The Department of Archaeology
Bilkent University

ARCHAEOLOGY CLUB
BILKENT UNIVERSITY

BILKENT UNIVERSITY
FACULTY OF HUMANITIES AND LETTERS
DEPARTMENT OF ARCHAEOLOGY

#7 BILKENT ARCHAEOLOGY DAYS

FROM SEEDS TO COLLAPSE:
DISCOVER ANCIENT CRISES THROUGH ANCIENT ENVIRONMENT

FRIDAY 10 APRIL 2026
LIBRARY, ART ROOM

Morning Session

09.30-10.00 Opening Speeches

10.00-10.30 Sullivan Heywood (University of Queensland/ANAMED)
Resilience or Collapse? Archaeobotanical Evidence from Kaman-Kalehöyük during the 4.2 ka Event

10.30-11.00 Ebru Gizem Ayten (Middle East Technical University)
Tracing Environmental Stress through Animal Bones: A Zooarchaeological Perspective on Past Crises

11.00-11.30 Coffee Break

11.30-12.00 Benjamin Irvine (Bilkent University)
What's Going on, What's all This Shouting We'll Have No Global Catastrophe Here. This is a Local Crisis, for Local People

12.00-12.30 Esra Ergin Erdoğmuş (İstanbul Technical University)
Vegetation Reconstruction Modelling and Human Environmental Impact during the Holocene in Southern Turkey

12.30-13.00 Ebrar Sinmez (Middle East Technical University)
Investigating the Impacts of 4.2 ka and 3.2 ka BP Climatic Events on Wheat and Barley Cultivation in the Bronze Age Kingdom of Mukish: Evidence from Tell Atchana and Toprakhisar Höyük (Hatay, Türkiye)

13.00-14.30 Lunch Break

Afternoon Session

14.30-14.50 Mervenur Sevil Kandemir (Koç University)
Application of Proteomics Techniques in Environmental Archaeology

14.50-15.10 Volga Zengin (Bilkent University)
Applications of Epigenetics in Methylome Inferred Environmental Archaeology

15.10-15.40 Coffee Break

15.40-16.00 Busenaz Telci (Ankara University)
Soil Salinization : The Case of Sumer

16.10- Closing

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2026 Bilkent Archaeology Day Abstracts

Sullivan Heywood

"Resilience or Collapse? Archaeobotanical Evidence from Kaman-Kalehöyük during the 4.2 ka Event"

The grand narrative of societal ‘collapse’ as a result of acute climatic change is a compelling topic that has driven both academic and popular discourse, often stimulating significant critical engagement and hypothesis testing within archaeology. Accordingly, archaeobotany has arisen as a key proxy used for understanding past environmental conditions and resource production, but also societal resilience in the face of external pressure. The Mid-Late Holocene transition marked by the 4.2 ka climatic event, has attracted such discourse and is often described as a period of severe multi-centennial drought and rapid climatic oscillation. In the archaeological record, significant agricultural disruption corresponding with settlement and socio-political contraction is noted across western Asia. Until recently Central Anatolia has remained quiescent in our understanding of this period and large-scale archaeobotanical datasets have been missing or unrepresentative. This presentation will explore collapse narratives surrounding the 4.2ka event and present a case study using novel high-resolution archaeobotanical data from the site of Kaman-Kalehöyük to assess evidence of settlement resilience during the period.

Ebru Gizem AYTEN, PhD

Tracing Environmental Stress through Animal Bones: A Zooarchaeological Perspective on Past Crises Understanding past environmental crises is essential for contextualizing present-day ecological challenges, and archaeology provides a unique long-term perspective on human environment interactions. Zooarchaeology, the study of animal remains from

archaeological contexts, offers critical insights into how past societies responded to environmental stress through changes in animal exploitation, management strategies, and dietary practices.

This presentation introduces the theoretical and methodological foundations of zooarchaeology and explores its potential for identifying environmental crises in the archaeological record. Faunal assemblages preserve multiple lines of evidence, including taxonomic composition, age-at-death profiles, biometric variation, and butchery patterns, all of which can reflect shifts in subsistence strategies under changing environmental conditions. For instance, increased reliance on resilient species, changes in herd management, or evidence of nutritional stress may indicate periods of ecological instability.

In addition, biomolecular approaches such as stable isotope analysis ($\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$) provide direct proxies for reconstructing past environments, including vegetation patterns, water availability, and climatic fluctuations. When combined with zooarchaeological data, these methods enable a more nuanced understanding of how environmental pressures influenced both animal and human behavior.

Dr. Benjamin Irvine

What's going on, what's all this shouting we'll have no global catastrophe here. This is a local crisis, for local people

What is a crisis? How do we define a crisis with regards to its aetiology and its scale (both temporally and geographically)? What is the effect, and scale of effect, of a crisis on people in the past and their ways of life – their economy, agriculture, subsistence practices, society, their exposure to violence, and perhaps, required migration?

The answers to these questions are both varied and multiple. One such cause of crises in the past, and the present, is related to climatic and environmental factors. Changes in the climate and environment, whether natural or anthropogenic, have been argued to have resulted in the alteration of peoples' ways of life in the past – ranging from an adjustment and modification of what they were previously doing, to full blown catastrophe and collapse. This has been at the societal, population, and settlement level, as well as at micro- and macro-regional scales.

To examine these further, this talk will use stable isotopic and bioarchaeological data to see how crises, or potential crises in the past, can be witnessed and studied through these scientific methodologies. In particular, it will focus on two case studies: western Anatolia around the time of the infamous 4.2 kya rapid climate change event, and a distinct violent episode at the late 3rd millennium site of Titriş Höyük.

Esra Ergin Erdoğmuş

"Vegetation Reconstruction Modelling and Human Environmental Impact during the Holocene in Southern Turkey." My PhD research focused on vegetation reconstruction using modelling approaches based on fossil pollen records covering the last ten thousand years. In this context, I would be happy to give a presentation on how our modelling results contribute to understanding past environmental change and human–environment interactions in southwestern Turkey.

Ebrar Sinmez

Investigating the Impacts of 4.2 ka and 3.2 ka BP Climatic Events on Wheat and Barley Cultivation in the Bronze Age Kingdom of Mukish: Evidence from Tell Atchana and Toprakhisar Höyük (Hatay, Türkiye)

Major Late Holocene climatic anomalies, particularly the 4.2 ka and 3.2 ka BP events, are often associated with environmental stress and societal disruption in the ancient Near East. Whether these climatic episodes directly affected agricultural practices at the local level, however, remains an open question. Archaeobotanical evidence from the Bronze Age Kingdom of Mukish provides an opportunity to explore how farming communities responded to changing environmental conditions. This research evaluates wheat and barley remains recovered from two sites in the Amuq Plain of southern Türkiye: Tell Atchana (Alalakh), the regional capital, and Toprakhisar Höyük, a smaller peripheral settlement. Changes in crop representation are examined in order to identify possible shifts in cultivation strategies through time. In addition, stable carbon isotope ($\delta^{13}C$) analysis of wheat and barley grains was conducted to reconstruct water availability during plant growth and to assess potential episodes of drought stress. The results indicate a shift toward drought tolerant barley at Toprakhisar Höyük at the end of the third millennium BC. At Tell Atchana, a comparable trend appears later, between 1350 and 1200 BC. Isotopic evidence suggests water stress at Toprakhisar from the early second millennium BC onward, whereas similar signals at Tell Atchana become visible mainly during the latest phases of the Late Bronze Age. The timing of these developments broadly corresponds with periods of increasing aridity linked to the 4.2 ka and 3.2 ka BP climatic events. Rather than indicating agricultural collapse, the evidence suggests adaptive shifts in crop management and cultivation strategies in response to environmental stress.

Mervenur Sevil KANDEMİR

A PROPOSAL OF THE PRESENTATION ON THE APPLICATION OF PROTEOMICS TECHNIQUES IN ENVIRONMENTAL ARCHAEOLOGY

Proteins have a significant potential to give insight into the organisms due to their functional and structural roles (Whitford, 2005). The entire set of proteins an organism expresses

(proteome) is analyzed with proteomics. The proteomics techniques have opened a new door in bioarcheology, under the name of paleoproteomics (Warinner et al., 2022). Thanks to paleoproteomics, organic artifacts from ceramics to bones can be analyzed in a way that other techniques fall short in answering certain questions. For instance, the identification of species may not be possible with morphological analysis when skeletal elements are highly fragmented. A specialized technique to be used on zooarchaeological materials, ZooMS (zooarchaeology by mass spectrometry) offers a method for taxonomic identification by analyzing collagen peptide mass fingerprinting (PMF) with a special MS, matrix-assisted laser desorption/ionization time of flight (MALDI-TOF) (Buckley et al., 2009). This technique gives insight into several archaeological concepts, such as biodiversity, husbandry strategies, and more.

The agenda of the presentation can be found below.

1. Proteomics and paleoproteomics

2. Archaeological collagen and ZooMS

3. Advantages and disadvantages of paleoproteomics

4. Q&A

Volga Zengin

An Epi-logue: Applications of Epigenetics in Methylome Inferred Environmental Archaeology Epigenetics is the study of chemical modifications on the genome that change the expression frequency of genes without altering the nucleotide sequence within the DNA. They serve as a control mechanism for protein synthesis and thus, are regularly inherited.

However, certain genes, or loci, have shown to be responsive to limiting environmental factors such as toxins, low nutrient intake or even psychological distress. These variables alter the epigenome and frequently result in epigenetic markers including methylation, which reduces the expression of the affected genes or acetylation and phosphorylation, which have an opposite effect.

While it is a novel and pivoting field in molecular genetics, its extent is not limited to natural sciences. Detection of gene-coding loci which tend to be vulnerable to environment induced methylation can provide invaluable new insights into past human activity. Primarily, identification of biochemical markers on the DNA itself can reveal genetic distance between populations, responses to environmental stress and social stratification through available resources in humans and further evolutionary connections within zooarchaeological and archaeobotanical taxa. My senior project aims to establish the positive and the negative outcomes of methylation patterns to discuss the plausibility of inferring environmental conditions and possible human adaptations, dietary practices, mobility patterns, developmental pathologies and ultimately the social organization within populations.

In this light, methylation patterns on the epigenome have the potential to serve as valuable environmental proxies to enlighten archaeological research in cases where other data such as isotopes, botanical or zoological assemblages may be inconclusive.

Busenaz Telci

Ankara Üniversitesi, Dil, Tarih-Coğrafya Fakültesi

Arkeoloji(İngilizce)

Soil Salinization : The Case of Sumer

Environmental crises have affected not only modern societies but also ancient communities. Various methods are used to detect these crises through archaeological evidence. This presentation focuses on how soil salinization affected the Sumerian society, analyzed through archaeological findings and scientific methods. Salinization typically occurs in arid or semi-arid regions, and southern Mesopotamia's geography is highly conducive to this process. Salts present in the primary soil material rise to the surface through capillary action; as water evaporates, soluble salts accumulate at specific depths in the soil. Over time, this leads to the formation of sodium (Na), calcium (Ca), magnesium (Mg), and potassium (K) salts, which, especially in the case of sodium, can render previously fertile soils toxic and unproductive.

One adaptation strategy employed by the Sumerians was to leave land fallow every other year, which lowered the groundwater table and partially reduced surface salt accumulation. However, this approach only mitigated the effects of salinization to a limited extent. Analyses of charred seeds indicate a shift from wheat to barley, demonstrating an agricultural adaptation to cultivate more salt-tolerant crops. Isotopic analyses, particularly $\delta^{13}C$ and $\delta^{15}N$, further confirm environmental stress: increased $\delta^{13}C$ reflects water and salinity stress in plants, while elevated $\delta^{15}N$ indicates declining soil fertility. Flooding events also reduced agricultural productivity, leading to population decreases in certain northern Mesopotamian cities and triggering shifts in the geographic distribution of farming and increased migration.

The Akkadians, who succeeded the Sumerians, developed strategies to restore the fertility of saline soils. These included focusing on barley cultivation, improving irrigation methods, constructing drainage channels, and applying appropriate agricultural techniques. The case of Sumer demonstrates that environmental stressors can induce long-term agricultural and

societal adaptations rather than immediate collapse. Archaeobotanical and isotopic evidence provide a quantifiable window into how ancient societies responded to ecological challenges.

Keywords: Sumer, salinization, soil fertility, archaeobotany, isotopic analysis, Mesopotamia, agricultural adaptation