the Brooklyn Museum who was not involved in the study, tells the Post's Ruane, these well-preserved specimens were revered as messengers capable of conveying requests to the gods.

“There are falcon mummies associated with the god Horus, cat mummies for Bastet, dog mummies for Anubis, ibis mummies for Thoth,” Bleiberg says.

Crocodiles, meanwhile, were commonly associated with Sobek, a powerful fertility god depicted as a deity with the head of a reptile and the body of a man.

“The requests that we have in writing are very standard,” Bleiberg concludes, “for health, for yourself, or for a relative, requests for intervention in business disputes.”

Please visit the site: <https://www.smithsonianmag.com/smart-news/ancient-egyptians-hunted-then-mummified-crocodiles-180973197/>

UNEARTHING CRETE’S MINOAN PAST ON MT PSILORITIS

Archaeologists working on the small Zominthos plateau in the foothills of Mount Psiloritis on Crete discovered a tablet inscribed in Linear A – a writing system used by the ancient Minoans from around 1800 to 1450 BCE – in what was once an archive of a building complex, during this season’s excavations. The tablet was used for accounting purposes.

Please visit the site: <http://www.ekathimerini.com/244956/gallery/ekathimerini/images/unearting-cretes-minoan-past-on-mt-psiloritis>
