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# Πληροφοριακό Δελτίο της Ελληνικής Αρχαιομετρικής Εταιρείας

**- Απρίλιος 2020 -**

**Know how to listen and you will profit even from  
those who talk badly.**  
*(Plutarch)*

## Newsletter of the Hellenic Society of Archaeometry

**- April 2020 -**

**Nr. 229**

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## **ΣΥΝΕΔΡΙΑ - CONFERENCES/WORKSHOPS**

### **AMS-15 SYDNEY 2020 - COVID-19 UPDATE**

For those interested in attending **AMS-15 on 6-11 September 2020** in Sydney, please check out our news item regarding COVID-19 on the homepage of our website.

To reduce email traffic, all further information and developments for AMS-15 regarding COVID-19 will be posted directly to our website, so please monitor <https://ams15.sydney/> for updates.

Dr David Fink

Chairperson, 15th International AMS Conference, Sydney, September 2020.

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## **INART 2020 - NEW DATES / SEPTEMBER 30TH - OCTOBER 3RD, 2020**

Dear Colleagues,

The current sanitary situations regarding the spread of Covid-19 and restrictions on international travel do not allow the inArt 2020 conference to be held on the dates scheduled in April.

The organizing and scientific committees have decided to postpone the inArt 2020 conference to provide an opportunity to all participants to attend the conference.

**The conference is now planned from Wednesday September 30th to Saturday October 3rd, 2020, in Paris.**

All submitted and approved abstracts are also postponed, as well as early paid fees.

The timetable is updated on the conference [website](#) with the modified registration and publication deadlines.

Looking forward meeting you in Paris next September,

The inArt 2020 organizing committee

Ludovic BELLOT-GURLET  
Anne-Solenn LE HÔ  
Delphine NEFF  
Céline PARIS  
Laurianne ROBINET  
Aurélien TOURNIÉ

\*\*\*\*\*

Contact: [inart2020@sciencesconf.org](mailto:inart2020@sciencesconf.org)

4<sup>th</sup> International Conference on Innovation in Art Research and Technology

inArt 2020

NEW DATES: September 30th - October 3rd, 2020 Paris (France)

<https://inart2020.sciencesconf.org/>

[inArt 2020: 4th International Conference on Innovation in Art Research and Technology](#)

*New dates: 30 Sep. - 3 Oct. 2020 Paris (France)*

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# **INTERNATIONAL SYMPOSIUM ON ARCHAEOLOGY, LISBON, 18<sup>TH</sup> – 22<sup>ND</sup> MAY 2020**

Dear colleagues,

Regarding the Contingency Plans around the new Coronavirus (COVID-19) the Standing committee considers more reasonable to adopt Portuguese Health Recommendations, and WHO orientations, avoiding meetings with such an amount of participants, as we expect for next 43rd ISA (around 500), particularly coming for all around the world.

It is so, with great regret, that 43<sup>rd</sup> organizers announce that the **43<sup>rd</sup> ISA will be postponed.**

**Date to be announced soon.**

All abstracts submitted and approved will be also postponed, as well as early payed fee.

Hoping to see you in Lisbon, all with good health!

Isabel Dias

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

**JOBBOARD - THE CYPRUS INSTITUTE –**  
**RESEARCH-TECHNOLOGY-INNOVATION,**  
**ASSISTANT PROFESSOR IN**  
**ARCHAEOLOGICAL MATERIALS**

(ref.no. CYLAPAM\_2o\_o3)

Reference Number CYI\_APAM\_2003

**Job Description** The Cyprus Institute (Cyl) is a non-profit research and educational institution with a strong scientific and technological orientation, emphasizing international collaborations and cross-disciplinary research and post graduate education. Cyl, through its established research centers, addresses challenging issues that are important at both the regional and international levels. Many of its research activities are being carried out in partnership with leading institutions in the respective thematic areas.

**Position Description**

The successful candidate will advance the research agenda of STARC in close collaboration with the A.G. Leventis Professor for Archaeological Sciences. S/he will conduct and publish high-impact research in archaeological materials science, with an emphasis on ancient ceramics, metallurgy and / or lithics in the Eastern Mediterranean and Middle East. The successful candidate will be able to formulate well-developed research enquiries and to communicate effectively with experts in other fields to generate research projects within the archaeological discourse and across disciplinary boundaries. Participation in fieldwork and presentation of research at conferences and workshops are expected. S/he will be expected to work collaboratively with existing staff and faculty, while developing their own independent research profile, complementing rather than replicating existing strengths.

The successful candidate will be expected to oversee the development of the Archaeological Materials Laboratories at Cyl, supported by a Technical Research Specialist, and to cooperate closely with staff at the Andreas Pittas Art Characterization Laboratories. This includes advising the Director on the expansion of the Institute's range of equipment, leading the procurement process for new equipment, developing Standard Operating Procedures and overseeing the day-to-day operation of the labs. Emphasis will be placed on the data quality assurance for the analytical instruments (primarily SEM-EDS, hhXRF and pXRF), and on developing in-house expertise in the analysis of inorganic materials using mass and other spectrometric methods, requiring a strong basis in chemistry.

As faculty member, an aptitude and/or experience in mentoring and teaching students is necessary as the successful candidate will be regularly involved in the delivery of taught (MSc) and research (doctoral) postgraduate teaching, including the supervision of

research theses, as well as the development and delivery of Continuous Professional Development Courses and ECTS creditbearing Summerschool Courses.

The Institute is expanding its instrumental capabilities to include X-ray microCT, and the successful candidate may be required to take on the role of Radiation Protection Officer, as well as cooperate closely with the Health and Safety Committee of the Institute.

**Responsibilities/activities to be involved in:**

**The successful candidate will be responsible for helping to shape and advance the Cyprus Institute's and STARC's research agenda by:**

Conducting and publishing independent research in archaeometallurgy, ancient ceramics and / or other ancient and historical materials appropriate to the Institute's mission;

1. Initiating and sustaining high-level collaborative projects with leading research institutions that conduct research in areas related to their respective fields;
2. Securing financial and other resources from national and international sources;
3. Overseeing the development and operation of the Archaeological Materials Labs;
4. Potentially taking on the responsibilities for Radiation Protection, within the legal framework of the Republic of Cyprus;
5. Contributing to postgraduate (MSc and PhD) teaching and supervision, incl. developing and delivering relevant courses and seminars, and providing research guidance to graduate students;
6. Communicating the results and implications of research conducted at STARC and the Cyl at all levels, including the academic community, the public at large and political and other decision makers.

**Job Requirements Candidate profile and qualifications**

The successful candidates are expected to be scholars of international standing with a minimum of five (5) years of research experience (after completion of the PhD) in fields relevant to STARC's research agenda. They will have demonstrated leadership skills and ability to work independently.

They should have communicated research results to a broad public and have a proven track record in project funding and management. The selected candidates must have excellent interpersonal skills aimed at maintaining contacts in academic, business and governmental circles. Proficiency in spoken and written English is a prerequisite. In addition, the following qualifications are required:

- PhD specialization in Archaeological Materials, Archaeometallurgy or similar
- BSc or MSc Degree in Chemistry or closely related field (Geology, Materials Science)
- Demonstrated ability to collaborate with local, regional and international research communities.
- A good peer-reviewed publication record appropriate for the applicant's career stage
- Experience setting up and managing a materials laboratory
- An aptitude and/or experience in mentoring and teaching students
- Supervisory experience at MSc and PhD level
- Postgraduate teaching experience (incl. formal organization of modules)

### **Preferred qualifications/skills/knowledge/experience**

1. Experience with peer-reviewed published research in at least two different categories of ancient material is highly desirable, as is experience in provenancing materials.
2. Knowledge of Greek will be an advantage
3. Experience in organizing and delivering short courses
4. Radiation Protection certificate

### **Application/Contact Application**

For full consideration, interested applicants should process their application at The Cyprus Institute JobBoard (<http://jobboard.cyi.ac.cy/>). Applicants should submit: a cover letter with their motivation for applying for this position, together with (i) a curriculum vitae including a list of publications and a compilation of research grants obtained, (ii) a vision statement that outlines their current and future research agenda, and (iii) a list of five potential references (including contact information). For further information please contact Prof Thilo Rehren ([director.starc@cyi.ac.cy](mailto:director.starc@cyi.ac.cy)). The position is available from October 2020, and recruitment will continue until the position is filled.

Applications must include the job reference number in the subject heading.

**Contact Person:** Prof Thilo Rehren

**Reference Number:** CYI\_APAM\_20\_03

**Opening Date** Tuesday, March 17, 2020

**Closing Date** Friday, May 15, 2020

**Center**

**Status** Open

**Apply to this Job:** <https://jobboard.cyi.ac.cy/?q=node/add/job-application/5159>

Please visit the site: <https://jobboard.cyi.ac.cy/?q=1628978706>

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## *INTERNET SITES*

### **DIVING FOR A SHIPWRECK**

<https://artsandculture.google.com/exhibit/exploring-the-phoenician-shipwreck/pgLyhfUxcvC2IA> are pix of the University of Malta's 2019 exploration of a Phoenician shipwreck off the small harbour of Xlendi, Gozo, Malta.

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***ΝΕΕΣ ΕΚΔΟΣΕΙΣ – NEW PUBLICATIONS***

**HELLENISTIC ASTRONOMY, THE SCIENCE  
IN ITS CONTEXTS SERIES: BRILL'S  
COMPANIONS TO CLASSICAL STUDIES**

Editors: Alan C. Bowen and Francesca Rochberg Hardback

ISBN: 978-90-04-24336-1

€197.00 \$236.00

In *Hellenistic Astronomy: The Science in Its Contexts*, new essays by renowned scholars address questions about what the ancient science of the heavens was in the ancient Near East and Mediterranean worlds, and the numerous contexts in which it was pursued. Together, these essays will enable readers not only to understand the technical accomplishments of this ancient science but also to appreciate their historical significance by locating the questions, challenges, and issues inspiring them in their political, medical, philosophical, literary, and religious contexts.

Please visit the site: <https://brill.com/view/title/22821>

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## **EΙΔΗΣΕΙΣ - NEWS RELEASE**

# **THE SPIRITUAL SECRETS OF ARKALOCHORI CAVE, BY PHIL BUTLER**

“For even as he has brought the Israelites out of Egypt, so has he rescued the Philistines from Caphtor, and Aram from Kir.”

The Arkalochori cave, outside the village of the same name in Heraklion Prefecture, is one of Crete island’s most important archaeological sites. A place of worship since prehistory, the site is most famous for an unusual horde of weapons and votive offerings found there in the early 20th century. Much has been written about these discoveries, but the cave’s contents and their significance seems somehow understated, even lost, in the greater inquiry into who the Minoans were. With this in mind, here’s some free-flowing thought on the matter.

The Arkalochori cave was discovered when locals found Bronze Age weapons there and sold them in Heraklion. Iosif Hatzidakis was the first explorer of the central cave chamber where he discovered masses of bronze votive weapons and silver labrys (double axe). Later weapons discoveries and a now-famous double axe made of silver, prompted archaeologists to probe deeper into the collapsed chamber of the cave.

The archaeologist Spyridon Marinatos took over the Arkalochori site when a child found a golden double axe, which prompted villagers to start plundering the site. Marinatos discovered the side chambers, which had been blocked with debris from the collapse of the cave’s natural roof. In these previously hidden chambers, researchers found hundreds of bronze axes, twenty-five golden ones, seven made of silver ones, and some fantastic bronze long swords from late third millennium BCE to Late Minoan II (ca. 1500 to 1425 BCE).

Dr. Marinatos believed that the cave had been a worship center to a war god (Ariadne/Astarte) since around 2500 BC, in favor of a war god possibly, as most of the votive were weapons. It is also possible that the cave was part of a center for metalworking since pieces of raw copper were found.

One myth about the cave is that this was the actual spot where the goddess Rhea gave birth to Zeus. The idea has merit for the fact that the site is unique for its hand-crafted buildings and its proximity to the main Minoan peak sanctuaries. From the top of Prophet Elias hill, one can see Mt. Kofina and Mt. Juktas. Another interesting coincidence here is the church of Profitis Ilias built atop the hill. While there are many locations in Greece associated with the prophet, the Arkalochori instance seems like a breadcrumb to a larger mystery. If you walk among the ruins of what was her before the current small chapel, you get the sense the site above the cave was more than a shrine.

The aforementioned hill remained sacred through the present because of an association with the prophet Elias. This prophet, some may recall, was a miracle worker who lived in the northern kingdom of Israel during the reign of King Ahab (9th century BC). This association brings into focus other myths about the Minoans and Crete (Keftiu).

According to scriptures, God performed many miracles through Elias, including resurrection (raising the dead). So, the linkages between Keftiu (Caphtor), the Egyptian references to Creta as the “Island of the Dead”, King Minos, and others bear mentioning here.

The biblical story of Elias condemning the worship of the Caananite god Baal is a fascinating connective here. But, the fragmented archaeological evidence from the Late Minoan period (1400 – 1100 BC) seems to link Minoan culture and that of Caanan. At Tel Kabri in Israel, for instance, archaeologists unearthed a palace dated to the 19th-century B.C.E. where Aegean-style wall frescos were found.

The Biblical accounts also seem to link the Minoans (Caphtor) and the Philistines, and some speculate that the last of the Minoans became the Israelites. But, such speculation is far outside the scope of this profile of Arkalochori. The prospects are fascinating and tempting, though. Perhaps we’ll one day find the linkages between Elias (My God is Yahweh), Minoan and Caananite religion, and catastrophes like the one that spelled the end for the Minoans? Elias’ mockery of Zeus and Poseidon during the challenge of Baal in the Hebrew version of the tale...

Fragments from a fresco at the palace at Tel Kabri – Dr. Eric H. Cline

While the connections I presume in between the Minoans and Arkalochori, and the land of Canaan and the prophet Elias are thin, it’s curious how Canaanite religious influences can be seen in Greek mythology, particularly in the tripartite division between the Olympians Zeus, Poseidon, and Hades.

The archaeological finds at Arkalochori are unique. The cave’s proximity to other Minoan sites, particularly the recently discovered Galatas Palace unearthed by the renowned archaeologist Dr. George Rethemiotakis, amplifies the importance of finds. Rethemiotakis has associated the votive objects of the Arkalochori cave with the Galatas palace, which is, in turn, a mysterious and unique find among Minoan sites.

The Arkalochori finds do, in fact, lend credence to the assertions of Rethemiotakis, and Knossos Curator Kostis Christakis. Their paper on the finds at Galatas point to the political, social and ideological power that must have been centered in this region of Crete.

Dr. Rethemiotakis believes that the region surrounding Galatas Palace succumbed to some sort of cataclysm from which the areas past glory never resurfaced. He was of the opinion that the object at the Cave of Arkalochori was hidden there to prevent looters from stealing them.

Perhaps they were religious items from the Galatas palace itself? If you visit the site you might agree the shallow cave resembles more a place to bury and hide something, than a ritual enclave where worship would take place.

The artifacts from Arkalochori remind us of a culture steeped in religion. Minoan Crete was the site of some of the most ambitious building projects in the ancient world, temples aimed at a higher belief system. Interposed onto this spiritual realm of inquiry we find linkages extending to the known world of the time. Take for instance the legendary

archaeologist John Pendlebury's (1939) view was that the Minoans combined their goddesses into a single deity. Could his ideas lead us to the Prophet Elias and the condemnation of Baal and polytheistic worship? Perhaps Zeus and Poseidon, and the animism that cloaked the mighty civilization abandoned the Minoans when Thera erupted? Or, their perception led them to abandon the gods?

Interesting ideas, I hope. For further reading on the Minoans' religion, here's an interesting report at <https://erenow.net/ancient/LifeinBronzeAgeCrete/20.php>.

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Phil Butler is a prolific technology, travel, and news journalist and editor. A former public relations executive, he is an analyst and contributor to key hospitality and travel media, as well as a geopolitical expert for more than a dozen international media outlets.

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Please visit the site: <https://www.argophilia.com/news/the-spiritual-secrets-of-arkalochori-cave/225429/>

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# **THE ODYSSEY OF AN EGYPTIAN CAT SCULPTURE - ANALYSIS OF A BRONZE CAT REVEALS CLUES ABOUT ITS ANCIENT PAST, BY JEFFREY MAISH, JUDITH BARR AND ALMOATZBELLAH ELSHAHAWI**

In ancient times cats were worshipped as gods; they have not forgotten this. — Terry Pratchett

Ancient Egyptians revered cats, and worshiped the goddess Bastet, who could appear in human form with a feline head, or as a cat. Bronze and wood cat statuettes were placed as votive offerings at temples, and some were hollow and held cat mummies, preserving the remains for eternity.

Cat mummies and bones have been found at several sites, but the city of Bubastis, located in the Nile delta, north of Cairo, is known as the cult center for cat worship. Bubastis seems to have been overrun with cats, who were fed and cared for, and buried in the temple precincts when they died. Although cat mummies are found over an extended period, many date to the Ptolemaic Period from 332 to 31 B.C.

Over two thousand years later, Egypt was becoming a center of the nascent field of archaeology. From 1887 to 1889 Swiss archaeologist and Egyptologist Édouard Naville led excavations at Bubastis, also known as Tell Basta. His excavations, which followed years of uncontrolled digging, yielded a wide range of cat representations, from life-sized to small votive bronzes. By the turn of the century, thousands of cat statuettes had flooded museums and the European art market. The demand for these charming feline bronzes reportedly led to a market for forgeries as well.

History Inscribed on the Base of a Bronze Cat For many years, a bronze cat statuette at the Getty Villa was believed to be one of these imitations, and was left alone in storage. But recent discoveries and scientific tests suggest that it is, in fact, ancient.

Discoveries like this often start as clues on the objects themselves. In this case, we found an inscription on the underside of the wooden base that reads:

“Mounted By W.T. Ready, Nov 1892, 55 Rathbone Pl(ace), London W.” A 19th century business directory listed Ready as “a dealer in antiquities, coins, metals and gems.”

In 1892, the Getty’s bronze cat was in Ready’s hands, but why? Was it being restored or reproduced?

To find the answer, we needed to understand a bit more about William Talbot Ready. He came from a family that worked with antiquities. He was the son of Robert Cooper Walpole Ready and brother to Augustus Papworth and Charles Joseph, all involved with antiquities, restoration, and part-time employees at the British Museum.

One of their trades (and sources of income) was in the relatively new technology of electrotyping, a copy process in which a thin metallic layer is deposited on a mold to create a metallic reproduction. The Readys amassed a substantial collection of electrotyped copies of coins and medals for sale. The Getty's collection includes a Greek mirror with a Ready electrotyped attachment.

Sixty years later, J. Paul Getty saw the cat at Spink & Son gallery in London while out with friends, and it became one of the first ancient objects acquired by his newly-formed museum:

“We all admired the bronze Egyptian cat and I bought it for 600 pounds.” Diary of (J. Paul Getty Jan 7, 1955)

Decades later it was classified as an imitation of an Egyptian statue, not as an antiquity. Last year, we began to look at the surface in more detail. It was curiously consistent and did not have the usual mottled corrosion patterns we are used to seeing on ancient bronzes.

It was also too shiny, giving it a modern appearance, and oddly proportioned. Is this what led people to believe it was an imitation or forgery?

### **Dating and Discovery of an Ancient Cat**

Intriguingly, the recessed and slightly hidden surfaces around the base of the statue hinted at something different, something ancient. The cat was x-rayed and found to be an accomplished casting, with few defects.

Metal analysis by portable x-ray fluorescence spectroscopy (pXRF), pointed to bronze, a copper-tin-lead alloy. Further investigation of the metal revealed the alloy was highly leaded (around 18%), consistent with published data on several bronze cat sculptures in European collections including from the Staatliche Museen zu Berlin, Preußischer Kulturbesitz and the Staatliche Sammlung für Ägyptischer Kunst, in Munich.

A radiographically opaque (light) area hinted at something nestled in the head. We decided it was time to remove the wooden base added by Ready in 1892 and to take a closer look inside. What we saw on the interior was a completely different surface of varied topography with corrosion formed over a very long time. In the head, a dark mass was tucked into the cavity, which also pointed to ancient molding and casting.

The sculpture's interior reveals green and white corrosion.

One of the most advanced technical processes from antiquity, lost wax casting, used a clay core over which the wax model was built up and modeled. The thin layer of wax was then reproduced by the bronze cast.

We suspected that this dark material might be a clay containing core material. If so, could it be dated by a process called thermoluminescence? To find out, we sent a sample to a dating laboratory in Oxford England. The material indeed contained clay and could be dated to between 1700 and 2700 years ago. Taken together, the alloy and clay core date point to the cat being an ancient Egyptian work after all.

Style and Past Restorations Led to a Mistaken Identity So what led to the cat's relegation as an imitation? Perhaps one of the main reasons was its style. Ancient Egyptian depictions of the cats ranged from sophisticated to primitive. This cat might be primitive, but a simpler style is not necessarily an indication of forgery. The cat also exhibits unusually deep-set depressions for the eyes. These may have held now-missing inlays.

The surface is dark, fairly even, and shiny, not what we would expect from an ancient bronze. Closer examination, however, revealed some striations, suggesting that the 19th-century restorer may have employed a rather aggressive abrasive treatment to produce an even surface. The surface appearance was further evened by the application of a coating. Today this evenness seems inconsistent with a corroded ancient bronze surface, and thus, somewhat deceiving. We removed a small window of the coating with organic solvents and discovered a more characteristic, corroded surface beneath. The nineteenth-century coating was analyzed and found to be a mixture of beeswax, paraffin wax and an oil.

### **What's next for the Cat?**

Coating removal in the conservation laboratory will continue to reveal the underlying aged surface. Further analysis will focus on the metal and its corrosion products, and the study of characteristic lead isotopes may help locate a production site more precisely (or at least the source of the lead). Additional provenance research may also clarify whether this cat came from Bubastis, and how it traveled to London by 1892.

Perhaps the bronze cat is reclaiming its 2300-year-old identity, moving from one stage of life into the next. A cat may have nine lives—even an ancient one.

Please visit the site: <http://blogs.getty.edu/iris/hello-kitty-the-odyssey-of-an-egyptian-cat-sculpture/> [Go there for pix]

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## **FINE-TUNING RADIOCARBON DATING COULD ‘REWRITE’ ANCIENT EVENTS, BY KATE BLACKWOOD**

Radiocarbon dating, invented in the late 1940s and improved ever since to provide more precise measurements, is the standard method for determining the dates of artifacts in archaeology and other disciplines.

“If it’s organic and old – up to 50,000 years – you date it by radiocarbon,” said Sturt Manning, the Goldwin Smith Professor of Classical Archaeology in the College of Arts and Sciences.

Manning is lead author of a new paper that points out the need for an important new refinement to the technique. The outcomes of his study, published March 18 in *Science Advances*, have relevance for understanding key dates in Mediterranean history and prehistory, including the tomb of Tutankhamen and a controversial but important volcanic eruption on the Greek island of Santorini.

Radiocarbon dating measures the decomposition of carbon-14, an unstable isotope of carbon created by cosmic radiation and found in all organic matter. Cosmic radiation, however, is not constant at all times. To account for fluctuations of cosmic radiation in the Earth’s atmosphere, the radiocarbon content of known-age tree rings was measured backward in time from the 20th century, for thousands of years.

Tree-ring calibrated radiocarbon started to be widely used 50 years ago. A standard calibration curve was introduced in 1986 and is updated every few years as more data are added.

“A single Northern Hemisphere calibration curve has formed the basis of radiocarbon dating in Europe and the Mediterranean for five decades, setting the time frame for prehistory,” Manning and co-authors write. “However, as measurement precision increases, there is mounting evidence for some small but substantive regional (partly growing season) offsets in the same-year radiocarbon levels.”

In their study, Manning and co-authors question the accuracy of a single calibration curve for all of the Northern Hemisphere. Using data collected by only one lab to control for interlaboratory variation, they compared radiocarbon data from northern Europe (Germany) and from the Mediterranean (central Turkey) in the 2nd and 1st millennia B.C. They found that some small but critical periods of variation for Mediterranean radiocarbon levels exist. Data from two other radiocarbon labs on samples from central Italy and northern Turkey then provided consistency.

Growing seasons play a role, the paper says. The radiocarbon level on Earth varies according to the season; there’s a winter low and a summer high, Manning said. The carbon in a tree ring reflects when the tree was photosynthesizing and, therefore, taking carbon out of the atmosphere.

“In northern Europe or in North America, a tree is going to be doing this in April through September. But a tree in Jordan or Israel does that October through April – almost the opposite time of the year,” he said.

These variations, although small, potentially affect calendar dates for prehistory by up to a few decades, the paper concludes.

Even small date offsets – 50 years or less – are important for building the timeline of the Mediterranean region, which, in the last two millennia B.C., was a hotbed of interrelated cultures.

The adjusted dates confirm previously awkward timelines, where radiocarbon and history did not seem to agree for some historical landmarks, including the death and burial of Egyptian pharaoh Tutankhamen, which is dated around the 1320s to 1310s B.C., according to recent Egyptology.

The study also addresses a debate over the date of a massive volcanic eruption on Santorini. This much-studied event is dated around 1500 B.C. by archaeologists but earlier – 1630 to 1600 B.C. – by scientists. Manning said the new findings rule out the date of 1500 B.C., but may also modify the science. A 1630–1600 B.C. date remains possible, but a later date in the range 1600-1550 B.C. now becomes plausible, and even works better with existing archaeological and historical records, including writings from Egypt.

The study also has ramifications for understanding which culture influenced the Minoans and Mycenaeans, which led to ancient Greece.

“Getting the date right will rewrite and get our history correct in terms of what groups were significant in shaping what then became classical civilization,” Manning said. “An accurate timeline is key to our history.”

He predicts follow-up on this study and a future with more specific regional calibration curves within the Northern Hemisphere – as well as subsequent adjustment to historical dates.

This research was funded in part by grants from the National Science Foundation and the Social Science and Humanities Research Council, Canada.

Please visit the site: <https://news.cornell.edu/stories/2020/03/fine-tuning-radiocarbon-dating-could-rewrite-ancient-events> [Go there for pix and caps]

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## **SCIENTISTS USE LAB EQUIPMENT TO REVEAL ANCIENT HIDDEN TEXT, BY MICHELLE TAYLOR**

<https://www.laboratoryequipment.com>

A sample Assyrian page scanned with X-rays showing the never-before-seen under text (green), especially visible in the left margin. ( University of Manchester/SLAC National Accelerator Laboratory)There is more to the Declaration of Independence than "We hold these truths to be self-evident: that all men are created equal."

Further down the parchment, the future Americans list reasons why the king of Great Britain is an unfair and unsuited ruler for America. At one point, Thomas Jefferson wrote, "He has constrained our fellow citizens taken captive on the high seas to bear arms against their country, to become the executioners of their friends & brethren, or to fall themselves by their hands." However, there is a smudge--rather than a cross out, which is common throughout the rest of the document--by the word citizen.

Heritage science researchers recently used a variety of instruments typically found in the laboratory to discover that Jefferson actually wrote fellow "subjects" before smudging the ink to replace the word with "citizens."

"It is a fairly distinctive change given what was happening at the time," said Fenella France, Chief, Preservation Research and Testing Division at the Library of Congress, in an oral session at Pittcon 2020.

France emphasized the multi-disciplinary nature of heritage science research, with collaboration from often disparate fields needed to undertake basic and applied research. In physical, chemical, optical and aging laboratories across the world, researchers rely on hyperspectral and multispectral imaging, FTIR, SEM, particle analysis, XRF, FORS, XRD and more to uncover secrets of the past and enable preservation of our world cultural history.

### **Hidden Medicine for Gladiators**

Galen of Pergamon was a physician, surgeon and philosopher in the Roman Empire from 129 to 210 AD. Tending to gladiators and emperors alike, Galen was one of the most influential physicians of the time, and his views went on to influence Western medical science. One of his many works, "On the Mixtures and Powers of Simple Drugs," was an important pharmaceutical text; however, the 6th-century manuscript was erased and written over with hymns sometime in the 11th century, creating a palimpsest, as it's called.

"The palimpsest's importance lies in the fact that Galen wrote in Greek. His medicine has been influential for over 1,000 years, especially in the Arab world. The question is, 'How did these Arab writings come about? Were they directly translated from Greek, or did they come through Syria, translated through Syriac?' Being able to read the Syriac

translation of Galen's work, we might shed light on how the information was transmitted from the Greek/Roman empire to the rest of the world," said Uwe Bergmann, a distinguished staff scientist at the Stanford PULSE Institute at SLAC, during a session at Pittcon 2020.

To make a palimpsest, ancient peoples used lemon juice, milk or wine to wash out the old writing, cut the parchment in two, rotated it by 90 degrees, and then wrote over it.

"That's why the original text and new text are in different directions on palimpsests," explained Bergmann. "In the case of Galen's work, the original text is vertical and the new text is at a 90-degree angle."

After failed attempts to use multispectral imaging to see the important writing underneath the hymn, Bergmann proposed using XRF, which he had previously leveraged to decipher hidden mathematical theories in a copy of a work by Archimedes.

Using XRF, synchrotron X-rays knock out electrons close to the nuclei of metal atoms, and the holes are filled with outer electrons, resulting in characteristic X-ray fluorescence. However, XRF can be time-consuming and results in an immense amount of data. For example, a single scan of the Galen palimpsest takes about 10 hours and leaves vast amounts of nuanced data, so the researchers turned to machine learning.

William Sellers, an expert in data processing and the director of the University of Manchester's zoology department, designed an algorithm that enhances the XRF signal. Rather than focusing on just one location, Sellers taught his algorithm to recognize different parts of the manuscript--including the undertext, partial text and the overtext--and measure spectra there.

"He trained the images to emphasize what is in this part of the spectra, which is the text," said Bergmann. "Incredibly, after several iterations, the image did enhance."

As shown in the photo to the left, this kind of data mining results in colorized images of the layers of text and parchment, giving scientists a much sharper image to analyze.

While the researchers are still processing the data and results, Bergmann was excited about the doors opened by the possibility of using XRF enhanced by machine learning for future projects.

"Next, we are thinking of going to Google next door to see if we can use non-linear algorithms," he joked.

**Please visit the site:**

<http://www.aina.org/ata/20200313110716.htm#Xm1UXn0QuuY.gmail>

## **ANCIENT AUTOMATONS IN MYTH AND HISTORY, BY ADRIENNE MAYOR**

Who first imagined robots? Most historians believe that automatons were first developed in the Middle Ages. Some philosophers of science claim that it was impossible for anyone in ancient times to imagine technologies beyond what already existed.

Other scholars assume that all animated beings in mythology were inert matter brought to life by gods or magic, like Adam and Eve or Pygmalion's ivory statue. But I wondered, was it possible that the concepts of robots could have been imagined in classical antiquity, long before technology made them possible?

I found descriptions of imaginary automatons as early as Homer, more than 2,500 years ago, in a remarkable group of Greek myths. Robots, synthetic beings, and self-moving devices appear in myths about Odysseus, Jason and the Argonauts, the sorceress Medea, the bronze automaton Talos, and Pandora. The stories envisioned ways of replicating nature by a process of bio-techne, "life through craft."

These beings were not simply inert matter brought to life by magic or a god's command. Ancient poets describe the artificial entities as "made, not born," to emphasize their technological, non-biological origins.

So, thousands of years before medieval and early modern machines-and centuries before innovations of the Hellenistic era (fourth century to first century BCE) produced real self-moving devices-ideas about creating artificial life were being explored in imaginative thought experiments, set in an alternate world where technology was marvelously advanced. My book, *Gods and Robots: Myths, Machines, and Ancient Dreams of Technology*, delves into the earliest expressions of the desire to create artificial life, from the age of mythology to proliferation of real automatons in Alexandria, Egypt.

According to Homer's *Iliad*, Hephaestus, the god of invention and technology, made a host of automated devices. Examples include gates that automatically opened and closed for the gods' chariots, "smart" bellows for his forge, a choir of singing statues, gold and silver animated watchdogs, driverless delivery carts to serve ambrosia at celestial banquets, and a staff of Golden Maidens as his assistants.

These female androids, says Homer, "looked just like real women" and moved on their own, with "reason and mind." Moreover, they were endowed with "all the knowledge of the gods," essentially an ancient version of Artificial Intelligence.

The bronze guardian Talos was charged with defending King Minos's kingdom of Crete. "Programmed" to spot strangers and hurl boulders to sink ships, the killer robot could also heat his body and roast people by hugging them to his chest. We even have the details of his inner workings: an artery ran from his head to his foot and in this conduit pulsed his power source, ichor, the life force of the immortal gods. The "vivisystem" was sealed with a bronze bolt on his ankle.

The story of Talos is best known from the Argonautica, the epic saga of Jason and the Argonauts, who almost became the robot's victims.

Luckily, the sorceress Medea figured out how to destroy Talos with a combination of persuasion and technology. She convinced Talos that she could make him immortal, but only if he allowed Jason to remove the bolt on his ankle. Talos agreed. When Jason removed the bolt, ichor flowed out like "molten lead" and Talos's "life" ebbed away. Scenes of Jason using a tool to remove the bolt appear on fifth century BCE vase paintings and vase painters humanized the bronze giant in their illustrations of his demise.

Drawing on metallurgy technology of the Bronze Age, classicist A. B. Cook proposed an intriguing theory for the distinctive physiology of Talos. In lost-wax casting, bronze statues were made with interior tubes of wax from head to toe. During casting at great heat, the melted wax flowed out at the feet. Notably, the myth described the tube in Talos with the ancient medical term for "vein." In antiquity, the vein on the ankle was used for bloodletting.

The imaginary integration of living and non-living components, melding biology with metallurgical "mechanics," makes Talos into a kind of cyborg. The myth also asks whether automatons could have emotions or agency, questions we ponder today about AI robotics.

Medea was portrayed as a kind of techno-wizard in myths. She also helped Jason overcome the deadly pair of fire-breathing bronze bulls, owned by King Aetes, who tried to thwart Jason's Quest for the Golden Fleece. Like Talos, the brazen bulls were forged by Hephaestus.

Hephaestus's hallmark automaton was fabricated for Zeus. To take revenge on humankind for accepting the gift of fire stolen by Prometheus, Zeus commanded Hephaestus to make a trap, "evil disguised as beauty," in the form of a seductive young woman called Pandora. She was to be sent to earth on a mission: to open a sealed jar filled with suffering to plague humans for eternity. In the original myth, written down by Hesiod (ca. 750-650 BCE), Pandora was a product of technology designed to Zeus's specifications. On vase paintings of Pandora being prepared for her assignment on earth, she is shown standing stiffly like a statue with an uncanny smile.

Hermes, Zeus's messenger, presented Pandora as a bride to Epimetheus. Dazzled by her beauty, he ignored the warnings of Prometheus, not to accept Zeus's "gift." Only later did Epimetheus realize his error.

Today many compare Artificial Intelligence to "Pandora's box," but the myth turns out to be even more relevant than anyone realizes. In ancient Greek, the name Prometheus means "foresight" while Epimetheus means "hindsight." In the face of advancing "black box" technology, we need more Prometheans to look ahead and restrain over-optimistic Epimetheans enchanted by short-term gains.

In the Greek myths, automatons are typically deployed by those in power, either Zeus or kings. Such things are benign and labor-saving when used by the gods in the heavens, but they can be dangerous and destructive on the human plane. In this, the myths presage modern concerns that technology might favor tyranny.

There is, however, one mythic example of a benevolent self-moving AI device, in Homer’s Odyssey. Odysseus has been away from his native island for twenty years. Visiting the Phaeacians, a mysteriously advanced society ruled by King Alcinous, Odysseus expresses his longing to return home. The king describes his miraculous fleet of ships that need no human pilots or rowers—they are navigated by thought alone. “Just give the name of your destination,” he tells Odysseus, “and the ship will deliver you there.” The ships themselves “understand what we are thinking about and want,” explains Alcinous, “They know all the cities and countries in the world and traverse the sea unaffected by storms or fog.” Odysseus accepts the king’s offer and marvels at the speed of the autonomous ship. With access to vast archives of maps and navigational charts, the Phaeacian ships bring to mind modern GPS and automatic navigation systems.

The ancient myths resemble science fiction tales, envisioning what wonders of technology one might achieve if only one possessed the powers and ingenuity of the gods. In historical times, animated devices were actually built beginning in the fourth century BCE, in the great center of imagination and invention, Alexandria. Ctesibius, Philo, Heron, and other brilliant engineers designed lifelike servants that poured wine, singing birds, moving figures of dragons and serpents, autonomous theaters, and colossal animated statues.

Gods and Robots focuses on mythology and historical inventions in the Greek-influenced world. But the Greeks were not unique in imagining and constructing self-moving devices and animated machines. Stories about artificial life from other ancient cultures show similar ingenuity and innovations. For example, ships powered by automaton rowers appear in Egyptian texts; android and animal automatons are described in Chinese chronicles; and flying chariots and synthetic swans, animated servants, giant robots, and machines appear in the Indian epics Mahabharata and Ramayana. Taken together, all these ancient dreams of technology reveal the timeless links between imagination and science.

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**Please visit the site: <http://www.asor.org/onetoday/2020/03/ancient-automatons> [Go there for pix and nice format]**

## **COSMIC IMPACT AT ABU HUREYRA?**

Researchers find evidence of a cosmic impact that caused destruction of one of the world's earliest human settlements by Sonia Fernandez, University of California - Santa Barbara

Before the Taqba Dam impounded the Euphrates River in northern Syria in the 1970s, an archaeological site named Abu Hureyra bore witness to the moment ancient nomadic people first settled down and started cultivating crops. A large mound marks the settlement, which now lies under Lake Assad.

But before the lake formed, archaeologists were able to carefully extract and describe much material, including parts of houses, food and tools—an abundance of evidence that allowed them to identify the transition to agriculture nearly 12,800 years ago. It was one of the most significant events in our Earth's cultural and environmental history.

Abu Hureyra, it turns out, has another story to tell. Found among the cereals and grains and splashed on early building material and animal bones was meltglass, some features of which suggest it was formed at extremely high temperatures—far higher than what humans could achieve at the time—or that could be attributed to fire, lightning or volcanism.

"To help with perspective, such high temperatures would completely melt an automobile in less than a minute," said James Kennett, a UC Santa Barbara emeritus professor of geology. Such intensity, he added, could only have resulted from an extremely violent, high-energy, high-velocity phenomenon, something on the order of a cosmic impact.

Based on materials collected before the site was flooded, Kennett and his colleagues contend Abu Hureyra is the first site to document the direct effects of a fragmented comet on a human settlement. These fragments are all part of the same comet that likely slammed into Earth and exploded in the atmosphere at the end of the Pleistocene epoch, according to Kennett. This impact contributed to the extinction of most large animals, including mammoths, and American horses and camels; the disappearance of the North American Clovis culture; and to the abrupt onset of the end-glacial Younger Dryas cooling episode.

The team's findings are highlighted in a paper published in the Nature journal Scientific Reports.

"Our new discoveries represent much more powerful evidence for very high temperatures that could only be associated with a cosmic impact," said Kennett, who with his colleagues first reported evidence of such an event in the region in 2012.

Abu Hureyra lies at the easternmost sector of what is known as the Younger Dryas Boundary (YDB) strewnfield, which encompasses about 30 other sites in the Americas, Europe and parts of the Middle East.

These sites hold evidence of massive burning, including a widespread carbon-rich "black mat" layer that contains millions of nanodiamonds, high concentrations of platinum and



tiny metallic spherules formed at very high temperatures. The YDB impact hypothesis has gained more traction in recent years because of many new discoveries, including a very young impact crater beneath the Hiawatha Glacier of the Greenland ice sheet, and high-temperature meltglass and other similar evidence at an archaeological site in Pilauco, located in southern Chile.

"The Abu Hureyra village would have been abruptly destroyed," Kennett said. Unlike the evidence from Pilauco, which was limited to human butchering of large animals up to but not younger than the YDB impact burn layer, Abu Hureyra shows direct evidence of the disaster on this early human settlement. An impact or an airburst must have occurred sufficiently close to send massive heat and molten glass over the entire early village, Kennett noted.

The glass was analyzed for geochemical composition, shape, structure, formation temperature, magnetic characteristics and water content.

Results from the analysis showed that it formed at very high temperatures and included minerals rich in chromium, iron, nickel, sulfides, titanium and even platinum- and iridium-rich melted iron—all of which formed in temperatures higher than 2200 degrees Celsius.

"The critical materials are extremely rare under normal temperatures, but are commonly found during impact events," Kennett said. According to the study, the meltglass was formed "from the nearly instantaneous melting and vaporization of regional biomass, soils and floodplain deposits, followed by instantaneous cooling." Additionally, because the materials found are consistent with those found in the YDB layers at the other sites across the world, it's likely that they resulted from a fragmented comet, as opposed to impacts caused by individual comets or asteroids.

"A single major asteroid impact would not have caused such widely scattered materials like those discovered at Abu Hureyra," Kennett said. "The largest cometary debris clusters are proposed to be capable of causing thousands of airbursts within a span of minutes across one entire hemisphere of Earth. The YDB hypothesis proposed this mechanism to account for the widely dispersed coeval materials across more than 14,000 kilometers of the Northern and Southern Hemispheres. Our Abu Hureyra discoveries strongly support a major impact event from such a fragmented comet."

**Please visit the site: <https://phys.org/news/2020-03-evidence-cosmic-impact-destruction-world.html> [Go there for maps]**

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# **A WEEK IN THE LIFE OF THE MOUSTERIAN HUNTER,** **BY GONEN SHARON AND MAYA ORON**

## **Introduction**

During the Middle Paleolithic in the Levant (250-45000 years before present – BP) Mousterian hunters were regularly hunting large game. Yet, our knowledge of their hunting practices, tools and even the location of hunting itself is lacking. Most Levantine Middle Paleolithic (MP) sites document a large variety of activities executed at the same place for a long time. But can we take a snapshot of just few days?

Eight seasons of excavation at the Late Middle Paleolithic (MP) site of Nahal Mahanayem Outlet (NMO) exposed a short-term, open-air hunting camp on the east bank of the Jordan River in the Upper Jordan Rift Valley. The primary data for this period, the final twenty thousand years of human occupation prior to the emergence of the Upper Paleolithic industries at ca. 50,000 years before present (YBP), was retrieved from the famous, multi-layered cave sites of the Levant.

The common features of these cave sites are their high intensity of occupation. Archaeological horizons at cave sites each represent considerable time and document a large variety of tasks and activities. Cave site layers are also subject to complex post-depositional processes. They provide a wealth of information but have a relatively low resolution of observation. In contrast, the site of NMO yielded information at a uniquely high resolution, enabling us to explore questions that rarely can be asked for Late MP sites in the Levant. It is a snapshot of a short episode in the life of Middle Paleolithic hunters.

The site of NMO was discovered on the east bank of the Jordan River opposite of the the Mahanayem Stream outlet to the Jordan, ca. 1.8 kilometers north of the Benot Ya' aqov Bridge, as a result of a drainage operation that took place during the winter of 1999.

Stratigraphic, sedimentological and archaeological evidence suggest that the people who occupied NMO found a basalt hill standing some 2 to 2.5 meters above the surrounding landscape, probably on the shore of the Paleo-Hula Lake spreading at the time further south than the historical Hula Lake. The foot of the basalt hill was later covered by fine, silty, dark mud. This mud accumulated rapidly on the bank of the shallow, low energy water body. Between the basalt and the dark mud is the archaeologically layer -Layer 4, comprised of flint tools, animal bones and botanical remains, forming a layer up to 40 cm thick. The layer is OSL (Optically-Stimulated Luminescence) dated to ca. 60,000 Years BP.

The data from Layer 4 suggests that it represents a short-term event or, more precisely, a series of two or more short visits to this favorable location. The fauna of the site is rich and includes animals ranging in size from rhinoceros to crabs and birds. The primary animal excavated at the site is the giant aurochs (*Bos primagenius*), weighing over 1000 kilograms.

Stone tools are found in immediate proximity to the bones, sometimes touching each other, and cut and hack marks are clearly evident on many of the bones. It is interesting to note that many of the large bones were unearthed complete. This is very different from any other MP site in the Levant where bones typically were found heavily fragmented due to human activity.

Probably the most significant characteristic of the NMO flint tool assemblage is its small size. After eight seasons of excavation at the almost 50 square meters of Area D, we have fewer than 1500 flint artifacts excavated in situ. This is an extremely low density, far below any other MP site in the Levant.

**The other unique characteristic of the assemblage is its composition.**

The percentage of tools within the assemblage is very high, currently about 30%, and it is dominated by cutting tools and pointed elements, many of them of high quality flint. Moreover, the NMO assemblage is unique not only for its frequency of cutting tools and pointed elements, but also for the absence of other tool types typically present in significant numbers in such assemblages. There are very few scrapers, and the same is true for other tool types such as burins, awls, and end scrapers. Refitting of flint elements from NMO allowed us to reconstruct some of the knapping sequences that took place at the site and shed light on the “flint economy” of the Mousterian hunting bands. This unique assemblage resulted from the selection of tools by the site’s inhabitants. The primary task that took place was the butchering of large, hunted game. Pointed elements and cutting tools, the tools dominating the assemblage, were brought into the site for this purpose in addition to chunks of raw material that were knapped on site in a simple but highly efficient reduction sequence.

The type of the humans occupying NMO is unknown. It has been widely accepted that Neanderthals were the dominant species during the final MP in the Levant, but recent data from the Manot Cave suggest the coexistence with anatomically modern humans in the region. The debate over the presence of Neanderthals in the Levant is the topic for another paper. Our analysis shows that the material culture of the NMO people is typically Middle Paleolithic. Yet, its features are modern, if you like, representing a significant advance.

NMO is interpreted as a hunting locality where a group butchered giant cattle. The ability of Late MP Levantine groups to hunt large game is well established. Yet the enormous size of the aurochs that were hunted calls for appreciation of the skills of the NMO hunters.

Their actual hunting gear is unknown. Yet the very high percentage of pointed elements enables us to suggest a reconstruction of the hunters’ tool arsenal.

We do not know how frequently Mousterians hunted large game, the size of their hunting party, or their hunting practices. The presence of many additional species of animals in the NMO layers, including deer, gazelle, wild boar and even carnivores, such as the skull and femur of a lion (*Panthera Leo*), suggest that we are looking at complex hunting behavior.

**Conclusion**

Eight seasons of excavation at the open-air Mousterian site of NMO unearthed a short-term, task-specific, low occupation intensity hunting locality. The evidence suggests advanced hunting behavior of the groups of hunters with excellent knowledge of their environment.

They had sophisticated planning, hunting and butchering skills, and they possessed lithic technology that was previously attributed only to later Upper Paleolithic knappers. The NMO hunters carried with them only the tools needed for their specific tasks, enabling us to reconstruct the tool arsenal of the Mousterian hunter.

Whether NMO was occupied by Neanderthals or by anatomically modern humans in the Levant is debatable. But the NMO data help define and understand the behavior and abilities of the final Mousterian groups at the brink of the emergence of modern people in the Levant.

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Gonen Sharon is Associate Professor at Tel Hai College. Maya Oron is a PhD candidate at the Institute of Archaeology, The Hebrew University of Jerusalem and an Archeologist at the Israel Antiquity Authority.

For further reading:

Sharon, G., 2018. A Week in the Life of the Mousterian Hunter. In: Akazawa, T., Nishiaki, Y. (Eds.), *The Middle and Upper Paleolithic Archeology of the Levant and Beyond*. Singapore: Springer, 35–47.

Sharon, G., Oron, M. 2014. The lithic tool arsenal of a Mousterian hunter. *Quaternary International* 331: 167–185.

Sharon, G., Grosman, L., Fluck, H., Melamed, Y., Rak, Y., Rabinovich, R., Oron, M. 2008. The first two excavation seasons at NMO: a Mousterian site at the bank of the Jordan River. *Eurasian Prehistory* 7: 129–151.

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Please visit the site: <http://www.asor.org/onetoday/2020/03/mousterian-hunter>

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## **HUMANS DOMESTICATED HORSES – NEW TECH COULD HELP ARCHAEOLOGISTS FIGURE OUT WHERE AND WHEN**

In the increasingly urbanized world, few people still ride horses for reasons beyond sport or leisure.

However, on horseback, people, goods and ideas moved across vast distances, shaping the power structures and social systems of the premechanized era. From the trade routes of the Silk Road or the great Mongol Empire to the equestrian nations of the American Great Plains, horses were the engines of the ancient world.

### **Where, when and how did humans first domesticate horses?**

Tracing the origins of horse domestication in the prehistoric era has proven to be an exceedingly difficult task. Horses – and the people who care for them – tend to live in remote, dry or cold grassland regions, moving often and leaving only ephemeral marks in the archaeological record. In the steppes, pampas and plains of the world, historic records are often ambiguous or absent, archaeological sites are poorly investigated and research is published in a variety of languages.

At the heart of the issue is a more basic struggle: How can you distinguish a “domestic” animal from its wild cousin? What does it even mean to be “domesticated”? And can scientists trace this process in archaeological sites that are thousands of years old and often consist of nothing more than piles of discarded bones?

As an archaeozoologist, I work in a field that seeks to develop ways to do just this – and with the aid of new technologies, recent research is turning up some surprising answers.

### **Looking for traces of domestication**

Analyzing horse bones from archaeological sites across Eurasia, 20th-century scholars argued over whether changes in the size and shape of horse bones might reflect the impacts of human control. They debated whether management of a domestic herd would leave recognizable patterns in the ages and sex of horses in the archaeological record.

Without agreed-upon criteria for how to recognize horse domestication in the archaeological record, a staggering range of different ideas emerged.

In nearly every corner of the world with grassland ecosystems and wild horses, various researchers hypothesized domestication began in Anatolia, Iberia, China and even North America. Some more outlandish models suggested an origin for horse domestication as far back as the last Ice Age, about 20,000 years ago.

Toward the end of the 20th century, a key breakthrough in the debate came when researchers recognized that the use of bridle mouthpieces, known as a “bit,” can cause unique damage to the teeth of a horse, known as “bit wear.”

Still the complicated nature of archaeological data has made the search for horse domestication a process of trial and error. For example, one famous horse with bit wear, from the site of Derievka in Ukraine, seemed to place horse domestication in Eastern Europe as early as around 4000 B.C. – until scientific dating showed that this animal lived around 600 B.C.

### **Evidence from Kazakhstan**

In the late 2000s, a proliferation of scientific research seemed to narrow the field to a single, compelling answer for the first domestication of the horse.

Researchers zeroed in on a site called Botai, in northern Kazakhstan, dating back to around 5,500 years ago. Nearly 100% of the animal bones they identified there were from horses. These animals were butchered and eaten, and their bones were used to make a variety of tools. Some were buried in ritual pits.

Initially, skeptics argued that the age and sex patterns of Botai horses were inconsistent with a domestic herd. Pastoral management involves culling young, mostly male animals, and far too many of these remains were from adults and females.

However, individual teeth found at Botai showed apparent bit wear. And, in a dramatic discovery made in 2009, a new technique that analyzes ancient fat residues suggested that the ceramic vessels recovered at Botai once contained horse milk products. If true, that finding would indicate humans had raised and cared for the horses that produced it.

This new biomolecular evidence appeared to place horse domestication deep into the past, around 3500 B.C. To some, if people were eating and milking horses, logic dictated that they must have also ridden them.

Many researchers took this thinking a step further, using this early timeline to argue that horse domestication kicked off the continent-wide dispersal of Indo-European peoples and language groups around five or six thousand years ago.

### **Newer techniques cast doubt on Botai**

As the 2020s begin, the pace of technological innovation in archaeology continues to accelerate. And new archaeological data have begun to trickle in from understudied areas.

With improving methods, new information has triggered serious doubts about the Botai/Indo-European model about domestication.

In a shocking 2018 study, a French research team revealed that the horses of Botai were in fact not the domestic horse (*Equus caballus*) at all, but instead *Equus przewalskii* – the Przewalski's horse, a wild animal with no documented evidence of management by human societies.

Another project using ancient DNA analysis of human remains from Botai showed no genetic links between the area's ancient residents and Indo-European groups,

undermining the idea that horse domestication at Botai stimulated a continental dispersal on horseback.

In the ensuing chaos, researchers must now find a way to piece together the horse's story, and find an explanation that fits these new facts.

Some, including the equine DNA researchers who published the new discoveries, now suggest that Botai represents a separate, failed domestication event of Przewalski's horse.

Other scholars now seek to reevaluate the archaeological and historical records around the horse's initial domestication with a more skeptical eye.

As of the writing of this story, the oldest clearly identified remains of the modern domestic horse, *Equus caballus*, date back only as far as about 2000 B.C. – to the chariot burials of Russia and Central Asia.

From here, researchers are scrambling backwards in time, seeking to find the “big bang” of the human-horse relationship.

### **No clear answers, but a path forward**

New data from places typically left out of the conversation, such as Mongolia, may help fill the holes in the story of horse domestication.

My colleagues and I, led by Shevan Wilkin, recently recovered ancient proteins from the teeth of Mongolia's ancient herders that suggest these pastoralists who lived around 3000 B.C. drank the milk of cattle or sheep or goats – with no evidence they drank milk from horses.

In fact, much of Central Asia may not have had domestic horses at all until well after 2000 B.C. Another recent study suggests the late second millennium B.C. saw a spike in the frequency of domestic horses across the continent – perhaps because the innovation of horseback riding occurred much later than researchers had commonly assumed.

The urgent question now becomes: Where did the first ancestors of the modern domestic horse first find themselves under human care? And what does this tell researchers about the rest of human history that followed?

In the decades to come, the story of humans and horses is likely to be dramatically rewritten – maybe more than once.

Archaeologists must continue to use cutting-edge technology, constantly reevaluating old conclusions developed with earlier techniques. DNA and biomolecular data must be paired with other kinds of information, such as skeletal clues, that can tell us how horses were bridled, exerted or cared for. That can help to distinguish wild horses from early domestic horses managed by humans.

Species identifications from archaeological sites must be made using DNA rather than assumed (as at Botai) – and each specimen must be directly radiocarbon dated to determine its age, rather than lumped in with other similar objects and dated through guesswork (as at Derievka).

Most importantly, archaeologists must continue to dive deeper into the archaeological record of the desert and grassland regions of the Old World – Eastern Europe, Russia, Central Asia, Mongolia and elsewhere – where the secrets of the past have not yet all been brought to light.

Please visit the site: <https://www.heritagedaily.com/2020/03/humans-domesticated-horses-new-tech-could-help-archaeologists-figure-out-where-and-when/126037>

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## **VOLUBILIS ARCHAEOLOGICAL SITE**

Mosaics, storks, and brothels—this ancient city has it all.

Built in and occupied since the third century BC, Volubilis had seen its share of residents—Phoenicians, Carthaginians, and Romans—before being taken back by the locals by 285.

The city remained occupied by Latin Christians, then Muslims, then the Idrisid Dynasty, the founders of modern Morocco. In the 11th century, it was abandoned when the seat of power moved to Fez, and the city's stones were looted for the building of Meknes after a powerful earthquake in the 18th century.

Under French occupation, excavation identified the site officially as the Roman city of Volubilis. The excavations revealed glorious mosaic floors, temples, a basilica, aqueduct, baths, gates, and—as in every good old town—brothels.

Besides the usual Berber men selling postcards and “authentic” Roman coins, the city is now occupied by a new kind of resident: storks.

What better place for these large birds to build their bulky nests than atop a Roman column? The smooth sides protect them from any land animal and their size and paternal protectiveness protect them from above. Storks can be seen throughout Morocco, nesting atop monuments.

In 1997, the city of Volubilis was designated a UNESCO World Heritage Site. A quick pit stop there is usually part of a tour package, on the road from Meknes to Fes.

**Please visit the site: <https://www.atlasobscura.com/places/volubilis-archaeological-site>**

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## **STUDENT DISCOVERS 5,000-YEAR-OLD SWORD HIDDEN IN VENETIAN MONASTERY, BY TOM METCALFE**

It's one of the oldest swords ever found.

A keen-eyed archaeology student made the find of a lifetime when she spotted one of the oldest swords on record, mistakenly grouped with medieval artifacts in a secluded Italian museum.

The ancient sword was thought to be medieval in origin and maybe a few hundred years old at most — but studies have shown that it dates back about 5,000 years, to what is now eastern Turkey, where swords are thought to have been invented, in the early Bronze Age.

The weapon was spotted in November 2017 by Vittoria Dall'Armellina, who was then a doctoral student in archaeology at Ca' Foscari University of Venice. She had made a day trip to the monastery on San Lazzaro degli Armeni, a tiny island on the edge of the Venetian lagoon.

The visit had nothing to do with her studies, and she'd never been there before. "It was a pleasure trip," Dall'Armellina told Live Science in an email.

When she spotted the sword among the medieval artifacts on display in the monastery's small museum, Dall'Armellina was sure she'd seen its distinctive shape before, she said. She'd written her master's thesis on social status in the early Bronze Age, and her studies had included high-status grave goods, such as ancient weapons.

"I thought that I knew that type of sword and that I was certain it was contemporary with those of Arslantepe and Sivas," she said, referring to swords from the east of Anatolia, now eastern Turkey, which date to about 3000 B.C. and are thought to be the oldest in the world.

### **Gift from Armenia**

Dall'Armellina and scientists from Ca' Foscari University set out to find out more about the mysterious sword.

They contacted the monastery at San Lazzaro degli Armeni, which has been a center for the Mekhitarist congregation of Armenian Catholic monks since 1717.

Research into the monastery's archives by Father Serafino Jamourlian revealed that the sword had been sent in a donation of gifts from an Armenian art collector named Yervant Khorasandjian, to a monk named Ghevond Alishan, known as Father Leonzio, about 150 years ago.

Alishan was a famous poet and writer who was a friend of the famed English art critic John Ruskin; Alishan died in 1901, and his belongings passed on to his monastery.

According to a document that accompanied the donation, handwritten in Armenian and dating from the second half of the 19th century, the sword was found at Kavak, a settlement near the ancient Greek colony of Trebizond on the Black Sea coast now Trabzon in eastern Turkey.

After Alishan's death, the sword found its way into the monastery's museum, where it was eventually placed in a cabinet of medieval artifacts.

It's taken more than two years of detailed study, including metallurgical research, to verify that both the construction and composition of the sword are similar to those of the ancient swords found in eastern Turkey. In the meantime, Dall'Armellina has now completed her archaeology doctorate.

### **Before bronze**

One of the surprises is that the weapon is made of arsenical copper, an alloy of copper and arsenic used about 5,000 years ago, before true bronze was invented by alloying copper and tin.

"I was pretty sure of the antiquity of the sword," Dall'Armellina said. But "when the results of the analysis revealed that the material was arsenical copper, it was a great satisfaction."

The style of construction of the sword, known as its typology, and its metallic composition indicate that the artifact dates from an early stage of the Bronze Age.

The researchers also found that the sword was constructed in a similar way to that of the twin swords found at the ancient palace at Arslantepe, an archaeological site in eastern Turkey. Those have been firmly dated to about 5,000 years ago, according to a statement by the university.

Archaeologists think swords were invented in that region, and the sword from San Lazzaro degli Armeni is now thought to be an early example — perhaps even the oldest.

Similar ancient swords have been found in eastern Anatolia, while a different style of sword from the same period has been found in barrow graves, known as kurgans, in the adjoining northern Caucasus region, Ca' Foscari University archaeologist Elena Rova told Live Science.

"It seems that in this area, between the northern Caucasus and eastern Anatolia, the sword was invented, and there were at least two typological variants," Rova said.

"Local chiefs were buried with a lot of weapons and other precious objects," she said. "They probably wanted to emphasize their status as warriors, and the sword was one of the symbols."

Please visit the site: [https://www.livescience.com/ancient-anatolian-sword-in-venetian-monastery.html?fbclid=IwAR3mlkKHpQ8Zt7zC9KjQPft3Vdftt\\_mliNbyE-GZxrxq-QAU9XwJIhAje18](https://www.livescience.com/ancient-anatolian-sword-in-venetian-monastery.html?fbclid=IwAR3mlkKHpQ8Zt7zC9KjQPft3Vdftt_mliNbyE-GZxrxq-QAU9XwJIhAje18)

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