Sessione

Antropologia dello Scheletro e Bioarcheologia

poster

Social Support and Disability after Trauma: an Early Medieval case study from the Villa dei Mosaici di Negrar di Valpolicella (Verona)

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The bioarchaeology of care is an anthropological framework that examines past healthcare behaviors through evidence of disease, trauma, and disability preserved in human skeletal remains. It offers insights into the social structures, cultural values, and caregiving practices of ancient communities, highlighting how societies responded to vulnerability and supported individuals with chronic conditions or impairments. In this study, we applied the bioarchaeology of care approach to the skeletal remains from a single primary burial (tb. 7), uncovered during recent archaeological excavations (2018–2022) at the Villa dei Mosaici di Negrar di Valpolicella (VR, 4th c. AD). The burial, along with the others, is dated to the villa's reoccupation phase (mid-7th c. AD) following its abandonment, and contained the remains of mature adult female who had sustained a severe fracture to the neck of the right femur. Likely caused by a fall, the fracture healed at an unnatural angle, leading to significant changes in bone morphology and structure.
To assess the impact of the trauma and infer aspects of community care, we conducted a biomechanical analysis of the lower limbs. Maximum and biomechanical measurements were taken, and cross-sectional data at midshaft were extracted from 3D models of both femora and tibiae. Femoral asymmetry in torsional moment (J) and total area (TA) was calculated and expressed as absolute, non-directional asymmetry. The right femur shows a 5.25% reduction in TA and 10.25% in J compared to the left, likely reflecting reduced loading on the right limb and compensatory overloading on the left during standing and walking. No such asymmetry is observed in the tibiae.
The trauma, along with secondary structural changes to the right acetabulum and lower lumbar vertebrae, undoubtedly impaired her gait. The lack of effective medical care likely led to a permanent disability, causing intense pain during and after the healing process. Nevertheless, the complete healing of the fracture suggests sustained care and community support, extending even into the post-recovery phase. This is further supported by dietary isotope values, which show no significant differences in her nutritional intake compared to other adults at the site. Notably, however, she is the only individual buried with personal ornaments—three metal Lombard-style armillae still on her forearms—possibly indicating a distinct social status or underlining her uniqueness within the community.

Dental pathologies and dietary patterns in prehistoric Sardinia: analysis of the specimens from Cuccuru Is Arrius (Cabras), San Benedetto (Iglesias), and Santa Caterina di Pittinuri (Cuglieri)

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The spread of farming and the agricultural intensification across Europe are key features of the Neolithic, implying significant transformations in dietary habits, daily practices, and broader lifestyle patterns.
This study aims at understanding dietary patterns and resource exploitation from the Middle Neolithic to the onset of the Copper Age in Sardinia. Data from continental areas suggest a linear trend of agricultural intensification, while environmental conditions in Sardinia may have generated a distinct developmental trajectory of the production economy.
The archaeological record suggests that on the island plant domestication progressed more rapidly in soft-soil, lowland areas near water sources, while other territories remained more dependent on mixed forms of subsistence.
Oral health serves as a key indicator for subsistence strategies, environmental interactions and social organization. It is expected that caries and calculus will increase with greater reliance on cereals as staple resource due to higher sugar intake, whereas a meat-based diet is expected to correlate with greater occlusal wear, alveolar resorption, and antemortem tooth loss due to masticatory stress.
This study tests the scenarios using oral health in three chronologically spanning samples (Cuccuru Is Arrius for Middle Neolithic, San Benedetto for Late Neolithic, and Santa Caterina di Pittinuri for Copper Age).
The examined dental remains include both in alveoli and scattered teeth. The recorded pathologies comprise carious lesions, dental calculus, dental wear, enamel hypoplasia, periapical abscesses,alveolar bone resorption, antemortem tooth loss, and chipping. The results will be contextualized within the framework of previous isotopic analyses, which indicate differential dietary patterns:Cuccuru Is Arrius exhibits evidence of marine resource exploitation, San Benedetto shows a predominance of swine and ruminant consumption, while Santa Caterina di Pittinuri is characterized by a legume-based diet with lower reliance on bush meat.
The analysis conducted so far reveal a slight increase in caries, AMTL, and calculus over time, which is coherent with increased reliance on cereal as a staple food. However, statistical significance is seldom reached, probably due to sample size. Forthcoming analysis will take into account age at death of the individuals under exam, which can significantly bias the results.

Sexual Dimorphism in the Human Cranium: Morphometric Evidence from the Sambaqui Site of Encosta da Lagoa (Brazil)

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Although Homo sapiens shows relatively low sexual dimorphism compared to other species, it still presents notable intraspecific variability, influenced by factors such as diet, ancestry, health, and genetics. Previous research demonstrates that sex estimation methods tend to perform well in population-specific contexts, but their accuracy often decreases in cross-population analyses. Therefore, case studies focused on well-defined populations offer valuable insight into patterns of sexual dimorphism. The Encosta da Lagoa site, located in
Garopaba, Santa Catarina, Brazil, provides a meaningful context for such investigation. Situated 2.2 km inland, the site covers 2,794 m^2 and is associated with the sambaqui tradition, shell-mound funerary
structures typical of coastal hunter-gatherer societies in South America, dated between 7,500 and 1,500 BP.
These communities relied heavily on fishing and shellfish gathering. The site includes a minimum number of individuals (MNI) of 23, including 18 subadults, with both sexes represented. This study aims to explore
sexual dimorphism in this population and to develop preliminary hypotheses about morphological variation patterns. A virtual anthropology approach was applied using geometric morphometrics. Crania of adults were digitized via medical CT scans, with 50 anatomical landmarks and a patch of 1,000 semilandmarks collected.
Comparative data from Indigenous South American individuals housed at the Museo de La Plata (Buenos Aires, Argentina) were also analyzed. Geometric morphometric analysis was performed in both shape and form space. Landmark variation was assessed using Generalized Procrustes Analysis (GPA), followed by Principal Component Analysis (PCA). Classification accuracy was evaluated through Linear Discriminant Analysis (LDA). Results confirm higher accuracy in sex estimation within single populations. The most dimorphic features remain consistent with global findings, with the frontal bone, glabella, mastoid processes, and the entire cranium ranking highest in discriminatory power.

The Roman Conquest and the Epidemiological Transition in Italic Populations of the Abruzzo Region: preliminary data

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The Roman conquest of central-southern Italy marked a turning point not only in the political and cultural landscape of Italic populations, but likely also in their health and disease patterns. This study aims to explore the epidemiological transition potentially associated with the Roman annexation, focusing on skeletal populations from two Abruzzese necropolises: Opi Val Fondillo (4th–5th century BCE, pre-Roman period) and Bazzano (mainly Classical period, Roman era).
A total of 205 individuals from Bazzano and 122 from Opi were examined using standard paleopathological protocols, with particular attention to trauma, degenerative joint diseases, infections, congenital anomalies, and metabolic stress markers. Dental and non-dental alterations were recorded separately for the Opi assemblage.
Preliminary results reveal distinct pathological profiles. In Bazzano, 45 probable non-dental infections (22%), 62 cases of joint disease (30%), 26 traumas (13%), 14 congenital anomalies (7%), 16 metabolic stress markers (8%), and 5 tumors (2%) were identified. In Opi, 70 individuals (57%) presented joint alterations, with 13 traumas (11%), 10 infections (8%), 5 tumors (4%), 8 stress indicators (7%), and 9 congenital anomalies (7%). Dental analysis in Opi revealed 45 cases of caries, 30 antemortem tooth losses, 37 severe wear cases, and 11 periodontal lesions, among other findings.
Compared to Opi, the Bazzano sample shows a higher frequency of non-dental infections (22% vs 8%) and trauma (13% vs 11%), while degenerative joint disease appears more prevalent in Opi (57% vs 30%). These differences may reflect shifting workloads, environmental exposures, and lifestyle changes following Roman integration. However, variations in preservation and diagnostic consistency must be considered.
These initial findings suggest a potential epidemiological transition during the Romanization of central Italy. Ongoing analysis, including forthcoming data from Sulmona and Alfedena, will provide a more robust framework for interpreting these health trends in their historical and socio-economic context.

Directional Limb Asymmetries and Lifestyle: A Diachronic Analysis of Three Pre-Industrial Populations from the Abruzzo Region (Central Italy)

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Humans are known to exhibit a certain degree of limb asymmetry, partly due to genotypic and phenotypic variability (fluctuating asymmetry), but more significantly as a result of lifestyle and preferential limb use over the course of life (directional asymmetry). Previous studies have reported a general population-level pattern of right-sided upper limb and left-sided lower limb dominance, although this may vary according to daily activities. This study aims to evaluate the degree of directional asymmetry in three populations from Abruzzo (central Italy), spanning different historical periods and subsistence strategies, in order to assess changes in the degree and pattern of asymmetry over time and in relation to lifestyle.

Thirty sagittal and transverse dimensions were recorded from paired humeri, radii, ulnae, femora, tibiae, and fibulae in adult individuals from Opi – Val Fondillo (Bronze Age, hunter-gatherers, 59 individuals), Sulmona – Contrada Santa Lucia (Classical Age, quarry workers, 49 individuals), and Teramo – Sant'Anna (Medieval Age, craftsmen, 38 individuals). Directional asymmetry (%DA) was calculated for each measurement and statistically compared both within and between populations. Population-level handedness was also assessed.

As expected, greater asymmetry favoring the right upper and left lower limbs was observed in the more ancient populations with more physically demanding lifestyles. Statistically significant asymmetries were found not only in transverse dimensions (related to muscular development) but also in sagittal ones, suggesting that intense physical activity began during skeletal development. In contrast, the more recent and sedentary Teramo population showed lower asymmetry (limited to right-side dominance) and a largely symmetrical skeleton in 18 out of 30 measurements.

These findings indicate that right upper limb dominance remained consistent over time and across subsistence strategies, whereas left lower limb dominance appears more influenced by lifestyle and environmental factors. Overall, the observed reduction in limb asymmetry over time reflects broader changes in lifestyle and physical labor, particularly the shift from natural/rural to urban environments and from dynamic, labor-intensive activities to more sedentary and evenly distributed ones.

Keywords: Directional asymmetry, limb dominance, handedness, Abruzzo, skeletal anthropology, lifestyle

"Di là dal fiume e tra gli alberi": Tomb 1 of Guardamiglio (Lodi, Lombardy) and its Topographical and Anthropological Context

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The Lower Lodigiano region, delimited by the Lambro, Po, and Adda rivers, presents a landscape shaped by fluvial action.
The Guardamiglio area is situated within the Po's meandering zone. Despite the presence of toponyms suggesting crossings and settlements linked to the hydrographic environment, archaeological evidence is scarce and primarily associated with preventative and emergency archaeology interventions. Indeed, the objective of this study is to present the results of the archaeological assistance conducted during the works for a gas pipeline, which brought to light funerary evidence, designated as Tomb 1.
The archaeological investigation, in the locality of Foppa, was conducted under the scientific supervision of the "Soprintendenza Archeologica, Belle Arti e Paesaggio per le province di Cremona, Mantova e Lodi". Through continuous monitoring along the gas pipeline's route, the average depth of the excavations reached -2.00 m below the modern ground surface, with deeper probes in specific locations. The discovery of anthropogenic evidence, concentrated in a single area, necessitated the opening of two trenches for the stratigraphic excavation of the inhumation and the documentation of adjacent features and finds.
Tomb 1 is an inhumation in a simple pit, oriented NW-SE. The individual is deposited supine with hands placed on the pubis. In the vicinity of the burial, other anthropogenic traces were identified, including cuts in the ground with carbonaceous fills, a possible posthole, and a feature interpretable as a ditch or channel.
The discovery of Tomb 1 and the associated features suggests a frequentation of the territory, possibly aimed at the seasonal exploitation of resources during periods of fluvial low water. In these periods, it is plausible to hypothesize a co-presence of spaces designated for craft activities and funerary use, generally assignable to the period between Late Antiquity and the Early Middle Ages.
Analysis of the recovered materials, in collaboration with the facilities provided by the Comune di Somaglia, particularly the steatite (pietra ollare), and the definition of the biological profile of the buried individual will provide elements for a better understanding of the populations who inhabited this territory and their interactions with a dynamic fluvial environment, integrating archaeological and anthropological data with historical and toponymastic information.

Nuraghe Su Angiu: a bioarchaeological perspective

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The reuse of earlier monumental structures is a widespread phenomenon in archaeology, reflecting diverse cultural practices across time. The motivations for such reuse remain uncertain, ranging from pragmatic to culturally symbolic. While cultural memory and the reappropriation of ancestral landscapes may often play a role, reuse frequently stemmed from practical and opportunistic motivations. Existing structures offered readily available, durable architecture, typically located in strategically or topographically favorable positions. Their material and spatial features made them suitable for various secondary uses – whether funerary, ritual, living, or military – resulting in complex palimpsests of activity.

In Sardinia, Nuragic architecture was often repeatedly reutilized from protohistory into the historical period. This study examines the Bronze Age quadrilobate Nuraghe "Su Angiu," near Mandas (SU), which was incorporated into a settlement that remained active at least until the fourth or fifth century AD. The reuse analyzed here is an episode of funerary use that pertains to the Sardinian Byzantine Era, which spans the 6th to 9th centuries AD. Excavations conducted from 2023 to the present have led to the recovery of commingled remains, archaeologically dated to the 8th century AD.

The evaluation of the osteological remains conducted thus far has determined that they belong to a minimum of ten individuals, who were apparently primarily buried in the Nuragic structure and heavily disturbed by later human activities. The assemblage includes both sexes, age spanning from young adult to mature. Macroscopic and microscopic analyses have evidenced the presence of healed cranial trauma, rare morphological variants (cervical ribs), and erosive and proliferative bony reactions compatible with systemic inflammation, possibly tuberculosis or brucellosis. A detailed differential diagnosis and systematic evaluation of these results will aid in reconstructing the osteobiographies and health status of the buried individuals.

Through detailed taphonomic and thanatological analyses, this study aims at contributing to our knowledge of Byzantine mortuary practices in Sardinia, focusing – through a bioarchaeological perspective – on how communities engaged with prominent monuments in the landscape – how these were perceived, repurposed, and assigned new functions – within a broader context of social, political, and economic instability and reorganization on the island.

Evaluating methodological consistency between metric and non-metric dental traits: a comparative approach

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In anthropology, the study of metric and non-metric traits is a key element in understanding biological relationships among ancient populations, their migration dynamics, human evolution, and genetic variability. Although qualitative and quantitative morphological traits are commonly analysed separately, owing to their differing nature and the distinct statistical approaches required, assessing their methodological congruence is critical to quantifying the biological distance between the populations analysed.
In this study, we analysed the coherence between metric and non-metric dental data from the Terramare necropolises in the Verona area, dating from the Bronze Age (c. 1500–1000 BC). Metric features were analysed using the Mahalanobis distance, which takes into account inter-variable covariance, while non-metric features, coded as binary presence/absence data, were analysed using the Gower coefficient, a method suitable for comparing different types of data.
We tested several analytical scenarios: (1) individuals grouped by site, and (2) individuals treated as separate units regardless of group affiliation. Although the strength and significance of the correlation varied between the scenarios, the overall results suggest a significant degree of convergence between the two types of data. Non-Metric Multidimensional Scaling (NMDS) visualisations further supported this pattern by revealing comparable clustering trends across datasets.
These results support the value of integrating metric and non-metric traits in bioarchaeological research, demonstrating that, under appropriate conditions, both can reflect comparable signals of population structures, despite differences in data type and measurement scale. This convergence highlights the potential of integrated approaches for reconstructing ancient biological relationships, especially in cases where only one type of morphological data is available. The combined use of Mahalanobis and Gower distances, complemented by the Mantel test, provides a robust and flexible framework for assessing methodological reliability in biodistance studies.

Paleoradiological and paleopathological investigations of Paolo Gorini's embalmed non-adult mummies (19th Century CE, Lodi, Lombardy, Italy)

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The scientific investigation of mummified and embalmed human remains has long been a cornerstone of bioarchaeological and paleopathological research, with significant methodological advances in recent decades. Within this field, the study of non-adult individuals is particularly important, as children's remains serve as critical indicators of population health, environmental factors, and maternal well-being. However, embalmed child mummies are rare, limiting our understanding of their preservation and diagnostic potential. This research focuses on five non-adult mummies embalmed using the petrification method pioneered by Paolo Gorini in 19th-century Italy. These individuals were analyzed using conventional radiography for the first time, enabling a comprehensive evaluation of the strengths and constraints of this technique when applied to petrified specimens. In parallel, both macroscopic and microscopic assessments were conducted on preserved skin to assess possible insect activity and postmortem changes. The results provide new perspectives on Gorini's embalming technique, particularly its implementation on juvenile bodies—a subject previously known primarily through physical specimens and scant archival notes. Radiographic evidence further revealed how Gorini may have adapted his methods in response to difficult cases. In addition, the skeletal analysis of these individuals offered crucial paleobiological data, including signs of developmental disruption probably consistent with vitamin D deficiency, shedding light on both embalming practice and the health profiles of these young subjects.

Bioarchaeological investigation of the remains of Blessed Bartolomeo Aiutamicristo (†1224): insights from a Canonical Reconnaissance

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The canonical reconnaissance of saints and blesseds of the Catholic Church offers a rare opportunity to examine ancient human remains, enabling multidisciplinary bioarchaeological research. This study focuses on the remains of Blessed Bartolomeo Aiutamicristo (†1224), a Camaldolese monk from a noble Pisan family, whose body has been preserved in the Church of San Frediano in Pisa. Initially kept beneath an altar, his remains were partially damaged in a fire in 1675, then reassembled and returned to public veneration between the late 18th and early 19th centuries.
In 2025, a canonical reconnaissance enabled the reconstruction of the biological profile of the individual through a multidisciplinary approach integrating macroscopic analysis, radiological imaging, stable isotope analysis, and dental calculus examination. Sex estimation based on cranial and pelvic morphology confirmed the individual as male, aged over 50 years at death, with a stature of 157 cm. The skeleton displayed robust muscle attachment sites, indicative of an active lifestyle. Paleopathological evidence included extensive dental disease, bilateral shoulder osteoarthritis, and vertebral degeneration.
Analysis of dental calculus revealed fragments of animal tissue associated with diet (possibly fish or meat), along with a variety of plant-derived elements that may be linked not only to dietary habits but also to living conditions. Stable isotope data confirmed a protein-rich diet derived from various sources, including meat, fish, and plants.
The body was found to be entirely skeletonized, with the bones reassembled in anatomical position. Notably, wooden replicas of several bones—including the right humerus and tibia, left patella and fibula, and multiple phalanges—replaced elements likely destroyed in the 1675 fire, as suggested by blackened skeletal fragments. These anatomically accurate replicas, along with the precise arrangement of the skeleton using wires and gauze, indicate the involvement of anatomists, possibly from the circle of Giovanni Paolo Mascagni (1755–1815), professor of Anatomy in Pisa.
This case study demonstrates the anthropological value of canonical recognitions, which, although rooted in religious tradition, offer unique opportunities for the investigation of individuals who occupied significant historical and cultural roles, contributing not only to the study of past human biology, but also to the interpretation of ritual, identity, and memory in Christian Europe.

Case of medieval cranial trephination in Siena

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At the end of March 2023, during the construction and operation of a low voltage power line along the itinerary of the Via Francigena, two tombs were brought to light at the church of SS. Vincenzo and Anastasio, in the quarter of Camollia, in Siena. From a historical point of view and in relation to the development of the pieve, the tombs can be dated back between 1087 and 1141 AD. The subject of this paper is the individual found inside the tomb 1. Sex determination was assessed by analysing the dimorphic traits of skull and pelvis; age at death was estimated through the degenerative changes on the articular surfaces of the first ribs and pelvis. Stature and body mass of the individual were calculated from the maximum length of the diaphysis and the head diameter of both femurs, respectively. For this reason, the individual of tomb 1is probably referred as and adult male with an age at death ranging between 35-50 years old, with a best point of 43 years. The analysis of body proportion yielded a stature of approximately 170 cm and a body mass of 68 kg, while the analysis of enthesis revealed a particular muscular strength in the distal elements of upper and lower limbs. The presence of specifical osteological traits found on the femurs and pelvis would suggest that the individual, during his lifetime, regularly practised horse-riding. A careful analysis of the cranial morphology has highlighted a regular bone opening of 2 cm x 2 cm located on the left fronto-parietal position, probably due to a trephination. The drill injury was analysed by computed tomography scan (CT scan). Inside and slightly below the hole there is a bony disc that was probably re-implanted; the bone remodelling surrounding the lesion indicates that the individual would have survived some time after the operation.

The Mystery of the Haifa Tomb: Analysis of the inhumates recovered from a hidden crypt of the San Paolo Church, Ferrara.

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In July 2023, a frescoed crypt containing numerous human skeletal remains was discovered during the renovation of the 16 th -18 th century Church of San Paolo in Ferrara, which provided an unexpected insight into early modern funerary customs. This study aims to investigate the biological and cultural features of the human remains found in the crypt, combining the archaeological context with anthropological and archaeo-entomological analyses.
The research involved the recovery and examination of human skeletal remains found in primary and secondary deposition. A combination of morphological and metric methods was employed to estimate sex, age at death, and stature. The materials were also examined for the presence of pathological lesion and taphonomic changes. An archaeo-entomological analysis was conducted to identify insect species associated with the stages of decomposition, which provided additional data on burial conditions and seasonal dynamics.
The skeletal assemblage is characterized by significant fragmentation and variable preservation, with evidence of both adult and subadult individuals.
The data obtained through this multidisciplinary analysis suggest a primary deposition with repeated use and reopening of the crypt over time, indicating a complex and dynamic use of space.
This interdisciplinary approach seeks to address issues of identity, social status and ritual in post-medieval Ferrara. The crypt is thus shown to be not only a burial space, but also a narrative fragment of a forgotten social and cultural landscape.

Functional Stress and Adaptations of the Cervical Vertebrae in Ancient Samples from Sicily: A Study on the Odontoid Process

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This study investigates the morphology and variability of the odontoid process of the second cervical vertebra (axis), a crucial element for the biomechanics of the atlantoaxial joint, in two ancient osteological samples from the Sicilian necropolises of "Ponte della Paolina" (Early Bronze Age) and Baucina (Archaic Age).
The primary objective is to document intra- and inter-population morphological variability and to evaluate possible correlations with functional stress or biomechanical adaptations related to occupational activities.
Methodology integrated osteological techniques, three-dimensional imaging, and radiological analysis. Thirty C2 vertebrae analyzed using 3D scanners, digital X-rays (clinical dentistry), supported by software for statistical analysis. Measurements: height, diameter, and width of the odontoid process; dimensions of vertebral body and articular facets. Morphological analysis identified variants (dens rectilineus, retroflexed, "crown-shaped"), and evaluated osteophytic alterations. Preliminary results indicate greater variability in odontoid process measurements in the Ponte della Paolina population compared to Baucina, with slightly higher average values in some dimensions. A higher incidence of osteophytic alterations was observed in the Ponte della Paolina remains, and a prevalence of retroflexed configurations in those from Baucina.
These morphometric differences and the observed association between the "crown-shaped" morphology and signs attributable to chronic cervical functional stress suggest potential mechanical adaptations to specific occupational loads. It is hypothesized that activities such as carrying weights or grinding may have influenced dens morphology. The morphometric variations of the dens appear not merely as anomalies but as potential reflections of adaptive strategies, functional stress, and possible hereditary traits.
This study highlights the effectiveness of an integrated multidisciplinary approach for the functional and evolutionary interpretation of the cranio-cervical region in archaeological contexts. The incorporation of advanced digital and forensic dentistry devices, such as oral scanners and dental X-ray machines, has proven invaluable, offering precise measurements and detailed imaging that enhance our understanding of historical human adaptations. This opens new perspectives for future insights into the influence of life practices on skeletal morphology.

Age-related changes in maxillary shape and bone remodelling throughout adulthood

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Age-related changes in adult facial morphology are marked by progressive reduced facial projection, increased facial concavity, and alterations in craniofacial proportions, reflecting key aspects of craniofacial senescence. These changes are due to bone remodelling, the continuous process by which old bone tissue is resorbed and replaced. While extensive jawbone resorption in older adults is often linked to tooth loss, the broader influence of aging on facial bone remodelling in adulthood remains poorly understood. This contribution explores the relationship between age, morphology, and bone remodelling in an adult sample of known age and sex from the Museum of Anthropology and Ethology of the University of Florence, Italy. We focus on the maxillary region using an integrative approach that combines microscopic and macroscopic analytical methods.
The sample, equally distributed between males and females was divided into four age groups: 20-35 (AG1), 36-50 (AG2), 51-73 (AG3), and 74+ years (AG4). High resolution casts of maxillary bone surfaces were produce using epoxy resin and analysed under a digital optical microscope. Surface histology was employed to visualize and quantify remodelling activities on the maxilla (N = 24). Mean bone remodelling maps were generated for each age group and compared with their respective mean shapes derived from a geometric morphometric analysis (N = 39).
On the microscopic scale, our results show that bone resorption was highest in the youngest adults (mean AG1= 25,77%), declined in intermediate age classes (mean AG2 = 12,15%; mean AG3= 11,75%), but appears to increase again in older individuals across both sexes (mean AG4: 30,57%). Results of the shapes analysis highlight that maxillary bone morphology is largely preserved in the younger age groups (AG1 And 2). In contrast, individuals in AG3 and 4 show a decrease in height in the maxillary arcade, likely associated with the higher incidence of antemortem tooth loss observed in these groups.
Our findings suggest that midfacial aging reflects the combined effects of localized remodelling due to tooth loss and systemic age-related increases in bone resorption. Notably, resorption continues to occur in regions consistent with those active in subadults, indicating a conserved spatial pattern of bone remodelling throughout life.

Testing commercial AI tools for Palaeopathology: potential and limitations of a case-assessed approach

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The rapid advancement of conversational artificial intelligence (AI) is transforming the field of medicine, particularly the way diagnoses and treatments are performed. Conversational AI models, especially pre-trained generative transformers such as the commercially available ChatGPT, are based on deep learning architectures trained on extensive datasets that include articles, websites, and various textual sources. In medicine, such AI systems have demonstrated potential as auxiliary tools for diagnosing typical and mildly atypical manifestations of common diseases. In the field of palaeopathology, differential diagnosis (DD) is a problem-solving process that sistematically evaluates potential diagnostic options while eliminating less plausible conditions. Given the inherently imperfect correlation between skeletal manifestations and specific diseases, palaeopathological diagnosis remains a complex undertaking. In this study, we explored the ability of commercial AI systems to assist DD. This investigation focused on case studies involving two young individuals, (both between 11 and 14 years of age), from a archaeological contexts dating to the Roman Imperial period and the Late Middle Ages who exhibited several lesions on both the cranial and postcranial skeleton. An experienced anthropologist conducted a rigorous DD, employing methodologies adapted from clinical medicine for the analysis of the archaeological remains. Subsequently, three commercially available and user-accessible AI chatbots, GEMINI (Google), ChatGPT (OpenAI), and Copilot (Microsoft), were evaluated. These systems were presented with a series of Information Sets. The AI systems were tasked with identifying known disorders across various body systems that could account for, or contribute to, the observed anomalies. They were also asked to propose a plausible DD. Then the diagnostic results were progressively refined by iterative querying, aiming to reduce the list to as few well-supported diagnoses as possible. The findings of this study revealed minimal differences among AI models in terms of scientific rigour and ability to generate plausible DDs comparable to those produced by the expert anthropologist. These outcomes are noteworthy and offer valuable insight into the potential role of AI in supporting decision-making processes in palaeopathological diagnostics.

Bioarchaeology of Childhood at Nora: Histological and Histomorphometric Analyses to Understand Growth Patterns in the Phoenician-Punic Necropolis

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The study of infancy in bioarchaeology is essential for understanding the evolution of life history in ancient human societies. Infant growth, health and mortality provide critical insights into population dynamics, cultural practices and the adaptive capacity of past communities. Among human remains from archaeological contexts, teeth are particularly informative due to their incremental growth microstructures, which preserve detailed chronological records of physiological stress, dietary changes, mobility and developmental patterns. Among the possible analytical approaches, dental histomorphometry coupled with biogeochemical analysis of dental enamel allows the reconstruction of an individual's biological life history. This study presents the preliminary results of dental histological analysis of 13 inhumed individuals (6 subadults and 7 adults) from the Phoenician and Punic necropolis of Nora (Cagliari, 7th – 4th centuries BCE). In recent years, excavations carried out by the University of Padova uncovered numerous burial contexts, revealing the necropolis to be a complex, stratified palimpsest containing both inhumations and cremations and reflecting cultural transitions from Phoenician to Punic influence. The sample includes both deciduous and permanent teeth, allowing a comparative approach: subadults, represented by their deciduous teeth, provide a snapshot of those who did not survive childhood, while early life of those who survived to the adult stage is studied through their first permanent molars.
A histomorphometric analysis of dental enamel was conducted to determine the crown formation times, the rates of enamel daily secretion and extension, and the presence of physiological stresses manifested as Accentuated Lines.
This dual framework allows us to explore the relationship between early life stress and later health implications. Furthermore, from an archaeological perspective, it also allows diachronic comparisons of health and growth conditions across the Phoenician and Punic phases.
Our findings enhance the understanding of growth patterns, physiological stress, and health conditions among infants in Phoenician and Punic societies. When compared to coeval sites, such as Motya (7th–6th centuries BCE, Sicily), they contribute to a broader interpretation concerning demographic dynamics and adaptive strategies of these communities across the western Mediterranean.

Intentional traumatic injuries related to three individuals from the cemeterial area of the Castle of Miranduolo (XI-XII century)

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The burials analysed belong to the population of the Castle of Miranduolo in the period between the end of the 11th and the beginning of the 12th century. In these decades, before 1133, Miranduolo was besieged by the bishop of Volterra, engaged in a biting conflict against the Gherardeschi counts for control of the Val di Merse. The cemetery stood next to the church in perfectly squared ashlars, paved in stone pieces and provided with a presbytery enclosure. On its exterior, two walls delimited the cemetery space; here an active and stratified community is revealed, divided between members of the élite, men-at-arms, and peasant families. Osteological analysis of the human remains from the cemetery area have highlighted significant traumatic cranial injuries on three adult male individuals (SK 69, SK 79, SK 86). The present work, supported by tomographic investigations, analyses and identifies these injuries as the result of intentional wounds caused by blunt and sharp weapons.

Reconstructing mobility in Bronze Age North-East Italian Communities: Strontium Isotope (Sr/Sr) Analysis of Dental Enamel

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Within the PRIN 2022 SHOVEL framework, this study investigates mobility and provenance among Bronze Age Terramare populations in Northern Italy. By measuring Sr/Sr ratios in dental enamel against local environmental baselines, we assess patterns of residence, regional exchange, and community connectivity.
Given the unusually high incidence of shovel-shaped incisors in these communities, we examined whether individuals possessing this trait exhibit distinct movement histories compared to those without it.
Enamel from 55 human individuals and 14 faunal specimens was collected across five necropoleis—Olmo di Nogara, Bovolone, Ballabio, Franzine Nuove, and Castello del Tartaro.
Soil and animal remains defined the local bioavailable strontium baseline, enabling us to distinguish local from non-local signatures. The results show that most individuals fall within the local isotopic range, indicating residential continuity.
A minority exhibits divergent values, reflecting episodes of movement between different groups. Comparative analysis reveals the overlap in isotope distributions between those with and without shovel-shaped incisors, suggesting no direct link between this dental trait and childhood provenance.
To better understand geographic origins, human data were modeled against regional bioavailable strontium isoscapes using probabilistic assignment frameworks. Isotopic provenance was then correlated with demographic factors, funerary treatment, and grave goods to explore possible social integration and residence rules.
These results contribute to debates on territoriality, exchange networks, and community organization in Bronze Age Po Valley societies. Under the SHOVEL project, enamel-based strontium isotope analysis, integrated with other isotopic and molecular analyses, underlines the power of bioarchaeology to reconstruct individual life histories and social dynamics in prehistoric Northern Italy.

From the individual to the community of the dead: taphonomic complexity at the western necropolis of Nora

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Funerary rituals constitute one of the most emblematic expressions of the cultural, social, and symbolic dynamics within a community. Each decision concerning the treatment of the deceased - ranging from the typology of burial structures, the number of individuals interred, to the positioning and orientation of the bodies - responds to well-defined logics that reflect social structures, religious beliefs, and culturally embedded practices. In this sense, the spatial and ritual organization of a necropolis offers a privileged framework for reading and interpreting both collective and individual identities of past societies.
Within this perspective, the western necropolis of Nora (Sardinia, CA), currently investigated by the University of Padua, stands out as a key case study in the central-western Mediterranean for investigating funerary practices during the late Phoenician and the Punic periods. The site shows evidence of long-term use and considerable ritual complexity, making it a valuable context for examining burial customs in a region marked by intense cultural interactions.
The excavation of 11 inhumation tombs, archaeologically dated between the late 7th and the 3rd centuries BCE, has revealed nuanced evidence. Through a multidisciplinary approach - integrating archaeological, anthropological, and taphonomic data - the research has documented substantial variability in the use of funerary space, depositional sequences, and the treatment of the dead. Marked differences were identified in both the architectural configuration and reuse of burial structures, as well as in the funerary gesture, including body positioning, orientation, and the treatment of human remains over time.
The coexistence of distinct funerary practices within the same necropolis - and at times within the same tomb - reflects the presence of a complex and dynamic community. This heterogeneity suggests a flexible use of funerary space and of ritual protocols, likely shaped by factors such as kinship, age, sex, and status.

Unpublished Anthropological and Paleopathological Analyses of the Population of the Roman Port of San Gaetano (Vada Volaterrana, LI) During the Late Antiquity–Early Middle Ages

Giulia Saviano, Paolo Sangriso , Silvia Marini , Simonetta Menchelli

In the 1st century AD, the site of San Gaetano was built as part of the port system of Vada Volaterrana, which belonged to the city of Volterra. Between Late Antiquity and the Early Middle Ages, the district was abandoned and transformed into a burial area. To date, 32 burials have been uncovered, and their analysis aimed to reconstruct the living conditions, health, and socio-labor organization of this coastal community. The sample, consisting of 18 adults and 14 subadults, was studied using established methods for determining sex and age, as well as for identifying dental pathologies, physiological stress markers, enthesopathies, and signs of muscular activity.

Adults were buried in simple pits or cappuccina-style graves, while subadults were buried in amphorae, revealing funerary rituals that granted even newborns social recognition.

The sample shows a slight predominance of women and a lack of individuals aged 20 to 29, along with adolescent mortality occurring exclusively among females—possibly indicating risks associated with pregnancy or childbirth.

Widespread dental pathologies reflect a diet rich in carbohydrates and poor oral hygiene. The presence of cribra orbitalia, enamel hypoplasia, and periosteal reactions indicate nutritional deficiencies, infections, and poor hygienic conditions, with particular vulnerability noted between ages 3 and 4, during the post-weaning phase.

Musculoskeletal analysis reveals a clear gender-based division of labor. Women display markers associated with repetitive upper limb movements and kneeling postures, compatible with domestic or agricultural tasks; men exhibit skeletal changes linked to stress on the lower limbs and prolonged walking.

Both sexes show signs of vertebral osteoarthritis, Schmorl's nodes, and other overload-related pathologies. Additional skeletal alterations were identified, including an osteoma, suspected idiopathic skeletal hyperostosis, and endocranial lesions potentially attributable to tuberculous meningitis.

Despite the fragmentary nature of the remains, the data provide valuable insights into the lifestyle of a population from an early medieval coastal context in Tyrrhenian Italy, marked by harsh environmental conditions, nutritional imbalances, and a well-defined social structure that also considered the youngest members of the community.

The burial in the baths: an uncertain deposition in the roman "Domus dei mosaici marini", Porto Torres (SS)

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Turris Libisonis (modern-day Porto Torres) was the first Roman city established in Sardinia, founded in 1st century BCE by the Gens Julia. Located on the city's western side were the Pallotino thermal baths and several private buildings, such as the so-called Domus dei Mosaici Marini (Marine Mosaics), named for the numerous fish depictions inside.
This structure, excavated by the archaeological superintendence for Sassari and Nuoro, underwent multiple phases of occupation and functional transformation between the 3rd and 5th centuries CE.
On the western side of the building, a distinct space had three phases of use:
1.Thermal/ Residential Phase (3rd century CE)
2.Paleo-Christian Phase (4th century CE)
3.Industrial Phase (5th century CE)
Tomb 2 was located on the western side of this final rectangular space, directly above the Paleo-Christian floor. The stratigraphic context suggests that the burial occurred during the transitional period between the abandonment of religious functions and the establishment of industrial activities.
The purpose of this study is to understand who this individual is and why the reason for his burial in this area.
The burial was an inhumation in an earth-cut grave with well-defined edges. It contained a single individual interred in a primary right-sided lateral position, oriented along a southwest-northeast axis. This specific positioning appears to have been more frequently associated with non-local individuals during this period.
The osteological analysis identified the individual as an adult male, with an estimated age at death between 35 and 45 years. Stature estimation suggests a height of approximately 175 cm. Pathological assessments revealed the presence of small, poorly defined destructive lesions (¡2 cm in diameter) with some reactive sclerosis on the internal cranial vault of the parietal bones. Additionally, an osteoma was observed on the external right parietal bone.
The left petrous portion of the temporal bone was sampled and submitted to the Archaeo and Palaeogenetics group at Institute for Archaeological Sciences of the University of Tübingen (Germany) for ancient DNA analysis. Shotgun screening results reveal that the ancient DNA in this specimen is well preserved, with 18.9% of human DNA and around 35% of CtoT substitutions at the molecule termini. Further genome-wide analyses are currently in progress.
A multiple inhumation, belonging to third phase, was identified on the eastern side of the same room.

A new online database of virtual cranial remains from Sardinia, from prehistory to modern times

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We are pleased to introduce *The Collection of Sardinian Crania from the Museo Sardo di Antropologia ed Etnografia (MSAE), University of Cagliari*, a newly established open-access digital repository featuring high-resolution 3D models of human crania from prehistoric and historic periods of Sardinia. This curated collection, hosted on the online platform MorphoSource, includes 416 cranial specimens spanning from the Neolithic to the 20th century. With increasing reliance on virtual osteological collections for interdisciplinary studies, this project contributes substantially to advancing data-driven research in human skeletal biology.

The collection derives primarily from mid-20th-century excavation campaigns by the museum's founder and collaborators. These efforts recovered human remains from multiple archaeological sites across Sardinia. The crania, now curated at the MSAE, represents diverse chronological and geographic contexts within the island, offering a rare opportunity to explore long-term biological variation and population history in a Mediterranean setting. Digitalization and public dissemination were made possible through authorization from Sardinian cultural heritage authorities.

The 3D models were created using ultra close-range digital photogrammetry (UCR-DP), a non-invasive imaging method enabling accurate capture of external morphological features. Photographs were taken with a DSLR camera setup and processed via cloud-based photogrammetric software. Each model was scaled using repeated measurements between anatomical landmarks, allowing precise morphometric analysis. This process was conducted by undergraduate and doctoral students as part of their thesis work, integrating training and data production within an academic framework.

In addition to preserving and democratizing access to this important collection, the database is already supporting new scientific work. We anticipate this resource will stimulate a wide range of future investigations, including studies of cranial morphology, pathology, population dynamics, and heritage conservation. We encourage the international research community to engage with this collection as a tool for collaborative exploration of Sardinia's complex human history. By offering a standardized, scalable dataset, this initiative supports reproducible research and promotes broader engagement with Mediterranean bioarchaeological heritage.

Funerary rituals in the Recent Bronze Age of the Veneto region: a bioarchaeological study of the necropolis of Franzine Nuove di Villa Bartolomea (VR), 1350-1000 BCE

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Funerary archaeology represents an essential tool for the historical reconstruction of past societies, since the analysis of burial practices, including the distribution of tombs, the study of human remains and the examination of grave goods, provides valuable information on the individuals, which includes age at death, sex, social status, wealth and beliefs. This study focuses on the biritual necropolis of Franzine Nuove di Villa Bartolomea (VR), one of the most important Bronze Age sites in Northern Italy, dated between 1350 and 1000 BCE. The site was discovered in 1968 during excavation work for the construction of a corn drying plant, and archaeological research was carried out from 1968 to 1983 by the Civic Museum of Natural History of Verona, in collaboration with the Archaeological Superintendence of Veneto, bringing to light 582 burials arranged on two levels of the ground. The aim of this study was to investigate possible correlations between the biological profile of the individuals and the burial ritual, with particular attention to the position of the body at the time of deposition. In this study, 117 individuals were analysed. For each skeleton, the biological profile (sex and age estimation) was determined, paleopathological analysis was carried out on bones and teeth, osteometric indices were calculated, and statistical analyses were conducted to assess the distribution of biological profiles in relation to funerary rituals. Furthermore, the presence of non-metric traits on the skull and teeth was also observed to evaluate particular aspects related to the different types of burial found. The sample consisted of 54 subadults and 60 adults, including 18 males and 33 females. Sex could not be determined for 9 adults or any of the subadults. In 3 cases, both sex and age could not be assessed due to missing key skeletal elements and severe fragmentation of the remains. From a paleopathological perspective, several cases of metabolic and biomechanical stress emerged. The comparison of the biological profile and burial position highlighted the adoption of different funerary rituals according to the sex and age of the individuals, aligning with the evidence brought to light in other contemporary Veronese necropolises. This study contributes to the understanding of social and funerary dynamics within Bronze Age communities of Northern Italy, highlighting the importance of integrating osteoarchaeological data with ritual context.

Trophy Skulls from Papua: Interdisciplinary Insights into Decoration, Preservation, and Cultural Meaning

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The practice of preserving skulls as trophies, relics, or ritual objects is a widespread phenomenon documented across various cultures and geographic regions. In Indonesia and New Guinea, indigenous population used to preserve crania of fallen enemies after cleaning and decorating them with pigment and incisions. Such prepared skulls are commonly referred to as "trophy skulls."

Approximately 80 such specimens are held in the Anthropology and Ethnology collection of the Museum of Natural History in Florence, mostly collected by Lamberto Loria between 1911 and 1914, and primarily originating from the D'Entrecasteaux Islands and the Gulf of Papua. These skulls typically display different type of incisions on the frontal bone, with the mandible secured to the cranium using various intricate bindings made of vegetal fibers. Several specimens also show traces of pigments, likely ochre. In some cases, teeth were replaced with wooden substitutes, while in rare instances—particularly in skulls with complete or nearly complete dentitions—cordage was used to hold the teeth in place.

A detailed analysis of these trophy skulls was conducted through an interdisciplinary approach that integrates anthropological, conservation, and ethnographic perspectives, with the aim of: (i) reconstructing and evaluating potential correlations between incision, pigmentation, and cordage patterns and the biological characteristics, geographical origin, and cultural context of the individuals; and (ii) assessing material degradation and preservation conditions needs to support future conservation efforts.

The skulls were digitalized using Artec 3D scanner, and a dedicated cataloguing form was developed to record detailed information on the collectors, biological profile, pathologies and traumas, geographical origin, types of decorations, presence/absence of pigments, additional decorative elements (e.g., cordage and wooden teeth), as well as the overall preservation state.

Here we present preliminary results of this project. To date, 63 skulls have been digitized and studied: 32 identified as male, 29 as female, and 2 of undetermined sex. Age-at-death estimation indicates that 11 individuals were young adults, 41 were adults (probably up to 40 years old), 6 were mature adults, and 5 were children. Additionally, 26 skulls exhibited identical or highly similar incision patterns, potentially indicating shared cultural practices or a common symbolic meaning.

Tracing back a modern dental disease: a severe case of Molar Incisor Hypomineralisation (MIH) in an Imperial Roman Child (Isola Sacra, 1st-3rd century AD)

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Molar Incisor Hypomineralisation (MIH) is a pathological condition caused by a qualitative alteration in the mineralization process of dental enamel and currently occurs in about 13% of the world's population. Although its etiology is still unknown, it is believed that systemic prenatal diseases, vitamin deficiencies and metabolic imbalances could be involved. To date, a few studies have reported possible cases of MIH in ancient populations according to modern diagnostic criteria, but due to its complexity this anomaly remains largely undiagnosed, misdiagnosed or confused with taphonomic processes.

This study presents an ancient case of severe MIH identified in the in situ mandibular dental remains of an Imperial Roman child (SCR 6302) from the Isola Sacra necropolis (Portus Urbis Romae, Latium, 1st–3rd century AD), employing a comprehensive approach that integrates modern clinical classification methods, X-rays imaging (XRM) techniques and histomorphometric analysis.

MIH-induced lesions were detected in the second deciduous molars, manifested as a collapse of the occlusal surface with exposure of the dentine. XRM analysis revealed an early stage of pathology, evidenced by marked enamel hypoplasia in the first permanent molar and the presence of secondary caries on the first deciduous molar. Following histomorphometric analysis, the age at death was set at 2.5 years and the onset of MIH was circumscribed to the first months of life, thus highlighting the presence of non-specific physiological stresses in the pre- and postnatal enamel portion.

Through a multidisciplinary approach, the present study reports a confirmed case of severe MIH in an ancient population, revealing an earlier occurrence than typically reported in modern cases. Furthermore, it is suggested that the development of MIH may be driven by common or similar aetiological factors present in both past and contemporary populations, offering novel insights into the pathological processes underlying this condition.

Body size and sexual dimorphism of the coxal bone: allometric variation in two contemporary Italian populations

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Allometry investigates the biological scaling relationship between the size of a body part and the overall body size. This study aims to investigate whether sexual dimorphism of the coxal bone may be related to allometric differences in body size. If allometry is not responsible for the sexual dimorphism observed in a set of coxal bone metrical traits, we hypothesize that other factors — such as obstetric demands, environmental conditions, genetic background, hormonal influences, and biomechanical stability — may play a prominent role. A set of metric measurements of the coxal bone were recorded in a sample of 132 individuals from the two documented human osteological collections of Bologna and Sassari (Bologna = 64, Sassari = 68) housed at the University of Bologna. These two populations are coeval but originate from very different geographical regions (island vs. peninsula) and have distinct genetic backgrounds. Previous population studies report differences in stature, with Sardinians being generally shorter and North Italians being taller. Measurements of the maximum femoral length and the diameter of the femoral head were collected, and a geometric mean was calculated as a proxy of body size. Following log-transformation of the body size data and the pelvic measurements, a Standardized Major Axis (SMA) analysis was performed.
The results showed that a considerable number of dimorphic variables follow allometric patterns. Particularly, longitudinal measurements (such as M01: coxal bone maximum height) reflect scaling tendencies, indicating that individuals with larger body size tend to have proportionally bigger hip dimensions. Other variables display divergent trends between populations or the sexes. For instance, some measurements related to the width of the coxal bone (such as M04: coxal bone depth) scale with body size in males but not in females, suggesting an obstetrical constraint in females. Finally, differences in allometric patterns between Sassari and Bologna may be explained by the interplay of distinct environmental and genetic influences that characterised these two populations.