Cremations in Archaeology 2024

7. 5. 2024 – 10. 5. 2024

Ljubljana, Novo mesto – Slovenia

Book of Abstracts

Editors: Matija Črešnar, Tamara Leskovar, Nidia Lisić Fox

CIA 2024

Cremations in Archaeology

UNIVERSITY OF LJUBLJANA | FF Faculty of Arts

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Edited by: Matija Črešnar, Tamara Leskovar, Nidia Lisić Fox
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IRON AGE DANUBE route

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Keynote

Louis D. Nebelsick[1]
[1]*Uniwersytet Kardynała Stefana Wyszyńskiego, Warsaw, Poland*

Reconfiguring the dead. Urnfield and Hallstatt Period cremations as heterotopia

Since Michael Foucault´s formulation of the concept in 1967, heterotopia has been challenged, critiqued, but also intensively embraced, adapted, and used as an analytical framework by many social scientists, ranging from architectural theorists to literary critics. Heterotopia is a socially demarcated space, which is subject to an order set against the ambiguities of the surrounding world and thus ambiguous to it. Foucault saw heterotopia in places as diverse as convalescent homes, psychiatric clinics, prisons, museums, as well as libraries and significantly thought the cemetery to be a highly heterotopic space.

Indeed, his "heterotopia of crisis" is a particularly useful framework to contextualize the dramatic events that accompany elaborate cremation rituals whose imposing trace fossils, ostentatious chambered tombs, have long riveted the attention of Central Europe´s Bronze and Iron Age scholars.

Based on three case studies based on cremation graves from Hart an der Alz in Bavaria, Niederkaina in Saxony and Loretto in Burgenland, I hope to illustrate that a meticulous reconstruction of the sequence of funerary ritual and the spatial configurations of sepulchral deposition can lead to fascinating insights into the creative and complex narratives and imagery expressed by later prehistoric Central Europeans societies as they configure their funerary heterotopia.

Finally, I would like to invite my audience to a tour of a gorgeous Late Archaic Tarquinian chambered tomb. The vibrant sequence of images that envelop the living and dead visitors as they move into this interface between the realm of the living and the ancestral otherworld lends the imagined transformation processes on this heterotopic threshold, and by analogy, the funerary contexts I discussed previously, powerful emotional poignancy.

Session 1. Excavation and documentation of cremations

Chair: Matija Črešnar

1. **Daria Ložnjak Dizdar**, Challenges and limitations (inspirations) for the study of cremations and cremated human remains
2. **Marta Hlad**, Analysis of cremation deposits in archaeology and biological anthropology: emphasis on sex estimation practices of cremated remains
3. **Lukas Waltenberger**, The lateral angle: Insights into its development and proposal of a landmark-based method for sex estimation

Daria Ložnjak Dizdar[1], Petra Rajić Šikanjić[2]

[1]Institute of Archaeology, Croatia
[2]Institute for Anthropological Research, Croatia

1. Challenges and limitations (inspirations) for the study of cremations and cremated human remains

Archaeology is a science that has been overcoming its limitations ever since its conception. The rapid development and application of the multidisciplinary approach in archaeology in recent decades has further intensified the struggle of archaeology against its constraints. Research of cremated remains has faced many challenges. The study of funerary customs and age groups in the southern Carpathian Basin during the Bronze and Early Iron Ages will serve as an example of the challenges and limitations (but also inspirations) of the study of cremations and cremated human remains. The state of preservation of material remains and the method of collecting contextual data during research are two of the inherent limitations conditioning the development of the methodology of any archaeological study.

Fragmentation and limited possibilities are always a source of inspiration. The methodologies designed for these specific studies will be presented through their application, their observed advantages and disadvantages, and a critical review with possibilities for further development. These methodologies were developed through the excavation itself, the collection and recording of data, the realization of scientific projects with various kinds of multidisciplinary research, and the publication of the results.

Marta Hlad[1,2], Jacob I. Griffith[1], Tessi Loeffelman[1], Hannah F. James[1], Martine Vercauteren[2], Barbara Veselka[1], Christophe Snoeck[1]

[1]*Vrije Universiteit Brussel, Belgium*

[2]*Université Libre de Bruxelles, Belgium*

2. Analysis of cremation deposits in archaeology and biological anthropology: emphasis on sex estimation practices of cremated remains

Whether performed upon cremated or unburnt human remains, osteological analysis is a fundamental element for establishing biological profiles in bioarchaeology. Osteological data provides a basis for further research on palaeodemography, palaeopathology, and past sociocultural practices. Despite the consensus on the fundamental nature of these data, we rarely question how it was obtained. While there is widespread confidence among archaeologists and anthropologists in various methods, there is, to our knowledge, no clear, international, standardized protocol for analysing cremation deposits. All these issues are also particularly present in sex estimation of cremated remains. This study aims to identify patterns in analysis of cremation deposits, and sex estimation practices among experts working with cremated human remains from archaeological contexts.

For this study, an online survey containing 50 questions was designed using Lime survey. Participants, all osteoarchaeological specialists in the analysis of cremated remains, were recruited via emails and mailing lists (e.g. Jiscmail), Facebook groups and at the EAA meeting in Belfast in 2023.

The results of this inquiry confirm the findings of recent literature reviews in that there is very little standardisation in the protocols in terms of analysis, data collection, sex, and age-at-death estimation practices, and reporting on cremated remains. For sexing, most respondents trust the traditional morphological methods over recently published metric and other methodologies. These data flag an important issue and provide useful support for seeking future solutions for the standardisation of protocols for analyses of cremated remains in the archaeological and forensic research communities.

Lukas Waltenberger[1,2], Hannah Skerjanz[2], Stefan Tangk[3,4], Dominika Verdianu[2], Katharina Rebay Salisbury[1,2]

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[4]*Austrian Cluster for Tissue Regeneration, Vienna, Austria*

3. The lateral angle: Insights into its development and proposal of a landmarkbased method for sex estimation

Estimating the sex of cremated human remains is difficult. Previous studies showed that the lateral angle (LA) of the petrous bone is sexually dimorphic. Although they suggested various cut-off-points to separate females from males, the methods are hardly replicable and difficult to apply on digital 3D-data. Furthermore, the cause for this sexual dimorphism is still insufficiently understood.

We studied the sexual dimorphism of the LA in cremated petrous bones from adults (Late Bronze Age) using micro-CT scans. The sex of prehistoric individuals was estimated based on morphologic and metric methods. Technical errors of measurement were calculated for two methods to intersect the internal acoustic meatus in the midline (manual or landmark-based intersection). Logistic regression helped to define a cut-off-point in our sample. The technical errors of measurement suggested that the landmark-based method was more precise, whereas the manual intersection was much more intuitive. Inter- and intra-observer errors were low, which improved reliability. The logistic regression model produced good results for sex determination ($R2 = 0.38$, accuracy = 0.8). The mean LA was similar to studies that focused on prehistoric cremations. The landmark-based method we propose in this paper is precise, quick, and easy to apply.

Additional insights into the development of the LA were obtained using a historic collection with subadults of known sex. The reference collection showed that the LA is strongly associated with cranial breadth and the sexual dimorphism will form during puberty. However, the LA also seemed to be population specific.

Session 2. New developments, challenges and limitations for the study of cremations and cremated human remains

Chair: Christophe Snoeck

4. **Elżbieta Jaskulska**, Quantifying the Preservation Bias: Frequency Analysis of Identified Skeletal Elements in Cremated Human Remains Assemblages
5. **Adam Budziszewski**, True rate of destruction: Statistical evaluation of impact of usage of sieves on fragmentation of burned human remains
6. **Fabio Cavalli**, Scanning Cinerary Urns: Paleoradiology of the Cremation
7. **Hrvoje Kalafatić**, CT and MRI Insights: Advancements in Research on Bronze Age Cremated Burials
8. **David Gonçalves**, The contribution of X-Ray diffraction to predict heat-induced metric skeletal changes using chemosteometry
9. **Lucia Martina Scalise**, Integrating virtual, physical and proteomic analyses to the study of cremated remains from Bronze Age Northern Italy
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Elżbieta Jaskulska[1]

[1]*Department of Bioarchaeology, Faculty of Archaeology, University of Warsaw, Poland*

4. Quantifying the Preservation Bias: Frequency Analysis of Identified Skeletal Elements in Cremated Human Remains Assemblages

The analysis of cremated human remains poses a formidable challenge due to their inherent fragmentation. Early osteological studies have often relied on published information on the most frequently preserved bone fragments. This study introduces a comprehensive statistical analysis of identified skeletal elements, drawing from a dataset of cremated human remains I analysed during the last 15 years. The collected data comprises over 5000 fragments identified from over 100 kg of cremated human remains excavated across over 20 archaeological sites from the Early Bronze Age to the Early Medieval Period. The analysis focuses on reporting the actual frequencies of identified bone fragments, accounting for the size of the assemblages. Emphasis is placed on elements commonly utilised for Minimum Number of Individuals (MNI) determinations and age and sex estimations. This research aims to establish a robust statistical foundation for developing more refined analytical methods, shedding light on the identification capabilities inherent in analysing cremated human remains.

Adam Budziszewski[1]
[1]*Institute of Archaeology, University of Warsaw, Poland*

5. True rate of destruction: Statistical evaluation of impact of usage of sieves on fragmentation of burned human remains

The fragmentation of human remains forms the foundation of a widely used methodology for bioarchaeological investigations of cremation burials. Multiple factors contribute to this fragmentation, including conditions during cremation (pyre temperature, duration, combustion degree), the individual's biological profile, post cremation ash collection, and burial circumstances (urned vs. unurned, disturbance level, soil type), as well as both field and lab excavation processes. Occasionally the latter factor is considered by some researchers to be one of the most significant factors.

Causing secondary fragmentation of skeletal remains is said at times to be a factor that leads to the loss of valuable information, such as the original dimension of bone fragments, the destruction of spongy tissue, the destruction of fragments with palaeopathological lesions or diagnostic fragments for determining the biological profile, etc. Due to that, the common use of sieves, integral to this methodology, came under criticism as part of yet further agency during laboratory work. Nevertheless, to date, the potential impact of sieves on secondary fragmentation has not been quantified and tested by scientific methods. In this presentation, I will present the results of a regression analysis to test the impact of a multiple sieving of cremains through a set of sieves. The data used in this experiment was obtained during an earlier experiment to test the effect of shapes of holes in two different sets of sieves on the results obtained in further analyses using fragmentation data.

Fabio Cavalli[1]

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6. Scanning cinerary urns: Paleoradiology of the cremation

The study by CT (computed tomography) of cinerary vessels has a rather limited record both in the literature and in archaeological practice, due in part to the limited availability of these machines but also because of the objective difficulty of diagnostic radiological analysis that confronts the (paleo)radiologist with both the archaeologist and many other specialists who, each in their own field, contribute to increasing our knowledge of this particular kind of cultural artifacts.

On the other hand, incineration is one of the most common treatments of the corpse in prehistoric and ancient historical societies of which the cinerary represents the result of a series of funerary gestures ranging from the rite of cremation to the choice of cremated material to be placed in the urn, their arrangement, and the deposition of funerary objects, net of the diagenetic processes that modified the cinerary itself from the time of deposition to the time of discovery.

If laboratory microexcavation is to be considered at the moment the *gold standard* in the study of ancient cineraria, microexcavation by CT allows for a complete and non-destructive analysis of the cinerarium from both an anthropological and archaeological point of view and appears in some aspects (morphological study of the grave goods, spatial arrangement of the ossilegium, morphological and metric study of epiphyseal fragments and short bones, possible palaeopathological aspects) superior to laboratory microexcavation. In addition, cortical bone densitometry would seem to provide the possibility of obtaining quantitative measurements on the exposure of the anatomical areas of the corpse to the heat of the funeral pyre, with the possibility of obtaining information on the pyre itself. Not considering, among other things, the possibility of the application of modern stereotaxic techniques, borrowed from surgery, which allow analytical micro-samples to be performed on the cinerary on CT guidance or, in the near future, the application of "intelligent" techniques of automatic image enhancement and segmentation.

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7. CT and MRI Insights: Advancements in Research on Bronze Age Cremated Burials

This paper outlines the continuous evolution of research methodologies concerning Bronze Age cremated burials in northern Croatia over recent decades. Traditionally, the focus of cremation burial studies was predominantly on urns, occasionally extending attention to the items surrounding them. Often, fragmented finds from grave fills, bearing potential significance, remained in the periphery of research interests. The widespread homogeneity of urn types within Bronze Age communities in northern Croatia acted as a barrier to in-depth analysis, prompting researchers to redirect their focus toward other grave contents.

Systematic and meticulous excavations brought to light intriguing interactions between older and younger burials, revealing visible grave marks on the cemetery's surface. The excavation of intact urns, along with their fill and cremated bones, coupled with subsequent micro-excavations in laboratory conditions, significantly advanced scientific understanding. At the Bronze Age cemetery sites of Mačkovac and Petrijevci, a systematic application of computed tomography (CT) and magnetic resonance imaging (MRI) was introduced prior to the opening of each grave urn.

Also is used μCT on cremated teeth. This pioneering approach provided unprecedented insights into the manipulation of cremated bones within the urns. Notably, CT proved highly effective in preserving bronze objects damaged during funeral pyres. These revelations underscore the intricate complexities of life in Bronze Age communities, paving the way for extensive future research endeavours.

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8. The contribution of X-ray diffraction to predict heat-induced metric skeletal changes using chemosteometry

Chemosteometry, an approach involving regression models based on chemometric parameters obtained through Fourier-transform infrared spectroscopy (FTIR) has been previously proposed to estimate bone pre-burnt dimensions (DOI:https://doi.org/10.1002/ajpa.24104).

In experimental settings aimed at sex and stature estimations, *chemosteometry* performed better than other approaches based on correction factors or metric references specific to calcined bones. As a follow-up, we investigated the potential of data provided by X-ray diffraction (XRD). Bones of 6 human skeletons from the 21st Century Identified Skeletal Collection (CEI/XXI) were experimentally burnt at maximum temperatures of 600-1100°C, achieved after 60 to 180 minutes, measured before and after the burns, and sampled for FTIR analyses on attenuated total reflectance mode and for XRD analyses. The crystallinity index (CI) and bands 630 cm^{-1}, 3572 cm^{-1} and 3642 cm^{-1} were used as FTIR variables. Additionally, crystallite size and mineral phases were used as XRD variables – CaO, $Ca(OH)_2$, $CaCO_3$, $CaHPO_4.2H_2O$, bioapatite and β-TCP. Most significant correlations were found between: (i) heat-induced metric changes (HIMC) and infrared bands 630 cm^{-1} and 3572 cm^{-1}; (ii) XRD bioapatite, β-TCP and crystallite size. The 10%, 12% and 15% correction factors resulted in mean absolute errors (MAE) of 5.67, 6.35 and 8.02 percentage points, respectively. In contrast, the MAE of the regression models ranged

between 2.71 and 3.18 percentage points. Crystallite size alone provided predictions similar to those obtained with models including two or more variables. In conclusion, XRD features, especially the crystallite size, were found to substantially contribute to regression models able to predict HIMC.

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9. Integrating virtual, physical and proteomic analyses to the study of cremated remains from Bronze Age Northern Italy

The challenges researchers face studying cremated remains are countless. Thanks to new analytical approaches, there are many experimental ways to face these limitations. This study aims to improve the quality and quantity of information that could be retrieved from the investigation of cremains by combining three analytical approaches. We performed CT (Computerised Tomography) analysis of ten non-excavated urns from the Middle-Late Bronze Age (15th-12th centuries BCE) necropolis of Vicofertile (Parma, Italy). After extraction of the remains, we reconstructed the individuals' biological profiles, analysed the heat-induced changes to the bones, and compared the preliminary results of the two approaches. We also selected some samples for Zooarchaeology by Mass Spectrometry to investigate taxonomy, and amelogenin analysis for sex estimation. The qualitative and quantitative virtual investigation of the distribution of the remains inside the vessels provided information about the funerary practices. Non-adult and adult remains were also identified. The results of the virtual approach were mostly confirmed by the physical investigation of the burials. The exceptions regarded taphonomy (e.g. the presence of concretions that were not identified in the scans), additional data about the Minimum Number of Individuals (MNI), and individuals' sex and

age at death. The scans proved to be an essential tool to guide and speed up the excavation process and help preserve the integrity of the bones and vessels, as well as aiding sample selection to maximise the likelihood of successful proteomic analyses. Finally, ZooMS analysis allowed for the identification of two non-human remains, one of which was burned.

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10. Once the fire is out. Experimental observations on pyre sites and the nature of their Transformation

Pyre sites are fundamental archaeological sources to better understand former pyre technologies and the various treatments of pyre remains, including cremated bones, pyre goods, and pyre debris. Despite their significance, pyre sites are rarely included in archaeological evaluations due to their rare and random discovery. Besides the systematic analysis of the few examples uncovered, however, we can take a glimpse into the hidden life of pyre sites using experimental methods. In our presentation, we investigate the archaeologically invisible early lifecycle of pyre places through the analysis of four open-air cremation experiments that took place in 2017- 2018 (Hungary) and 2023 (TEFRA project, Crete). We examine how factors such as the location of cremation, the weather, the characteristics of burning, the pyre structure, and the different collection methods influence this early phase. Through the intensive analysis, excavation, and modelling of the experimental pyre sites, we can understand why so few examples are known in the archaeological record. At the same time, we can have insights into the nature of data loss, and we can gain new information on the transformation of pyre sites as well as the treatment of cremated human bodies and the associated funerary toolset resulting in new aspects in our archaeological interpretation.

Kevin Salesse[1], Elisavet Stamataki[2], Mathilde Daumas[3], Arwa Kharobi[1], Marta Hlad[2], Alexandra Boucherie[4], Hannah James[2], Jacob Griffith[2], Giacomo Capuzzo[2,5], Martyna Kopec[2], Stéphane Louryan[3], Martine Vercauteren[6], Christophe Snoeck[2]

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11. Isotopic and Infrared Analysis of Corpse Manipulation during Cremation: An Experimental Study on Human and Animal Cadavers

In a pioneering study, Salesse et al. (2021) assessed the feasibility of reconstructing the initial positioning of the body on or within the pyre, as well as to provide evidence of the presence of worn garments. Experimental burnings using pig legs as human substitutes were performed, with subsequent isotopic ($\delta^{13}C$, $\delta^{18}O$) and infrared (ATR-FTIR) analyses, as these analytical tools have been shown to provide information about pyre conditions.

The study revealed significant impacts on $\delta^{18}O$ values in bone apatite carbonates ($\delta^{18}O_{carb}$) and cyanamide content in calcined bone (CN/P) based on the positioning of the feet and the presence of worn footwear. Closed shoes created a protective layer, delaying the burning of underlying pig tissues and intensifying the heat-shielding effect soft tissues on the bone mineral fraction. Consequently, bioapatite bone carbonates interact with relatively more ^{18}O-depleted atmosphere, resulting in a more pronounced decrease in $\delta^{18}O_{carb}$ values when burning shoed feet compared to unshod feet. The initial placement of shoed feet in the pyre also caused a top-to-bottom decrease in $\delta^{18}O_{carb}$ values among the shoed feet at different levels of deposition. Additionally, the detection of cyanamide, serving as a proxy for oxygen availability during cremation, appears to indicate the use of

closed footwear, as these conditions create favorable circumstances for its integration into bone apatite.

In this presentation, we broaden the research design introduced by Salesse et al. (2021) to encompass human cadaveric remains1, aiming to validate the previous findings and assess their relevance in archaeological contexts.

Session 3. Diet, mobility and society

Chair: Tamara Leskovar

12. **Christophe Snoeck**, Infrared and isotope analyses in cremated bones from prehistoric Aegean: Perspectives and archaeological integration
13. **Mario Novak**, On the move towards the Adriatic Mediterranean. Strontium isotope evidence for human mobility in the Greek colony of Pharos ($5^{th}/4^{th}$-2^{nd} c. BCE, island of Hvar, Croatia)
14. **Tom Boonants**, Kapiteljska njiva and Mestne njive cemeteries in Novo mesto: the perspective from elemental and isotopic proxies
15. **Tessi Loeffelmann**, Animal Kingdom: using strontium isotopes as proxy for animal-human relationships

Christophe Snoeck[3], Yannis Chatzikonstantinou[1], Vasso Papathanasiou[1], Niki Papakonstantinou[1,2], Sotiria Kiorpe[1], Sevasti Triantaphyllou[1]

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12. Infrared and isotope analyses in cremated bones from prehistoric Aegean: Perspectives and archaeological integration

Despite the limitations in terms of bone preservation and representation, our understanding of the various uses of fire in mortuary practices has been enhanced by the application of analytical methods to cremated remains. Following a meticulous macroscopic osteological analysis, a comparative examination of the heat-caused compositional, structural, and chemical changes in bone apatite offers precious information about the differential use of fire on human remains. A multi-proxy investigation combining infrared and isotopic analyses enhances our knowledge about issues related to pyrotechnology, funerary practices, diverse burning techniques, mobility, migration, and geographical origins. FTIR-ATR, $\delta^{18}O$, $\delta^{13}C$, $^{87}Sr/^{86}Sr$ analyses have been applied to more than 200 samples from prehistoric Aegean in the frame of the TEFRA project, covering a wide chronological range in a broad geographical context. The burnt bones are derived from 22 sites across the Greek mainland, Crete, and the Dodecanese and are dated from the Mesolithic (9300-9000 BP) to the Early Iron Age (8th century BCE). The archaeological values are compared to those derived from modern experimental work in Greece, examining various burning conditions.

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13. On the move towards the Adriatic Mediterranean. Strontium isotope evidence for human mobility in the Greek colony of Pharos (5th/4th-2nd c. BCE, island of Hvar, Croatia)

Adriatic islands such as Hvar and Vis were colonized in the 4th century BCE by the Greeks from Paros and Sicily. Although there are plentiful archaeological evidence of the Greek colonization and presence in the Adriatic we have very scant data on biological characteristics of both Greek and local populations during these periods. The information on demography, health and mobility are scarce, mostly due to a general lack of bioarchaeological studies.

The recent excavations conducted in the town of Stari Grad on the island of Hvar (Greek polis of Pharos) revealed a multiple cremation burial containing the remains of at least nine individuals (adults and subadults) and a variety of artefacts (weapons, pottery, coins and jewellery). Direct radiocarbon dates suggest that the burial was in use for at least several generations (5th/4th-2nd century BCE). Strontium isotope ratios of cochlear bones from all nine individuals were analysed with the aim of providing new information on mobility across the region. The isotopic data suggest very limited population movement as all sampled individuals but one exhibited strontium values consistent with having spent their early lives in the local area. IND 3 is isotopically non-local as they must have spent their early life in a region with a more radiogenic biologically available $^{87}Sr/^{86}Sr$. These are the first available strontium data for this part of the Mediterranean indicating limited movement and mobility during the Greek colonization and preceding periods, and as such will serve as an example for similar studies in the future.

Tom Boonants[1], Christophe Snoeck[1], Carina T. Gerritzen[1], Matija Črešnar[2], Tamara Leskovar[2], Luka Gruškovnjak[2], Petra Stipančić[3], Borut Križ[3], Steven Goderis[1]

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14. Kapiteljska njiva and Mestne njive cemeteries in Novo mesto: the perspective from elemental and isotopic proxies

Slovenia's position at a north-south and east-west crossing point has had a decisive influence on its (pre)history over thousands of years. One of the most important centers that underlines this idea is located in the area that is nowadays the city of Novo mesto. Here, on a "peninsula" on the Krka River, there are several archaeological sites spanning from the Late Bronze Age, through the Iron Ages, to the Roman period and beyond. From this archaeologically rich and diverse area, the Dolenjski muzej Novo mesto provided 127 samples of cremated human remains from 86 graves from the Kapiteljska njiva and Mestne njive cemeteries. The anthropological analysis was carried out at the Centre or Interdisciplinary Research in Archaeology (CIRA) of the University of Ljubljana, while further analyses were carried out by the Archaeology, Environmental Changes, and Geo-Chemistry (AMGC) research group at the Vrije Universiteit Brussel (VUB) (Belgium). Analyses were carried out by HR-ICP-MS, MC-ICP-MS, and ICP-QQQ-MS, yielding a rich dataset consisting of elemental and isotopic data for a total of 97 bone samples. Both trends by grave as well as per age are identified here. Interestingly, there also appears to be a potential correlation between the combined dataset of $^{87}Sr/^{86}Sr$ values, Sr concentrations, and salt consumption, which could in turn indicate different dietary habits of different periods and populations. These global results allow us to better understand the daily lives of the populations that roamed this area in the past, and the overall (pre)history of this important area in Europe.

Tessi Loeffelmann[1,2], Janet Montgomery[2], Barbara Veselka[1], Ben Gruwier[1], Joris Brattinga[3], Lucas Meurkens[4], Hannah James[1], Charlotte Sabaux[1],; Guido van den Eynde[4], Christophe Snoeck[1]

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15. Animal Kingdom: using strontium isotopes as proxy for animal-human relationships

The analysis of strontium (Sr) isotopes in cremated remains is used frequently to assess mobility in cemetery populations. The isotope, Sr, is taken up by mammalian skeletal tissues throughout life via consumed food and water and reflects the $^{87}Sr/^{86}Sr$ of the bedrock lithology from where the food sources derive from. Since the introduction of the method for cremated remains in 2015, analyses have managed to enrich our understanding of the level of mobility of people who were cremated across time and space. For a number of reasons, the same has not occurred for the cremated remains of animals, even though these frequently accompany those of humans. This omission may reflect modern western ontology, but this is unlikely to mirror how past communities engaged with other species. This paper argues that the inclusion of animals in Sr isotope analyses is important and necessary if archaeologists want to understand not only how people engaged with other people, but also with their wider environment and other organisms. In this presentation, human-animal relationships at a small number of prehistoric and early medieval cemeteries from the low countries and the UK will be investigated in order to demonstrate the potential of seeing animals as part of a wider network of mobilities.

Session 4. Case studies

Chair: Barbara Veselka

16. **Teodoro Scarano**, The Bronze Age cremation cemetery of Torre Guaceto (Apulia, south-eastern Italy)
17. **Petra Stipančić**, The oldest cremation graves on Kapiteljska njiva
18. **Tamara Leskovar**, Ashes to (considerably less) ashes: cremation burials in Roman Emona
19. **Llorenç Alapont Martín**, Cremation practices in Roman funerary archaeology: Comparative analysis of Pompeii and Rome necropolises
20. **María Sedeño Ráez**, A Case Study: The Main Chamber of the Iberian Necropolis of Piquía (S. I a.C)
21. **David Errera**, Cremation of mummies as a funeral rite in the pre-Wari period at the archaeological site of Minaspata in the Lucre Basin (Cusco-Peru)
22. **Christie Willis**, Honouring the cremated dead at Cladh Hallan
23. **Giacomo Capuzzo**, Reconstructing chronology, human mobility, and funerary practices at the Late Bronze-Early Iron Age urnfield of San Valentino (San Vito al Tagliamento, Italy) using a multi-proxy approach

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16. The Bronze Age cremation cemetery of Torre Guaceto (Apulia, south-eastern Italy)

The Torre Guaceto cremation necropolis was discovered in 2019, a few hundred meters northwards from the already-known coastal Bronze Age settlement within the namesake State Natural Reserve and Marine Protected Area. The investigations carried out by the University of Salento, in collaboration with the University of Bologna, from 2021 to 2023, allowed the documentation of approximately 60 urns dating from the Middle Bronze Age 3 to the Final Bronze Age (mid-15th to 11th century BCE). Until now, the research has primarily focused on three main topics: landscape and environmental reconstruction, absolute and relative chronology, and funerary practices.

From the outset, the site's location (situated on a low rocky spit between two pocket beaches) and the distribution of evidence, from above to below sea level, have guided the research project within the framework of intertidal archaeology. More than 800 features (mostly funerary pits and postholes) excavated in the calcareous bedrock were mapped in the photogrammetric survey. Torre Guaceto, together with Pozzillo in northern Apulia, represents the earliest Bronze Age cremation necropolis in the Italian peninsula and it is nearly coeval with the earliest urnfields in the Terramare area. The contact with the Terramare area is also testified by the presence of bronze pins of typical Northern Italy models deposed in the urns together with bones. A systematic ^{14}C dating of cremated bones is also underway, to specify chronological/cultural sequence defined on the base of the grave goods typologies. Regarding funerary practices, the organic residue analysis showed that accompanying vessels contained cereal-based alcoholic brews.

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17. The oldest cremation graves on Kapiteljska njiva

With its extraordinary archaeological past, Novo Mesto ranks among the most important prehistoric sites in Europe and plays a valuable part in shaping our picture of prehistoric European culture. First and foremost is the prehistoric cemetery of Kapiteljska Njiva, which was in use throughout the first millennium BC. The Late Bronze Age graves at Kapiteljska Njiva are represented by large pottery vessels – urns – filled with cremated remains, bones and small fire-damaged grave goods. Only in a few graves were the cremated remains simply scattered into a burial grave pit without an urn. Most of the graves are badly damaged as a result of long years of cultivation of the fields. The urns were covered by a shallow pottery dish on which a stone slab was placed. This slab could vary greatly in size. Some graves were covered by large stone slabs weighing hundreds of kilograms. It is likely that all the graves were marked by stone slabs, which, however, have unfortunately not survived. Some slabs on the bottom of graves have survived and likewise vary greatly in size. The funeral ritual included the ceremonial shattering of ceramic vessels and the placing of their fragments in the urn containing the ashes of the deceased. Unbroken vessels containing food and drink to accompany the deceased on their journey to the afterlife were also placed in or beside the urns. Analysis of grave goods or elements of costumes helps us identify the sex of the deceased and their status within the community. Osteological analysis revealed considerable variation in the weight of the remains found in the graves, along with corresponding diversity in the minimum number of individuals. However, these two aspects are only partially correlated. Despite challenges posed by relatively poor preservation, some biological profiles were constructed. These profiles showed that the cemetery accommodated burials of individuals spanning all age groups and both sexes.

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18. Ashes to (considerably less) ashes: cremation burials in Roman Emona

Cremation was a predominant burial practice in the Roman colony of Emona (Ljubljana, Slovenia) during the initial two centuries of its existence (1st-2nd centuries AD). Among the more than 3500 uncovered burials to date, a substantial portion involves cremated remains. However, the bioarchaeological exploration of this material has been limited, primarily due to the limitations of developed methods for analysing the extensively fragmented remains resulting from the cremation process.

Recent advancements in methodology and theory, however, have underscored the potential of cremated remains in unravelling insights into past cultural and funerary practices. Within the scope of the examined Emonan cremations, various questions have arisen. Notably, we emphasize the considerable variability in the weight of skeletal remains and the significant disparities between the weights of remains discovered in individual graves and estimations derived through experimental archaeology, delving into possible explanations for these discrepancies.

Llorenç Alapont Martín[1], Gianni Gallello[1], Marina Marcelli[2], Pilar Mas Hurtuna[1], Juan José Ruiz Lopez[3], Mark Thomas[4], Aarathi Prasad[4], Ruairidh Macleod[5], Emily Tilby[5], Ana Miguelez Gonzalez[6], Joaquin Alfonso Llorens[6]

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19. Cremation practices in Roman funerary archaeology: Comparative analysis of Pompeii and Rome necropolises

This study compares data from two funerary archaeology projects in Pompeii (Porta Nola and Porta Sarno) and Rome's Via Ostiensis necropolises. Both sites offer exceptional conditions for analyzing well-preserved cremation graves, facilitating the creation of comprehensive databases highlighting grave and individual aspects. Statistical analysis of these databases yields innovative, comparable data crucial for interpreting funerary rituals and materials within urns. A multidisciplinary approach combining archaeological techniques with bioanthropology, archaeobotany, zooarchaeology, and geochemistry reveals insights into cremation processes, bone gathering, and funerary deposition. Osteological and X-Ray Fluorescence analyses provide data on cremation temperatures, biological profiles, and paleopathologies. Comparing data from Pompeii and Via

Ostiensis enables testing hypotheses about funerary practices and rituals. Statistical analyses also pave the way for gender-based archaeological studies, exploring potential relationships between funerary customs, grave goods, and the sex of cremated individuals to reconstruct the social identity of ancient Romans.

María Sedeño Ráez[1]

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20. A Case Study: The Main Chamber of the Iberian Necropolis of Piquía (S. I a.C)

With the arrival of Rome to the Iberian Peninsula and its interaction with the Iberian societies, begins a process of change and transformation that culminate with the appearance of a new culture in which the Iberian and the Roman culture intermingle. This process began to be studied in the Necropolis of Piquía, based on the ceramic materials documented during the excavation and the typological study of the funerary structures. However, the human material, the cremated bones of individuals, remained in the background until now, when the study of the funerary context has been resumed and the focus has been placed precisely on the information that these bones can provide us. We present, as a particular case study, the anthropological data obtained from the analysis of the cremations that were collected inside the main structure, the methodology applied and the conclusions related to the MNI, sex, age and pathologies. Likewise, the results related to the temperature or quality of the record, among others, will be presented. However, our objective is not only to present the purely anthropological conclusions, but also to highlight the particular context in which the Necropolis takes place, and how the study of the material remains of the individuals will allow us to understand who used this funerary space during a little more than a century, and how they reflected in the world of death, the various relationships that were taking place in the world of the living.

David Errera[1]

[1]*Dirección Desconcentrada de Cultura Cusco, Ministerio de Cultura del Perú, Lima, Perú*

21. Cremation of mummies as a funeral rite in the pre-Wari period at the archaeological site of Minaspata in the Lucre Basin (Cusco-Peru)

Cremation is an archaeologically unrecorded activity in the pre-Hispanic Andes. The few findings consist of offering chambers in which fragments of human and animal bones, ceramics, textiles, and malacological materials were burned together. The findings in Minaspata, an archaeological site 31 km from Cusco City between 2014 and 2016 and under the auspices of the University of Pennsylvania and the Peruvian Ministry of Culture, have shown a series of funerary practices not recorded until now. This is the cremation of mummies along with complementary practices such as the cutting of feet and beheadings, all as part of a possible simultaneous ritual of the cult of fire and ancestors. This finding was dated to before the arrival of the Wari culture, the first Andean Empire, to the study site. This means that the cremation of these mummies was progressive between 1,400 BCE and 550 CE, when Minaspata was abandoned. Ethnographic studies carried out demonstrate a relationship between these ancient cremations and the current burning of mummified fetuses and newborn camelids in ceremonial offerings to the Pachamama (Andean mother earth). In the same excavation season, evidence of the occupation of the Inca nobility was found, corroborating the writings of the early Spanish chroniclers in the Andes that the site was the birthplace and residence of Huáscar, the last Inca Governor. The discovery of two mortuary contexts, among them a Capacocha (sacrifice of a child), is evidence of the Inca Civil War (1529–1532) on the site.

Christie Willis[1]

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22. Honouring the cremated dead at Cladh Hallan

Cladh Hallan, on the island of South Uist in norther Scotland, is best known as Britain's first evidence of mummification when two composite mummies were recovered. Often labelled as 'Frankenstein' mummies by the media, they were created by using the body parts of at least three deceased individuals per 'mummy' who were tightly wrapped into bundles then mummified prior to burial. However, the cremation practices which dominated the site in the years preceding, and indeed contemporary with and after the mummifications, have received little attention.

This paper presents evidence for the cremation practices from Cladh Hallan and suggests that the cremation burial rites played an intricate role in shaping the Early Bronze Age farming and funerary landscape which, during the Late Bronze Age, evolved into a settlement of roundhouses for which the dead became a type of focal point. The continued interaction between the cremated remains and unburnt bones throughout 1,000 years of activity reveals this site being an origin point -a sense of place and belonging which was brought into being by cremation practices across long and complicated histories in which the cremated dead were honoured and remembered.

Giacomo Capuzzo[1,2,3], Elisavet Stamataki[2,4], Michael Allen Beck De Lotto[5], Silvia Pettarin[6], Philippe Claeys[4], Nadine Mattielli[3], Giovanni Tasca[6], Christophe Snoeck[4]

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23. Reconstructing chronology, human mobility, and funerary practices at the Late Bronze-Early Iron Age urnfield of San Valentino (San Vito al Tagliamento, Italy) using a multi-proxy Approach

The site of San Valentino at San Vito al Tagliamento is one of the main urnfield cemetery in northeastern Italy. Archaeological excavations carried out in the seventies brought to light a cremation cemetery of mainly urn graves with pottery and metal artefacts as grave goods. These materials suggested that the individuals buried in San Valentino were not an isolated local community but had intense contacts with other north-Adriatic communities, in particular with the neighbouring Veneto area. This presentation aims to provide the first osteoarchaeological study of the individuals buried at San Valentino and uses an innovative multi-proxy approach to reconstruct the site chronology through radiocarbon dating on bone apatite, to investigate the human mobility using strontium isotopes on calcined human remains, and to attempt a reconstruction of the funerary practices by coupling FT-IR-ATR data with carbon and oxygen isotopes on cremated bones. The results date the cemetery to the end of the Late Bronze Age and the Early Iron Age, with a sporadic occupation in the fourth century BC. Strontium isotopes and concentrations show the individuals buried at San Valentino were a local community that exploited local resources. Interestingly, variations in

cremation conditions were detected between San Valentino and the contemporary sites of Velzeke, Blicquy, Grand Bois, and Herstal, located in Belgium, by using FTIR-ATR and carbon and oxygen isotope data.

Session 5. Cremations and chronology

Chair: Carola Nebelsick

24. **Mateusz Stróżyk**, Biritual burial rites in cemeteries from the beginning of the Bronze Age in Poland: chronology and characteristics
25. **Katharina Rebay-Salisbury**, Dating depositional events: new radiocarbon dates from the Middle to Late Bronze Age transition in the Lower Austrian Traisen Valley
26. **Klára Šabatová**, Chronological Insights into Late and Final Bronze Age: Urnfield burials and Radiocarbon Dating in Moravia

Mateusz Stróżyk[1], Mateusz Jaeger[2]

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24. Biritual burial rites in cemeteries from the beginning of the Bronze Age in Poland: chronology and characteristics

The presentation concerns transformations in funeral rites in the areas of present-day Poland during the period 2300-1300 BC. Characteristics of funeral rites are widely recognized as a significant criterion for understanding the cultural diversity of different geographical regions. Generally, it is assumed that the adoption of cremation in the Late Bronze Age in today's Poland(1200-800 BC) was the result of relatively rapid processes, often explained in a close relation to migrations. From this perspective, fundamental changes in the nature of funeral rites were to be the result of transformations influenced by contacts with regions (closer or more distant) where the mentioned changes in burial practices occurred earlier. In order to verify this assumption, biritual burials from the Early and Middle Bronze Age were analysed. The coexistence of both skeletal and cremation rites suggests the existence of an initial stage of transformations in the funeral sphere of the Bronze Age communities. Two analytical scales were applied to the phenomenon: a broader one, encompassing the coexistence of two rituals in a specific cemetery, and a narrower one, limited to the space of the grave itself (mass graves, biritual burials).

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25. Dating depositional events: new radiocarbon dates from the Middle to Late Bronze Age transition in the Lower Austrian Traisen Valley

In calcined remains, dating can be done on the structural carbonate in the bone's mineral fraction. Previous studies have clarified the complex interaction of carbon from the human body, pyre fuel, and the environment in bones cremated to varying degrees. We radiocarbon dated over 100 samples of cremated human and unburnt animal bones included as grave goods in the scope of the 'Unlocking the Secrets of Cremated Human Remains' project. The radiocarbon dates from the Middle Bronze Age to the early Iron Age (c. 1400–400 BC) were not only taken to establish a scientifically based absolute chronology for the region, but also to understand depositional practices.

In this contribution, we compare dates from graves at Unterradlberg, Inzersdorf, Franzhausen-Kokoron and Statzendorf, derived from charcoal, cremated human remains, and unburnt human and animal bones, which refer to different time spans and events: the life of a person or animal, the cremation event, and the deposition of the remains in a grave. We discuss how temporal differences between these time spans and events may reveal aspects of ritual practices such as curation of objects and urns as well as sequential burial.

Comparing the absolute dates to the typo-chronology based on bronze grave goods, we evaluate how these different types of data inform the modelling of C^{14} dates in the absence of stratigraphic overlaps of graves within the large urnfields of the Traisen Valley.

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26. Chronological Insights into Late and Final Bronze Age: Urnfield burials and Radiocarbon Dating in Moravia

This paper presents an overview of cremation cemeteries from the Late and Final Bronze Age in Moravia, focusing on radiocarbon data. Case studies, including those from Přáslavice and Znojmo, illustrate diverse approaches to dating Urnfield period burials. Archaeobotanical sampling of grave pit infills has provided crucial insights, while carbonized bones, despite challenges related to the old wood effect, offer valuable information for Urnfield burial site research.

The integration of short-lived archaeobotanical residues reveals the initiation of Urnfield cemeteries from the early 13th century, coexisting with skeleton burials. Noteworthy is the absence of cremation graves of Final Bronze Age in certain Urnfield cemeteries (R HB). Radiocarbon dating of calcinated bones or charcoals addresses similar questions, providing an establishing Terminus post quem and points the importance of anthracological analysis. These findings contribute to a nuanced understanding of the chronology and burial practices in the Late and Final Bronze Age in Moravia.

Session 6. Cremations and funerary practices

Chairs: Ian Armit, Matija Črešnar

27. **Yannis Chatzikonstantinou**, Mesolithic and Neolithic cremations from Greece: New insights into the differential use of fire in Aegean prehistory
28. **Agata Hałuszko**, Occurrence of multi-individual burials from the Middle Bronze Age to the Early Iron Age in southwestern Poland
29. **Giovanna Gambacurta**, Towards complexity: the preroman genealogies of Este, 'Casa di Ricovero' necropolis (8th-7th century BC)
30. **Hrvoje Potrebica**, Cremations and Burial Mounds in the Eastern Hallstatt circle
31. **Cecilia Moscardo**, Pyre debris in the necropolises of Iron Age Padova: from archaeobotanical remains to ritual aspects
32. **Sevasti Triantaphyllou**, TEFRA project: the technology and the bioanthropology of the use of fire in the prehistoric Aegean
33. **Bogumila Wolska**, F(T)IR-E at the pyre: spectroscopic studies on cremation intensity among Iron Age societies in Poland
34. **Gediminas Petrauskas**, Rethinking Collective Cremation in Lithuania during the Period of Conversion to Christianity
35. **Kaja Stemberger Flegar**, Cremation burial as a process: Case study of the Hajdina Murko cemetery (Colonia Ulpia Traiana Poetovio)
36. **Željka Bedić**, Funerary practices at the necropolis of the Roman city of Apsorus – anthropological and archaeological aspects
37. **Filipa Cortesão Silva**, Infant cremation burials from southwest Roman Hispania: a bioarchaeological perspective
38. **Borut Toškan**, The boomtown shrews. Accumulation of small mammal remains in an urn from the Early Iron Age cemetery at Kongresni trg (Ljubljana, Slovenia)

Yannis Chatzikonstanou[1], Sevasti Triantaphyllou[1]
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27. Mesolithic and Neolithic cremations from Greece: New insights into the differential use of fire in Aegean prehistory

Firing conditions have been used differentially in the treatment and the manipulation of the deceased in the Aegean since the early prehistory. The Mesolithic cave at Franchthi in the Peloponnese presents the earliest secure evidence for crema-on rituals in Greece (around 9500-9000 BP). The burnt human remains from Franchthi were mixed with inhumations and preserved moderate to advanced heat-induced alterations. In addition, several Neolithic cremations (6500-4000 BCE) have been traced across the Greek mainland, although the prac-ce was adopted strongly in Thessaly (e.g. EN Soufli Magoula, LN Pla-a Magoula Zarkou) and LN western Macedonia (e.g. Dispilio, Avgi, Kleitos, Toumba Kremastis Koiladas). The osteoarchaeological study of the burnt human remains carried out in the frame of the TEFRA project informs us about variations in the use of fire in the manipulation of the deceased, accompanied by an advanced knowledge of pyrotechnology. This oral presentation includes information derived from the osteological study of cremated human bones from Greek Mesolithic and Neolithic archaeological contexts, involving insights concerning the biological profile of people whose bodies were subjected to burning, along with indications related to burning conditions and the technology of the use of fire.

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The research was carried out as a part of research project no. 2023/48/C/HS3/00020, funded by the National Science Center, Poland

28. Occurrence of multi-individual burials from the Middle Bronze Age to the Early Iron Age in southwestern Poland

The occurrence of more than one individual in cremation burials is not an isolated phenomenon, but identifying the relationships between these individuals is a challenge for bioarchaeology. Even specifying the type of burial is often problematic, because it is not clear whether in the case of many individuals, e.g. in one urn, we should talk about a collective, mass or simply multi-individual grave. Of course, the practice of depositing more than one individual in a burial may be associated with transformations in the economic sphere, which with the beginning of the Iron Age became a superior element, probably more important than the role of kinship observed in the Middle and Late Bronze Age. This can be confirmed by funeral objects with complex structures and unique grave equipment. In the area of south-western Greater Poland, Middle Bronze traditions are preserved, e.g. in the practice of barrow construction, until the end of the Bronze Age. Against the background of such an outline of the early Iron Age community, it is difficult to disagree with the archaeological postulates about the formation of elite groups. However, attention should be paid to the paleodemographic changes taking place in the final phase of the Late Bronze Age, which, as a result of improved socio-economic conditions, most likely led to the creation of an "elite" social layer or an increase in the well-being of the general population during this period.

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29. Towards complexity: the preroman genealogies of Este, 'Casa di Ricovero' necropolis (8th-7th century BC)

The desire to emphasize family bonds in the organization of funeral areas and the arrangement of grave goods is gradually emerging as a distinctive topic in the necropolises of ancient Veneto, particularly in those of Este, which is among the most significant sites recently investigated in northeastern Italy.

This research focuses on a sample of burials from the necropolis Casa di Ricovero necropolis (excavations 1983-1993), a funerary site located in the north of Este that was in use from the 8th century BC until the 3rd – 2nd century BC. The objective is to delineate the structure and evolution of three groups of tombs from a stratigraphic, topographical and anthropological standpoint, while also examining the composition of grave goods. The primary aim is to identify significant markers of familial ties or other social relationships expressed within various hierarchies. Additionally, the study seeks to evaluate the means by which infants accessed the necropolis and the social status attributed to certain individuals of a young age.

The examination of personal items within grave goods, coupled with anthropological data, enables the identification of consistent patterns related to the funerary representation of infants. It also sheds light on the projection of the role that the deceased would have assumed in adulthood and the modes of inheritance transmission. The chronological scope considered spans approximately seven to eight generations, providing a timeframe sufficient for reconstructing segments of family histories.

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30. Cremations and Burial Mounds in the Eastern Hallstatt circle

Although in the Eastern Hallstatt Circle majority of communities use cremation as preferred burial ritual. Cremation has been mostly understood as technical process of preparation of the body for the actual burial ritual under the mound (or in some of the cases in the flat grave). However, level of inclusivity varies between individual communities and so called "cultural groups". In the Kaptol Group the difference between number of mounds and assumed population is quite drastic. The hypothesis that the rest of population has been buried in flat graves has not been confirmed yet although extensive excavations have been performed around the mound or on other positions around the settlement. At the same time careful analysis of grave inventories indicated that grave goods significantly differ from material culture and other offerings that were part of the cremation event itself. The paper will try to suggest that cremation itself was burial ritual, while subsequent deposition of human remains under the mound or in a flat grave was another stage in burial process reserved for special group of people. The remains of the other members of the community might have been deposited in communal pits, bodies of water or in other places hard or impossible to locate in the field. These remains could have also been "recycled". In other words the majority of population would not have visible individual places of burial.

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31. Pyre debris in the necropolises of Iron Age Padova: from archaeobotanical remains to ritual aspects

Nowadays, we are witnessing an increasing interest in the investigation of every aspect of the cremation process, from the setting up of the pyre, to the collection of the cremated remains, up to the burial practices. Since the 1980s, these themes have been at the core of research interest in the study of the funerary contexts of Iron Age Veneto. From the earliest phases, Venetic necropolises are characterized by a significant biritualism marked by the clear prevalence of cremations. Despite the considerable variability in the typology of burial structures, pyre debris is constantly redeposited in cremation burials. The redeposition of pyre debris shows a varied range of ritual choices in treatment, location, and quantity within the burial structures. Although in recent years significant progress has been made in the study and publication of anthracological and archaeobotanical data from Venetic necropolises, the relation between the pyre debris composition and other aspects of the cremation ritual needs to be further investigated. Therefore, this contribution aims to examine a sample from the Iron Age necropolises of Padova combining anthracological/archaeobotanical analysis of the pyre debris with stratigraphic, archaeological, and osteological data. This analysis not only will help to define the criteria regulating the selection of pyre wood fuel and the deposition of food offers or other objects on the pyre, but it could also be useful to identify possible correlations between the pyre technology, the ritual aspects, and the identity/status of the deceased. This interdisciplinary approach will help to better understand the variability and peculiarities of the entire cremation process in Iron Age Padova.

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32. TEFRA project: the technology and the bioanthropology of the use of fire in the prehistoric Aegean

To date, limitations in the type of information as well as the overall 'poor' archaeological data failed to recognize the rich value and a number of new insights that the act and process of cremation and of burning the human remains can provide about the living and the societies of the past. The last decade has undergone a 'revolution' of primary research and analytical work undertaken in thermally altered archaeological human remains. In Greece, although the practice was extensively discussed within the context of the social transformations that took place in the Early Iron Age (12th-8th c. BCE), the particular components of the use of fire on the human body such as the technology of fire and the bioanthropology of the people who were burned were investigated only at a limited scale. The TEFRA research program which is a 3-year project funded by the Hellenic Foundation of Research and Innovation has attempted to shed new light on the use and the technology of fire on human remains in the Aegean as well as on the bioanthropology of the people who were subjected to this process. Bibliographical overview of published archaeological cases together with the application of macroscopic and analytical methods in selected assemblages ranging from the Neolithic to the Early Iron Age (7th mill. BCE - 8th c. BCE) as well as the simulation of thermal conditions through experimental work have brought together a great range of information and data in order to define the phenomenon and its variability in the pre- and protohistoric Aegean.

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33. F(T)IR-E at the pyre: spectroscopic studies on cremation intensity among Iron Age societies in Poland

Heat-induced changes of human remains provide valuable insights into past mortuary practices. For example, variable colours displayed by burned skeletons may suggest different burn intensities. Completely vs partially calcined skeletons may result from different practices and objectives. However, bone colour can be affected by several other taphonomic agents (e.g. soil/charcoal) and therefore disturb macroscopic assessment. Fourier-transform infrared spectroscopy is commonly used to provide more reliable information about changes in the molecular structure of heat-exposed bones.

We evaluated burn intensity of cremains from three Iron Age communities (Pomeranian, Oksyvian and Przeworsk cultures) inhabiting the current Polish territory to better understand their funerary practices. Burned human remains from seven cemeteries were subjected to macroscopic examination. Bone powder samples were also collected from each skeleton and measured through FTIR-ATR. Chemometric indices (CI, C/C, and OH/P) were used to test for any differences in skeletal oxidation level among the three communities.

Thermal changes observed macroscopically on human remains suggest potential differences in cremation practices. The FTIR results correlate with these observations, even accounting for the expected intra-one and inter-observer theoretical variations postulated by Rosa et al. (2023). Significant differences were obtained between the Pomeranian and Przeworsk communities ($p<0.001$) for all indices. Results from the Oksyvian culture were intermediate to the other two. Assuming that diagenesis had not major impact on the spectra, the observed differences may be explained by distinct

pyre managements (e.g. wood selection/oxygen supply/duration). Our results go against previous reports suggesting that burn intensity was quite uniform among cultures at this time.

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34. Rethinking Collective Cremation in Lithuania during the Period of Conversion to Christianity

Cremation is one of the most distinctive ways of expressing a final farewell to the deceased. Over the last few thousand years, the dead have been cremated by many Indo-European nations and cultures. Grand Duke Mindaugas of Lithuania adopted Christianity in 1251 and was crowned king in 1253, however, Christianity was abandoned, and the Grand Duchy of Lithuania existed as the only pagan state in all of Christian Europe until it finally converted to Christianity in 1387. During these nearly one and a half hundred years, cremation was the predominant way of burying the dead in ethnic Lithuania until the end of the 14th century and, with a few exceptions, in some places until the beginning of the 15th century. Collective cremation graves on land and in water are an integral feature of 13th–14th century burial practice in Lithuania. The cemeteries of this period are characterized by a horizon of collective cremation graves up to 30–40 cm thick, with a layer of scorched earth on the surface containing cremated bones, fragments of deliberately broken and melted items, and crushed potsherds. No clear boundaries between graves can be defined in these burial grounds. The lack of anthropological data, the shortcomings in the definition and identification of collective graves and inadequate research methodology have long been a problem in the study and interpretation of collective cremation. This paper presents cases of research on collective cremation graves in Lithuania in the 13th–14th centuries, examines their context, provides analogies, and discusses the concept of collective cremation burial.

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35. Cremation burial as a process: Case study of the Hajdina Murko cemetery (Colonia Ulpia Traiana Poetovio)

Cremation burials are not just the final snapshot of a burial, but are the cumulative record of the rituals and processes that preceded the final act of burial, as well as those that followed it. Several elements of these rituals, such as textile, foods and drinks, and other organic materials are frequently absent from the record since they have deteriorated. In this paper, we examine 121 graves excavated at the site Hajdina Murko, which was part of the western cemetery of Colonia Ulpia Traiana Poetovio, modern Ptuj in Slovenia. The focus will be on the burial ritual, with the aim of determining which items went on the funeral pyre and which items were included as additional grave goods. Preliminary analyses suggest that certain objects such as unguentaria were regularly incinerated, but several other groups of items, for example items of personal adornment or bone artefacts, indicate signs of burning as well. We aim to establish which objects were utilised at what stage of the funerary ritual, and why some of them were intentionally burned while others were "ritually killed" in a different manner. Moreover, we discuss what happened with the pyre remains in relation to the grave goods to establish deposition patterns inside the graves.

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36. Funerary practices at the necropolis of the Roman city of Apsorus – anthropological and archaeological aspects

In Roman burial practices after the funeral grave goods were put in the grave in order to provide for the needs the deceased had during his lifetime. The amount and type of grave goods depended on one's personal socio-economic status, but also upon the occupation, sex and age. In the 2022 rescue excavations were conducted on the island of Lošinj and revealed one of the burial grounds of the roman city of Apsorus (present day Osor, island of Cres). More than 200 graves were excavated (188 incineration graves and 14 inhumation burials). In the graves a variety of ceramic and glass vessels, with bronze, iron and bone objects were found dating the necropolis from the last decades of the 1st century BCE until the middle of the 2nd century CE.

Anthropological analysis was used to determine the sex and age, as well as pathological changes on the incinerated skeletal material. Altogether 118 graves were available yielding 122 skeletons.

Due to poor preservation in 60 cases, it was not possible to estimate the sex, while for the rest of the sample was determined to contain 26 males or probably males, seven females or probably females, and 29 subadults or probably subadults/young adults.

We will try to establish if there is a correlation between grave goods and sex category and, if so, whether it can be used for the deceased whose sex could not be determined. Furthermore, the socioeconomic status, and in some cases the occupation of the deceased, will be tried to be ascertained.

Filipa Cortesão Silva[1,2]

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37. Infant cremation burials from southwest Roman Hispania: a bioarchaeological perspective

Bioarchaeology of cremation in Roman times is an increasingly explored topic. Even so, little is known about the specific case of children. This work aims to analyze the cremation funerary practices linked to infants from southwest Roman Hispania (1st century BCE to 2nd century CE), by combining anthropological and archaeological data. To this end, thirty cremation burials from three Roman cities, namely, *Augusta Emerita* (Mérida), *Salacia* (Alcácer do Sal) and *Augusta Firma Astigi* (Écija) were studied. Bone remains were subjected to macroscopic/metric study.

The analysis of the characteristics of the bones indicates complete cremations for all sites, as well as evidence for the presence of pyre goods. Almost half of the infant bone remains were associated with another individual, usually an adult female. Most of the burials are secondary bone deposits in ceramic urns. In a few cases the grave goods found were related to childhood. The data achieved suggest that the funerary treatment of these *mortui immaturi* could be influenced by age, showing some differences according to the Roman city. Nevertheless, further research with larger samples and a multidisciplinary approach is needed on this issue.

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38. The boomtown shrews. Accumulation of small mammal remains in an urn from the Early Iron Age cemetery at Kongresni trg (Ljubljana, Slovenia)

The greatest challenge in interpreting animal remains from funerary contexts and associated features is usually distinguishing between deliberately and accidentally deposited assemblages. If they are demonstrably associated with the burials, these finds are commonly interpreted as (grave) goods, provisions for the afterlife, waste from funeral feasts or other rituals of worship of the dead. Remains of animals with pronounced symbolic meaning (e.g. horse, dog, wild animals) or the most important sources of meat (e.g. cattle, caprines, pig) generally fit well into this interpretation paradigm, less so the 'marginal' species such as shrews, moles and voles.

Excavations at the Eary Iron Age cemetery at Kongresni trg in Ljubljana (Slovenia) revealed several small barrows enclosed with a ring ditch with single, double or triple cremations in the centre of the tumulus. In addition, individual flat cremations and even two inhumations were found between the tumuli, which is unusual for the region. One of the urns dating to the 8th/7th century BC, recovered from a secondary position, contained the remains of several dozen shrews, voles and moles belonging to at least six species, mixed in with the burnt remains and cremated human bones. Based on the number of specimens, the ethology and habitat requirements of the different species and the taphonomic evidence, the animals appear to have been placed in the urn by humans, possibly as part of a special ritual.

Poster Session 1 (Wednesday)

1. **Anneminne Frère**, Counting beyond ashes: Identifying the possible presence of up to six people in an urn through strontium isotope analysis
2. **Hannah F James**, The benefits of integrating archaeological and environmental contexts when interpreting strontium isotope and concentration data
3. **Ian Armit**, Exploring mobility and cemetery organisation through the strontium analysis of Late Iron Age Cremation Burials from Westhampnett, UK
4. **Carina T. Gerritzen**, The first combined $^{87}Sr/^{86}Sr$, $\delta^{88}Sr$, and [Sr] analysis of cremated human remains (Brinjeva gora, north-eastern Slovenia)
5. **Hannah Leonard**, The Early Adoption of Cremation Practices: $^{87}Sr/^{86}Sr$ Analysis of Cremated Remains in Weelde, Belgium
6. **Ana Luísa Brandão**, FTIR-ATR Study of Human Skeletal Remains from the Tongobriga Necropolis, Portugal (1st century AD)
7. **Emma M. Legrand**, Strontium isotope analysis of cremated remains from Poljana Križevačka
8. **Julianne J. Sarancha**, Matrix-Matched Standards for Trace Element and Isotopic Analysis of Cremated Remains
9. **Zdeněk Vytlačil**, Preliminary results of the mobility analysis in the Hallstatt period bi-ritual cemetery at Modřice, Czech Republic
10. **Oriana Pulcrano**, Mobility and social relationships in the cremation necropolis of Borgo Panigale (Bologna, 9th century BCE)

Anneminne Frère[1,5], Tessi Löffelmann[1], Barbara Veselka[1], Amanda Sengeløv[2,3], Hannah James[1], Carina T. Gerritzen[1], Guy De Mulder[3], Nicolas Cauwe[4], Free De Backer[5], Christophe Snoeck[1]

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1. Counting beyond ashes: Identifying the possible presence of up to six people in an urn through strontium isotope analysis

Cremations represent complex social processes where, sometimes, the remains of several individuals may end up in the same urn, either intentionally or accidentally. In grave 11 of Court-Saint-Étienne, a Late Bronze Age – Early Iron Age cremation site in the region of Belgium, osteoarchaeological research identified the remains of at least three individuals. However, osteoarchaeological analyses alone are insufficient to accurately estimate the Minimum Number of Individuals (MNI) in a grave. To better identify the number of people, present in a cremation deposit, strontium isotope analysis emerges as a valuable complementary method, as significantly varying $^{87}Sr/^{86}Sr$ are not only indicative of mobility but may also indicate the presence of different individuals.

This study demonstrates that sampling multiple skeletal elements, representing various life stages, can aid in reconstructing life histories and in providing additional insights into the MNI of a cremation deposit, using grave 11 as a case study. From this urn, 3 petrous parts, 2 teeth, 2 ribs and 7 diaphyseal fragments were sampled and subjected to strontium isotope analysis. The results reveal a range of possibilities, spanning from three individuals with significant mobility throughout their lives to the potential presence of up to six individuals. While definitive conclusions remain challenging, this study shows the value of using strontium isotope analysis and a multi-skeletal sampling method in advancing our understanding of the complexity of cremation practices and the (un)intentional treatment of cremated remains.

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2. The benefits of integrating archaeological and environmental contexts when interpreting strontium isotope and concentration data

The application of strontium isotopes ($^{87}Sr/^{86}Sr$ and $\delta^{88}Sr$) alongside strontium concentrations on cremated human remains provides invaluable information on past human mobility and diet. The interpretation of these data though, always require archaeological and environmental context. By combining isotope ratios and concentration values with existing archaeological evidence of diet and mobility, and an environmental strontium baseline, a fuller picture of human mobility can be seen. This poster will present strontium data from cremated individuals from Gallo-Roman sites in Belgium, such as Ursel Rozenstraat, Huise-Lozer and Waasmunster. Environmental baselines provide an indication of whether an individual or their food sources are local. Archaeological information such as on grave goods, spatial distribution of burials, or grave features, can then be used to provide an indication on an individual life and can be used to interpret the diet or mobility identified with the application of strontium isotope and concentration analysis.

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3. Exploring mobility and cemetery organisation through the strontium analysis of Late Iron Age Cremation Burials from Westhampnett, UK

The adoption of cremation burial during the Late Iron Age in southern Britain (c.150 - AD 43) occurred amidst significant social and cultural change. This period witnessed heightened cross-channel interactions, evident in the parallels in funerary customs between southern England and northeastern France. While numerous Iron Age cremation burials have been excavated, the absence of preserved DNA poses a challenge for determining whether funerary parallels are related to human mobility or broader cultural exchange. To address these questions ($^{87}Sr/^{86}Sr$) isotope analysis was undertaken on 30 cremations from Westhampnett Iron Age cemetery in West Sussex. Westhampnett contained over 150 graves along with associated structures (e.g. pyres, postholes, shrines) (Fitzpatrick 1997) and displays clear spatial organisation. Notably, two groups of graves can be distinguished: an arc of graves to the north of the cemetery, termed the 'inner circle', containing predominantly older adults, and a series of slightly isolated 'focal' graves distinguished by their square or rectangular shape and higher number of grave goods. The Westhampnett isotope results indicate that the cremated individuals most likely lived in the local area in the decade or so prior to their death, challenging previous suggestions drawn from burial treatments and grave goods. Furthermore, no significant isotopic differences were identified according to age, sex or grave type. Our research highlights the potential for using $^{87}Sr/^{86}Sr$ on cremation burials to build a more detailed understanding of Iron Age mobility patterns, connectivity and cemetery organisation.

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4. The first combined $^{87}Sr/^{86}Sr$, $\delta^{88}Sr$, and [Sr] analysis of cremated human remains (Brinjeva gora, north-eastern Slovenia)

Brinjeva gora above Zreče in northeastern Slovenia experienced several phases of inhabitation during the Bronze Age. It reached its zenith in the Late Bronze Age, i.e. the Urnfield period, as the settlement expanded from the southern part of the ridge towards the summit. The site was also occupied during the Early Iron Age, then underwent a considerable hiatus, and saw renewed habitation in the Late Iron Age, with intermittent periods extending to the present day. Situated on a limestone/dolomite ridge with two peaks, the archaeological site commands authority over the hills of Dravinjske gorice and the surrounding lowlands. Brinjeva gora stands out as the sole known hilltop settlement in the broader Pohorsko Podravje region, which was settled in all the phases of the Bronze Age. The associated Urnfield period flat cremation cemetery at Gračič is positioned on the southeastern slope of Brinjeva gora. Notably, the cemetery at Gračič includes 78 graves that have been excavated thus far, although recent geophysical investigations showed that the cemetery was in fact larger and parts of it are still unexcavated.

This study presents results of combined $^{87}Sr/^{86}Sr$, $\delta^{88}Sr$, and [Sr] on cremated human remains from Gračič. The concentrations and isotopic compositions of Sr in bones are directly linked to the human diet. While $^{87}Sr/^{86}Sr$ ratios are acknowledged as powerful proxies for palaeomobility studies, the integration of $\delta^{88}Sr$ values and [Sr] in cremated remains enhances our comprehension of diverse processes related to Sr transfer and assimilation into human tissue. The analysis of $\delta^{88}Sr$ variability in cremated remains is an exciting, novel tool for the study of diet in past populations.

Hannah Leonard[1], Giacomo Capuzzo[2], Amanda Sengeløv[1],Guy De Mulder[3], Koen Deforce[4], Possum Pincé[4], Mathieu Boudin[5], Marine Wojcieszak[5], Philippe Crombé[6], Sophie Verheyden[7], Christian Burlet[7], Isabelle De Groote[8], Philippe Claeys[1], Christophe Snoeck[1]

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5. The Early Adoption of Cremation Practices: $^{87}Sr/^{86}Sr$ Analysis of Cremated Remains in Weelde, Belgium

This study focuses on $^{87}Sr/^{86}Sr$ analysis of cremated remains in Weelde, Belgium as part of the LEAP (LEArning from the Past) project aimed at understanding the impact on Rapid Climate Change events on Belgian prehistory. This site has been radiocarbon dated to the Early and Middle Bronze age and acts as a transition point to cremation as a funerary practice, showing how this was adopted concurrent to inhumation. This site displays distinctive features of both funerary practices beneath

one barrow and includes tree coffins, indications of inhumation, as well as cremations with and without urns.

Isotopically, Weelde displays higher strontium values than local baselines would suggest, asking questions about the identity and location of early cremation adopters near the Meuse Basin and in the Kempen area, their lasting impact, as well as their relationship with the landscape around them.

Through a comparison with neighbouring sites across different Bronze Age phases, knowledge of how funerary practices evolved, and cremation became the dominant practice in Belgium is extended.

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6. FTIR-ATR Study of Human Skeletal Remains from the Tongobriga Necropolis, Portugal (1st century AD)

Tongobriga (Freixo, Portugal) was an Iron Age fortified settlement located in the Tâmega river valley, and then a Roman city when the north-western Iberian Peninsula became part of the Roman Empire. Twelve cremation burials were recovered from the 1st century AD necropolis. This work aims to shed light on the cremation funerary practices linked to Tongobriga by combining anthropological, archaeological, and chemical data. The cremated bone was previously analysed to collect anthropological data about the biological profile of the individuals and the cremation funerary practices involved. Powder samples of bones from distinct anatomic regions, collected from skeletons from 10 different burials (man and woman adults), were analysed by FTIR-ATR, aiming at determining chemical and structural changes induced by the cremation process (*e.g.*, at different temperature conditions and oxygen availability).

Through infrared data, which was compared with spectra previously obtained for modern bones, taken as references, it was concluded that all samples were cremated at temperatures above 700°C. Moreover, some bones from five cremation burials showed infrared signals assigned to cyanamide that were not detected in other samples from the same burial. This presence of cyanamide in cremated bones is still not well explained, its formation being either due to an incomplete burning process of the organic matter (with ammonia free), or to contamination (*e.g.*, calcium cyanamide from agricultural fertilizers). These results are expected to contribute to a better understanding of the cremation practices in one of the most important cities of the Tarraconensis province, during the High Roman Empire.

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7. Strontium isotope analysis of cremated remains from Poljana Križevačka 2: first insights into the mobility of a Croatian Urnfield period population

The site of Poljana Križevačka 2 (Križevci, Koprivničko-križevačka county) is located on the eastern bank of the Glogovnica river, connecting the Drava and the Sava river basins, in Northwestern continental Croatia. Rescue excavations conducted in 2011 uncovered remains dating from the Copper Age to the Middle Ages, including a significant occupation from the end of the Middle Bronze Age to the beginning of the Late Bronze Age. Associated material linked the site to the Virovitica group of the Urnfield Culture, and dates it to the 14-12th centuries BC. Both a settlement and a cemetery were recovered, where 47 out of 50 graves contained cremated remains, among which 8 were radiocarbon dated to the 14th century BC. Thus to this date, Poljana Križevačka 2 is the largest cemetery from the Virovitica group found south of the Drava river, as well as the only cemetery linked to a contemporary settlement. In this study, strontium isotope ($^{87}Sr/^{86}Sr$) and concentration ([Sr]) data is presented for 36 individuals of the cemetery. The goal is to provide first insights into the mobility, life and social dynamics of a Late Bronze Age community in this area, as it is the first study of this sort to be undertaken in Croatia. Sr data from plants collected around the area are also presented, to contextualize human data and form part of the construction of a bioavailable Sr isoscape for continental Croatia.

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8. Matrix-Matched Standards for Trace Element and Isotopic Analysis of Cremated Remains

Robust quality control (QC) measures for elemental and isotopic analyses requires use of suitable standards. This is critical not only to ensure validity of data, but also for acceptance in legal settings and comparisons across datasets. Best practices call for standards that mimic the elemental and isotopic composition of samples, known as matrix-matched standards. One of the most common standard reference materials (SRM) for strontium isotope analysis of bone is SRM 987 ($SrCO_3$). However, pure $SrCO_3$ varies significantly from the complex matrix of calcined bone. NIST-1400 (Bone Ash from a cow) is a commercially available standard with a certificate of analysis for some elemental concentrations, but not for isotope ratio values. However, many labs report measurements of NIST-1400 as a working standard for isotopic analysis. While NIST-1400 approximates the matrix of human cremains, the Bone Ash is made from cow bone and is not an exact matrix-match. Our lab received a set of human cremains, JWS, that were donated specifically to be used as a standard. JWS more closely matches a small set of modern cremated remains compared to NIST 1400: human cremains (n= 5) Ca/Sr: 2654 ± 132; JWS (n = 15) Ca/Sr: 2238 ± 90; NIST-1400 (n = 16) Ca/Sr: 1573 ± 69 (all 1SD). JWS serves as both an analytical and a process matrix-matched standard for isotopic and elemental analysis of cremated remains. However, NIST-1400 and SRM 987 are also included in routine workflow for additional QC measures in our laboratory.

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9. Preliminary results of the mobility analysis in the Hallstatt period bi-ritual cemetery at Modřice, Czech Republic

A Hallstatt period bi-ritual cemetery was excavated at Modřice in South Moravia (Czech Republic). Using strontium isotope analysis, the mobility of 48 individuals buried therein has been examined so far. The dataset consists of 24 tooth enamel samples from the skeletal burials and 24 calcined long bone fragments. The preliminary results suggest high mobility especially among elites and individuals with a presumed religious role, as well as craftsman, with possible links to the areas of today's Germany and Austria, as suggested by the character of the accompanying grave goods.

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10. Mobility and social relationships in the cremation necropolis of Borgo Panigale (Bologna, 9th century BCE)

The necropolis of Borgo Panigale (Bologna, Italy) is a large cremation site located in the north-west area of Bologna. It was in use during the Early Iron Age, during the Villanovan phase I and II (9th century BC E and includes almost 200 urn cremations. The interdisciplinary analysis of material culture and human remains allows for the reconstruction of several aspects related to social structure and funerary ideology. The evidence indicates a community without complex internal social stratifications, organized along the lines of extended families. However, the presence of male individuals with razors and female individuals with amber elements suggest differentiated roles, possibly related to different social positions. Furthermore, the funeral rite is intrinsically complex, as confirmed by the use of various types of ossuaries and the practice of dressing the cinerary urn for a symbolic representation of the human body. The presence of a high percentage of infants, also under the 2 years of age, suggests the high degree of social inclusiveness of the cemetery and ritual norms. $^{87}Sr/^{86}Sr$ isotope analyses were conducted on 30 individuals' petrous bones and indicate that some individuals were non-indigenous. While male individuals tend to show isotope signatures that are more consistent with the local environment, female individuals fall into a wider range and, in some cases, seem to originate in the broader hinterland, or to more distant areas. The data suggest a tendency to patrilocality and, to some extent, female exogamy. The study addresses one of the key historical inquiries regarding the mobility dynamics of Italy during the first millennium BCE and presents new data on the origins of the Villanovans in Etruria Padana.

Poster Session 2 (Friday)

11. **Giampaolo Piga**, Transformation processes and decomposition of burned human bones after high temperature
12. **Serena Vitri**, Necropoli della prima età del ferro"del Dominu". Rituale e composizione dei resti del rogo funebre / Early Iron Age necropolis "del Dominu". Burial rite and composition of cremated remains
13. **Katarina Hladikova**, Navigating the Flames: Comparative Analysis of Cremation Practices in the Roman and Early Medieval Periods at Gbely-Kojatín, Slovakia
14. **Marianna Porta**, Pyre charcoal analysis from the Bronze Age cremation cemetery of Torre Guaceto (Apulia)
15. **Elisavet Stamataki**, The seasonality experiment: Investigating how the season and weather conditions affect pyrotechnology and cremation process
16. **Zofia Arcab**, Unraveling the Enigma of Cremation Diversity: Exploring Funeral Practices at the XXI Site in Czerwony Dwór
17. **Nicola Pollon**, A Burial Cluster from the Iron Age Necropolis of Palazzo Emo Capodilista-Tabacchi (Padova). Research Workflow and Aspects of the Cremation Ritual
18. **Claudio Cavazzuti**, The Late Bronze Age cremation cemetery of Gubbio (Umbria, Italy): preliminary results of CT scans, micro-excavation, restoration, osteological and archaeological
19. **Saša Kovačević**, Cremation Funerary Practices: Insights from the Drava River Valley

Giampaolo Piga[1], Fabio Cavalli[2], Eugénia Cunha[3], Stefano Enzo[4], Michele Guirguis[1], David Gonçalves[3,5,6]

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11. Transformation processes and decomposition of burned human bones after high temperature

Experiments in controlled environments can highlight some qualitative aspects and contribute to understanding the causes and effects of the various pre-combustion factors, but nevertheless they have the limitation of not always being able to return reliable quantitative values, as they cannot replicate all variables that come into play in the combustion process. The observation of commercial crematorium samples and archaeological cremations are therefore complementary to controlled experiments. In this study, 105 human samples (46 from crematorium, 37 from controlled experiments and 22 from archaeological cremations) were analyzed using powder X-ray powder diffraction (XRD) and infrared spectroscopy in attenuated total reflectance (ATR-IR) to highlight possible chemico-physical differences, in terms of mineralogical phases, crystallinity and spectral properties.

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12. Montereale Valcellina (PN, Italia), Early Iron Age necropolis "*del Dominu*". Burial rite and composition of cremated remains

The small cremation necropolis, excavated in the 1980s, shows some peculiarities in the treatment and deposition of the cremated remains. The poster presents some results of the re-examination of the excavation data, of recent analyzes on cremated human bones and on the charcoal contained in the grave pits.

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13. Navigating the Flames: Comparative Analysis of Cremation Practices in the Roman and Early Medieval Periods at Gbely-Kojatín (SK) and Přítluky (CZ)

Cremation emerged as the predominant funerary practice in the Middle Danube region during the Roman period (1st–4th century AD) in Barbaricum and resurged at the onset of the Early Medieval Period (7th–8th century AD). The Gbely-Kojatín site in southwestern Slovakia represents a poly-cultural site, documenting burial grounds from both these historical periods. By using histotaphonomic analysis, Fourier transform infrared spectroscopy, and carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotope analysis on skeletal samples from cremation graves in both the Roman and the Early Medieval burial grounds, we examined the temperature intensity, fuel composition, type, and quantity used during cremation. The aim of this research is to investigate and compare the differences in cremation practices between the Roman Period and the Early Medieval period at the Gbely-Kojatín site in Slovakia. Our focus is specifically on comprehending the technology of the cremation process.

Marianna Porta[1], Girolamo Fiorentino[1], Teodoro Scarano[1]
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14. "Di quella pira l'orrendo foco, tutte le fibre m'arse avvampnˇ!" Pyre charcoal analysis from the Bronze Age cremation cemetery of Torre Guaceto (Apulia)

The Torre Guaceto protohistoric cremation necropolis is located in the namesake State Natural Reserve and Marine Protected Area near Brindisi (Apulia, Southern Italy). The investigations carried out by the University of Salento, in collaboration with the University of Bologna, from 2021 to 2023, allowed the documentation of approximately 60 tombs dating from the Middle Bronze Age 3 to the Final Bronze Age (mid-15th to 11th century BCE). We present the preliminary results of the anthracological analysis carried out on an initial dataset of 10 tombs. This work aims to recognize the dynamics of the exploitation of vegetal resources in a specific functional context. Charcoal remains, in fact, represent the material outcome of the preparation of funeral pyres and the deposition of cremations. The selection of plants, in relation to the technological properties of wood and its symbolic and ritual value, as well as the choices of timber procurement, allows for an open interpretation of the availability of wood resources and the dynamics of supply, transport, and possible storage of wood functional for use in the funerary practices of the cremation necropolis.

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15. The seasonality experiment: Investigating how the season and weather conditions affect pyrotechnology and cremation process

The study of cremated bones is challenging due to the high temperatures (up to 1000°C) reached during combustion. The burning at high temperatures causes significant structural, chemical, and isotopic changes in the inorganic fraction of bone (bone apatite). However, recent developments in Infrared Spectroscopy and carbon and oxygen isotope analysis indicate that the study of burnt bones provides important information regarding pyre technology and body management in ancient societies. In combination with analytical techniques, experimental archaeology through the reconstruction of funerary pyres also contributes to increasing our knowledge regarding the effect of fire on the human body and the thermal decomposition of skeletal remains.

This study aims to investigate how seasonality and weather conditions affect the way cremation was performed in past societies by combining experimental archaeology and stateof-the-art analytical techniques. For this reason, the four legs of a pig were burned in four outdoor pyres. Each leg was burned in a different season (winter, spring, summer, and autumn) in the same location and using the same type and amount of fuel and the same pyre structure. The infrared and isotopic results of the experimentally burned bones indicate that the weather conditions and the season where cremation takes place influence the way cremation is performed. For example, humidity seems to affect the temperature reached during burning with the spring season to present the highest humidity (75%) and the highest average pyre temperature during burning (647°C).

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16. Unraveling the Enigma of Cremation Diversity: Exploring Funeral Practices at the XXI Site in Czerwony Dwór

The site XXI in Czerwony Dwór, situated in northeastern Poland within the Puszcza Borecka forest (formerly known as Borkener Forst), is a necropolis associated with the Gołdap Group, part of the Sudowska culture (Migration Period). The site consists of numerous burial mounds, with a minimum documented count of 35-40 instances, as well as other funerary structures.

All interments at this site encompass cremated human remains, but the diversity in grave forms is striking. The graves can be categorized into distinct types, including single and multiple burials, flat graves, and already mentioned burial mounds. The burials often contain urns but others do not, and some show possible remnants of organic containers. The grave structures include other elements like the presence of stone pavements.

These elements mingle in diverse combinations, reflecting a spectrum of funeral customs that evolved over a span of 400 years, during which this cremation cemetery remained in constant use. This poster presents the temporal and spatial distribution of these distinctive grave characteristics, aiming to provide insights into the factors underlying such pronounced variability within a single cremation cemetery.

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17. A Burial Cluster from the Iron Age Necropolis of Palazzo Emo Capodilista-Tabacchi (Padova). Research Workflow and Aspects of the Cremation Ritual

The necropolis of Palazzo Emo Capodilista-Tabacchi, situated in the modern city of Padova, stands as one of the most extensive Iron Age funerary sites in Veneto, northeastern Italy. Since its discovery in 2002, research contributions have explored the interplay between inhumations and cremations, the analysis of perishable burial structures, and the archaeobotanical remains within pyre debris. Despite comprehensive examination and publication of early phases (9th to mid-8th century BCE), a substantial portion of graves awaits analytical investigation. As part of an ongoing project led by Giovanna Gamabacurta (University of Venice) focusing on the systematic study of Padova's necropolises, this research examined 16 cremations and one inhumation burial located in the northwestern area, dating between the 8th and 7th centuries BCE. The poster outlines the workflow, archaeological, and osteological methodology employed in the study. Within the examined burial group, a distinct cluster of 3 cremation burials has been selected for presentation. The group likely represents a nuclear family, formed by an adult male (grave 339), an adult female (grave 337), and a juvenile individual (grave 338). This sample also illustrates recurring aspects of the cremation ritual in the necropolis, including rather low and uneven combustion temperatures (ca. 450-700°C) and diverse burial structures (simple pit, wooden box, circular cist/barrel) linked to varying treatments of redeposited pyre debris. The choice of the grave goods reflects different gender identities and affirms interpersonal ties. Moreover, the presence of a unique bronze fibula with a monkey-shaped application on the bow in grave 337 confirms the trans-regional networks of Padova with the Villanovan centres of Bologna and Verucchio during the Orientalizing period.

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18. The Late Bronze Age cremation cemetery of Gubbio (Umbria, Italy): preliminary results of CT scans, micro-excavation, restoration, osteological and archaeological analysis

The 2013 rescue excavation carried out in the centre of Gubbio (Umbria, Italy) yielded 40 urn cremations that were probably part of a larger urnfield dated at the end of the Bronze Age (mid-12th-10th century BCE). After the fieldwork, we performed CT scan of 30 urns, which subsequently guided the micro-excavations that were carried out at the Restoration Laboratory of the History and Culture Department of the University of Bologna. Human bones and bronze grave goods were accurately collected and analysed at a macroscopic level; urns and lids were then subjected to preservation and restoration process, which allowed a first chrono-typological assessment of the context.

Bone chromatism ranges from blu/grey to white-calcined, with the typical fractures, shrinkage, and modification of the medium and high-temperature cremations. The weight of bones ranges from 240 g (infant) to 1183 g (adult male). Urns contain only one individual, and no traces of pyre debris, which is also absent from the pits. This probably means that bones were collected from the *ustrinum* and washed to remove charcoal and other residuals before the final deposition in the ossuary. Bones were deposed in anatomical sequence, with the skull fragments on top of the assemblage,

sometimes with bronze grave goods, mostly female ornaments. We observed the presence of adults of both sexes and subadults, which indicate the high degree of inclusivity of the Late Bronze Age urnfields in the Italian context.

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19. Cremation Funerary Practices: Insights from the Drava River Valley

On the south edge of the Drava River valley, East of Varaždin in NW Croatia, lies an archaeological landscape with two large burial mounds. One is in Jalžabet and another in nearby Martijanec. Scientific analysis of the Early Iron Age in northern Croatia started exactly here, after the Second World War. In recent years, after a robbery was discovered, the Institute of Archaeology in Zagreb has conducted a rescue excavation of the big burial mound Gomila in Jalžabet (2017-2021). In previous decades, two smaller burial mounds – Gamulica in Martijanec and burial mound 2 in Jalžabet – have been researched. All burial mounds contained cremation burials and can be attributed to the Eastern Hallstatt culture. In my talk, I will try to analyze new data and compare them to the old ones. Through this comparative approach, I'll try to address the challenges and gain deeper insights into the complex cremation funerary practices that were prevalent over 2500 years ago in this corner of the Hallstatt world.