

**JULY 7-8, 2023
COIMBRA, PORTUGAL**

Porous Skeletal Lesions

INTERNATIONAL MEETING

Achievements and future directions

**PROGRAM
&
ABSTRACT BOOK**

INTERNATIONAL MEETING ON POROUS SKELETAL LESIONS: Achievements and future directions

Program | Abstract Book

July 7th – 8th, 2023



RESEARCH CENTRE FOR ANTHROPOLOGY AND HEALTH

Department of Life Sciences
Faculty of Sciences and Technology
University of Coimbra
Coimbra, Portugal

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Committees

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PROGRAM

DAY 1 07 JULY**08h30 | REGISTRATION****09h00 | WELCOME SESSION Room 1.43 [Anfiteatro 1]****KEYNOTE LECTURE****09h25 | Porotic skeletal lesions: Potential and problems in Paleopathology**
Megan BRICKLEY**PODIUM SESSION | Chairperson: Jan Novacek & Agata Ciešlik****10h00 | Erythropoiesis and skeletal lesions: A clinical perspective**
Maria Letícia RIBEIRO**10h15 | How porous lesions can further our understanding of infant and maternal health in Iron Age and Roman Britain**
Rebecca PITT, Mary LEWIS**10h30 | Cribra orbitalia, cribra cranii, and cribra femoralis: Frequencies and possible association with malaria in the 14th century's ossuary from the deserted village of Geridu (Sardinia, Italy) ****
Cinzia ROGGIO, Marco MILANESE**10h45 | Two decades of searching for malaria in Asia-Pacific: What we've learnt (or rather unlearnt) when it comes to porosity**
Melandri VLOK, Hallie BUCKLEY**11h00 | Cribra orbitalia and age-specific mortality in Medieval and early Modern Aberdeen, Scotland**
Jenna DITTMAR, Rebecca CROZIER, Marc OXENHAM**11h15 | Coffee break****11h30 | Young but exuberant: Proliferative periosteal reactions on perinates and infants from an 18th-19th century sample of Lisbon (Portugal) ****
Marina LOURENÇO, Francisco CURATE, Eugénia CUNHA**11h45 | Trying to get to the bottom of the hollow: Porous skeletal lesions and their potential for mapping rare bone diseases**
Nivien SPEITH**12h00 | The potential association between porous cranial lesions and cortical bone loss: A study on the Coimbra Identified Skeletal Collection**
Francisco CURATE, Célia FREITAS, Ana Luísa SANTOS**12h15 | POSTER SESSION | Chairperson: Álvaro M. Monge Calleja****P1 Hypertrophic porous lesions and endosteal skeletal alterations: A possible case of treponematosi in an infant from Prehistoric Brazil**
Ana SOLARI, Anne Marie PESSIS, Gabriela MARTIN, Dany COUTINHO NOGUEIRA, Álvaro M. MONGE CALLEJA

P2 Systemic pathological condition in an infant from the Inca period (15th century CE) found in La Troya area (Fiambalá, Catamarca, Argentina): Infection, metabolic disease, and/or anemia?

Claudia ARANDA, Álvaro M. MONGE CALLEJA, Norma RATTO, Ana Luísa SANTOS, Douglas UBELAKER, Pablo RODRÍGUEZ, Leandro LUNA

P3 Possible β -Thalassemia *major* in an infant from 17th century Portuguese countryside (Flôr da Rosa, Crato)

Ana CURTO, Teresa FERNANDES, Célia LOPES, Álvaro M. MONGE CALLEJA

P4 Parasites infection in the past: Investigating possible association with porotic hyperostosis and cribra orbitalia

Federica DE LUCA, Jessica MONGILLO, Alba PASINI, Natascia RINALDO

P5 Signs of disease on a cremated child from the Roman city of *Augusta Firma Astigi* (Écija, Spain): Possibilities and limitations of a differential diagnosis

Filipa CORTESÃO SILVA, Ana Santa CRUZ MARTIN, Cristina CIVICO LOZANO

P6 Porous new bone formation in an uncommon place: A case of sphenoid sinusitis from late Roman Etruria (Tuscany, second half of the 3rd-4th century CE) **

Alessia BAREGGI, Giacomo TOCCO, Lisa ROSSELLI, Valentina GIUFFRA, Giulia RICCOMI

13h00 | Lunch

KEYNOTE LECTURE

14h00 | **Porotic phenomena in Paleopathology: A holistic view from Medicine**

Manuel POLO-CERDÁ (Virtual)

PODIUM SESSION | Chairperson: Marie Louise Jørkov

14h30 | **A macroscopic assessment of porosity and new bone formation on the inferior *pars basilaris*: Normal growth or an indicator of scurvy? *****

Jack EGGINGTON, Rebecca PITT, Claire M. HODSON

14h45 | **The non-adult endocranium: Exploring physiological and pathological new bone formation and porosity**

Claire M. HODSON

15h00 | **Porous skeletal lesions in connection to metal pollution: Case studies from Spain and Sweden**

Olalla LÓPEZ-COSTAS, Noemi ÁLVAREZ-FERNÁNDEZ, Elvira MANGAS-CARRASCO, Clara VEIGA-RILO, Anna KJELLSTRÖM, Antonio MARTÍNEZ CORTIZAS

15h15 | **Nondestructive pXRF analysis of porous skeletal lesions: Interplay of sex, age, and cause of death *****

Ricardo A.M.P. GOMES, Lídia CATARINO, Ana Luísa SANTOS

15h30 | **The contribution of bone collagen stable isotope analysis in the study of cranial porotic lesions**

Giorgia TULUMELLO, Giovanni MASTRONUZZI

15h45 | Coffee break

KEYNOTE LECTURE

16h00 | **Now and then: Porous cranial lesions in New Mexico**
Lexi O'DONNELL

PODIUM SESSION | Chairperson: Marie Louise Jørkov

16h30 | **Visualizing cribra orbitalia using modern imaging techniques**
Jo BUCKBERRY, Ashim ALI, Michael HEBDA, Adrian EVANS, Tom SPARROW,
Hannah KOON, Andrew WILSON

16h45 | ***Cribra sunt e pluribus unum*: 3D- μ CT and thickness mapping confirms that more than one process can cause cribra orbitalia ****
Fanny THEVENON, Bruno DUTAILLY, Olivier DUTOIR, H el ene COQUEUGNIOT

17h00 | **Quantifying the accuracy of anemia diagnosis using porous orbital lesions****
Brienne MORGAN, Rachel SCHATS, Isabelle RIBOT, Megan BRICKLEY

17h15 | **POSTER SESSION | Chairperson:  lvaro M. Monge Calleja**

P7 Scurvy in Bolivia? A case study of a pre-Columbian child
Alice PALADIN, Amy ANDERSON, M. Linda SUTHERLAND, Jhimy BUTR ON, Frank
MAIXNER, Marco SAMADELLI, Guido VALVERDE, Albert ZINK

P8 Frequency of probable scurvy within adults from the outskirts of an early Modern (16th-19th century CE) Wroclaw (Poland) **
Joanna WYSOCKA, Agata CIE SLIK

P9 Porous skeletal lesions during the late Iron Age: Morphological and genetic study of a non-adult individual of the Staggered Turriform of Son Ferrer (Balearic Islands, Spain) **
Paloma SALVADOR, Xavier JORDANA, Jaume GARC IA, Manuel CALVO, Silvia
QUINTANA, Cristina SANTOS

P10 That's just full of holes! Critical exploration of PSL phenotypes and their paleopathological significance: Two case studies from Neolithic Northern Germany
Emmanuele PETITI, Daria MOSER, Detlef JANTZEN, Florian KLIMSCHA, Katharina
FUCHS

18h00 | **END OF DAY ONE**

DAY 2 08 JULY

KEYNOTE LECTURE

- 09h00 | **Complex connections? The correlation and association of different porous skeletal lesions**
Rachel SCHATS

PODIUM SESSION | Chairperson: Natasa Sarkic

- 09h30 | **Newborn bone porosity: A case study of infection in Iron Age (Vilars d'Arbeca, Spain) ****
Carolina SANDOVAL-ÁVILA, Ani MARTIROSYAN, Daniel R. CUESTA-AGUIRRE, Xavier JORDANA, Dominika NOCIAROVÁ, Cristina SANTOS, Assumpció MALGOSA
- 09h45 | **Cranial porotic lesions in enslaved African individuals (Valle da Gafaria, Lagos, Portugal)**
Diéssica SILVA, Maria Teresa FERREIRA, Sofia N. WASTERLAIN
- 10h00 | **Cranial porosity: Distribution and relationship between cribra cranii and cribra orbitalia across time in Italy**
Simona MINOZZI, Giulia RICCOMI, Antonio FORNACIARI, Valentina GIUFFRA
- 10h15 | **Porous skeletal lesions in the riverside population (14th-19th century CE) of Sarilhos Grandes (Montijo, Portugal)**
Bruno MAGALHÃES, Ricardo A.M.P. GOMES, Paula ALVES PEREIRA, Ricardo Miguel GODINHO, Roger LEE JESUS, Ana Luísa SANTOS
- 10h30 | **Porotic skeletal lesions of human remains from funerary unit (UF) 221 of the Santa Caterina convent site (1243-1836) in Barcelona ****
Antony CEVALLOS, Carme RISSECH, Xavier TOMAS, Lluís LLOVERAS
- 10h45 | **Porous skeletal lesions in identified fetuses and infants: Analysis by type, age at death, sex, and cause of death**
Álvaro M. MONGE CALLEJA, Ricardo A.M.P. GOMES, Ana Luísa SANTOS

- 11h00 | Coffee break

KEYNOTE LECTURE

- 11h15 | **Issues in the assessment of porotic hyperostosis and cribra orbitalia in human skeletal remains: The need for a standardized data collection procedure**
Natascia RINALDO

PODIUM SESSION | Chairperson: Natasa Sarkic

- 11h44 | **Observer error: Another hole in the cribra evaluation**
Elvira MANGAS-CARRASCO, Ricardo A.M.P. GOMES, Ana Luísa SANTOS
- 12h00 | **Beneath the surface of eyebrows: Investigating the vermiculate pattern in Medieval central Italy**
Giulia RICCOMI, Giacomo TOCCO, Alessia BAREGGI, Stefano CAMPANA, Valentina GIUFFRA

12h15 | **POSTER SESSION** | **Chairperson:** Álvaro M. Monge Calleja

P11 Cribra orbitalia in a Portuguese late Neolithic population: The sample of Cova das Lapas

Ana Maria SILVA, Álvaro M. MONGE CALLEJA, Francisco CURATE

P12 Porous skeletal lesions in a pre-Hispanic non-adult individual from Santiago del Estero, Northwest Argentina

Ailem PALADEA ROJO, Leandro LUNA, Claudia ARANDA, Olalla LÓPEZ-COSTAS

P13 Distinguishing cribra orbitalia from other lesion and pseudopathologies in Medieval populations from Silves, Southern Portugal ***

Ana GONZÁLEZ-RUIZ, Maria José GONÇALVES, Ana Luísa SANTOS

P14 Porotic lesions in the osteological collection excavated from a Medieval cemetery in Grodek on the Bug River: An insight into the living conditions of the inhabitants of historical (12th-15th century CE) Chervens' Towns

Agata CIEŚLIK, Joanna WYSOCKA

P15 Porous skeletal lesions in two young children from São Martinho church, Leiria, central Portugal (13th-16th century CE)

Susana GARCIA, Carolina SANDOVAL-ÁVILA

P16 Measuring morbidity in skeletal material: Cribra cranii and cribra orbitalia on the Lisbon Identified Skeletal Collection (19th-20th century CE) **

Liliana Matias de CARVALHO, Susana GARCIA, Sofia N. WASTERLAIN

12h55 | **Workshop instructions**

13h00 | **Lunch**

HANDS-ON WORKSHOP Room 1.39 [Laboratório 1.2]

14h00 | **Session 1**

15h00 | **Session 2**

15h45 | **Coffee break**

16h00 | **Session 3**

KEYNOTE LECTURE Room 1.43 [Anfiteatro 1]

17h00 | **Plugging the holes: What we have learned here and a way forward**

Jane BUIKSTRA

17h30 | **PLENARY DISCUSSION**

PRIZE PRESENTATION

SOCIAL PROGRAM Seminário Maior de Coimbra

19h00 | **Sunset** with Grupo de Fados e Guitarradas da Secção de Fado da Associação Académica de Coimbra (SF/AAC)

19h30 | **Dinner**

** *Student prize entrant*

*** *Student prize winner*

ABSTRACTS

Systemic pathological condition in an infant from the Inca period (15th century CE) found in La Troya area (Fiambalá, Catamarca, Argentina): Infection, metabolic disease, and/or anemia?

Claudia ARANDA^{1*}, Álvaro M. MONGE CALLEJA², Norma RATTO³, Ana Luísa SANTOS², Douglas UBELAKER³, Pablo RODRÍGUEZ¹, Leandro LUNA^{1,5}

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In 2004, a single burial of an infant was discovered in La Troya area, Fiambalá valley, Catamarca, Argentina. This 1–2-year-old male, dated from the Inca period (501 ± 29 years BP; calibration 2σ: 1410–1462 CE), was inhumed in a laterally flexed position inside a pottery urn, with abundant grave goods (an uncommon practice for non-adults in the region). Isotopic analysis indicates this individual was lactating and that his mother had a mixed and balanced diet. This study aims to evaluate possible etiologies that caused a pattern of micro and macroporosity widely spread over the skeleton, and that eventually led this child to be differentially buried. Exuberant, porous, hyperplastic bone is visible surrounding the temporal and lambdoid sutures. Both parietals endocranial surfaces show new bone formation around vascular *sulci*. Both orbital roofs have hypertrophic, macroporous, and active new bone formation. The maxillae, mandible, sphenoid, *pars basilaris*, *pars lateralis*, *scapulae*, and ribs, among other bones, show both new bone formation and micro/macroporosity. Bilateral cribra femoralis are present, and macroporous are also visible in the distal metaphyses of *humeri* and in the vertebral bodies. Radiological examination revealed bone formation in the cranial bones, projecting in a hair-on-end appearance, and osteopenic areas in the long bones. Considering that paleopathological analysis is a major challenge when studying infant skeletons, the preliminary differential diagnoses considered are metabolic (most likely scurvy), infectious (tuberculosis), or acquired and genetic anemias, although co-morbidity cannot be ruled out.

Keywords: Pre-Hispanic non-adult burial, porosity, new bone formation, scurvy, tuberculosis, differential diagnosis

Porous new bone formation in an uncommon place: A case of sphenoid sinusitis from late Roman Etruria (Tuscany, second half of the 3rd-4th century CE) **

Alessia BAREGGI^{1*}, Giacomo TOCCO¹, Lisa ROSSELLI², Valentina GIUFFRA¹, Giulia RICCOMI¹

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Inflammatory bone reaction is one of the most common pathological alterations observed in ancient human skeletal remains. However, such findings are usually detected in connection to the external cranial surface and postcranial bones, while the inner structures of the sinuses are rarely assessed due to their difficult access. The aim of this study is to present an uncommon case of porous new bone formation in the sphenoid sinuses of an inhumated old adult male individual (US 289) from the archaeological site of 'Volterra Le Colombaie' (Tuscany, central Italy; second half of the 3rd-4th century CE). The macroscopic analysis allowed us to observe deposits of porous woven bone (grey color) adhering to the underlying cortex of numerous fragments of the left sphenoid sinus. Differential diagnostic options included both neoplastic and inflammatory disorders; the process led us to identify this pathological alteration as a case of isolated chronic sphenoid sinusitis in the active stage at the time of death of this individual. Several organisms are responsible for the inflammation of the sphenoid sinuses, with *Staphylococcus aureus* being the most common pathogen, followed by the *Aspergillus* species among the fungal organisms. Bone remodeling and bone sclerosis, as seen in the present case, are signs of long-standing inflammation of the sinuses, usually associated with fungal infection in individuals with compromised immune systems (e.g., old people or those affected by serious pre-existing conditions). Sphenoid sinusitis is a rare entity in clinical practice, and, to our knowledge, no cases have been detected so far in palaeopathology.

Keywords: Infection, Mediterranean, bone reaction, chronic inflammation, sinuses

Porotic skeletal lesions: Potential and problems in Paleopathology

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Porosity in bone is likely the most common lesion type encountered by paleopathologists. Such lesions are omnipresent across the spectrum of disease and injury; the fact that porosity can also be linked to normal growth and development and taphonomic change has caused many difficulties for paleopathologists. Porotic lesions are commonly found in metabolic diseases. However, while a suite of other lesions is used to diagnose rickets and scurvy, to date, porotic lesions have been central to paleopathological investigations of anemia. Using explicit comparisons of approaches in clinical and paleopathology work, I will consider frameworks employed by paleopathologists to diagnose specific diseases and co-occurring conditions with a focus on anemia using biological and life-course approaches; work on approaches to rickets and scurvy is in press. Using an analogy with the diagnosis of osteoporosis, I argue that acquired anemia is better approached as a condition requiring metric evaluation of bone structures, supplemented by careful consideration of lesions. As porotic lesions are likely to have a relatively low, age-related frequency in acquired anemia where lesions are considered, paleopathologists should think more widely. Establishing frameworks that move away from porotic lesions is proposed to facilitate higher levels of more accurate paleopathological acquired anemia diagnosis, a condition likely widespread in past communities. This paper opens the conversation on the better diagnosis of anemia in paleopathology; it starts the iterative process of achieving some consensus and progress on diagnosing acquired anemia in paleopathology and provides a foundation for considering congenital anemia.

Keywords: Cribra orbitalia, porotic hyperostosis, paleopathology, bioarchaeology, scurvy, hereditary anemia

Visualizing cribra orbitalia using modern imaging techniques

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Cribra orbitalia is one of the most commonly reported porous skeletal lesions, and many different recording systems have been employed to assess its severity and stage of healing. These systems are almost always developed and tested on skeletal specimens macroscopically. However, with increased use of digital analogs in bioarchaeology it is timely to assess to what extent cribra orbitalia can be recorded from different scan modalities. Ten years ago, we launched Digitised Diseases, allowing researchers around the world to access digital analogs of pathological bones. Aimed primarily as a digital reference (to be used alongside images in key textbooks), the 3D models were created primarily using laser scanning technology, with color added by wrapping photographs around the 3D model using complex geometrical layers, referred to as texture. These models captured large scale morphological changes well but did not really capture fine detail such as porosity and pitting of the bone surface. Over the last ten years, developments in technology have left these original laser scans behind. This paper explores a range of scanning modalities (structured light, 3D microscopy, cone beam CT, and micro-CT) and assesses their relative performance in capturing the fine details of cribra orbitalia from a series of different digital analogs. Preliminary results show significant advances in imaging compared to our original laser scans, with the added benefit of cross-sectional data for CT and micro-CT scans.

Keywords: Pitting, porosity, CT, micro-CT, structured light, 3D microscope

Plugging the holes: What we have learned here and a way forward

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This paper will review and synthesize knowledge gained from presentations in this workshop, along with key recently published papers on topics represented here. A series of 10 questions central to advancing knowledge of the pathophysiology of diseases commonly associated with porosity and associated with accurate and biologically meaningful data collection are posed and addressed. A second portion of the presentation focuses upon the path forward in research based in biomedical knowledge, documented collections, and newly developed data capture strategies. In closing the meeting participants are urged to remain centered upon advancing knowledge of past peoples, especially those marginalized through identities that have silenced their voices until they are seen through the prism of bioarcheological study.

Keywords: Pathophysiology, cribra, porous skeletal lesions

Measuring morbidity in skeletal material: Cribra cranii and cribra orbitalia on the Lisbon Identified Skeletal Collection (19th-20th century CE) **

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Porous skeletal lesions (PSL) indicate the body reacted to a nutritional, pathological, or environmental difficulty. The two most studied skeletal stress manifestations in paleopathology are the PSL of the ectocranial skull (cribra cranii, CC) and orbits roof (cribra orbitalia, CO), caused by hypertrophy of the hematopoietic tissues. Although their etiology is discussed, PLS usually indicate nutritional deficiencies, infectious diseases, and/or parasitism. As PSL probably reflect a situation in which the organism tries to counterbalance a pathological burden with a biological reaction, they are considered indicators of morbidity but also resilience. To explore the relationship between morbidity (porotic data), the body's resistance to pathological conditions, and causes of death (classified as acute/immediate or chronic/slow development causes), 121 adult individuals from the Lisbon Identified Skeleton Collection housed in the National Museum of Natural History and Science in Lisbon (Lisbon, Portugal) were analyzed. All individuals were born between the mid-19th century and the late 20th century, a period that includes great biosocial changes related to the industrial revolution and the beginning of a dictatorship. CC and CO were macroscopically searched and, when noted, recorded as present/absent. Information on the causes of death of the individuals was also collected. CO was present in 20.3% (n=24/118) of the individuals, and CC was observed in 95% (n=115/121), revealing that the individuals suffered high physiological stress levels at the non-adult age. The relationship between the levels of PSL in the skull and the cause of death will be explored and compared with other studies, as no apparent connection was identified.

Keywords: Paleopathology, porotic lesions of the skull, post-industrial revolution society, nonspecific stress factors

Porotic skeletal lesions of human remains from funerary unit (UF) 221 of the Santa Caterina convent site (1243-1836) in Barcelona **

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The aim of this study is to analyze the porotic skeletal lesions of bone remains from the funerary unit (UF) 221 of the Santa Caterina convent site in Barcelona, which is divided into secondary burials (Medieval, 13th-14th century) and primary burials (Modern, early 16th century), in order to evaluate the health state of these individuals. A previous anthropological study indicated a minimum number of 62 individuals (medieval: 15 male, 7 female, and 5 immature; modern: 12 male, 8 female, and 15 immature). They were laypersons who were members of some guild. To carry out this study, macroscopic analysis, observation with a stereoscopic magnifier (x10 to x40 magnification), and radiology were applied. The results showed the frequencies of cribra orbitalia (Medieval: 33.30%, Modern: 14.30%) and cribra femoralis (Medieval: 5.90%, Modern: 3.30%) are lower in Modern than in Medieval individuals. Furthermore, these frequencies are lower when compared to contemporary and non-contemporary peninsular series from the literature. In addition to *cribrae*, unusual lamellar bone and porous skeletal lesions compatible with cortical reabsorption were found in almost the entire skeleton of at least one medieval individual of unknown sex and age. The potential diagnoses discussed include chronic leukemia, hemangioma, Gaucher's disease, lymphoma, and other related conditions. This study shows that individuals from the funerary Unit (UF) have fewer lesions, particularly in post-Medieval period, when compared to other peninsular series. Important data for paleopathological literature and new information on the living conditions of these individuals who lived in Barcelona are provided.

Keywords: Cribra orbitalia, cribra femoralis, medieval period, modern period, paleopathology

Porotic lesions in the osteological collection excavated from a Medieval cemetery in Grodek on the Bug River: An insight into the living conditions of the inhabitants of historical (12th-15th century CE) Chervens' Towns

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The porotic lesions visible on the skull have different forms, locations, and etiologies. The most frequently described are cribra orbitalia (CO) and cribra cranii (CC), usually connected to nutritional deficiencies. However, the pathogenesis of the porous lesions' formation is a complex problem due to the multitude of factors affecting the human skull during the ontogenesis. The aim of the research was to study the occurrence of porotic lesions (CO, CC) in the medieval (12th - 15th century CE) series excavated from Gródek on the Bug River cemetery in the context of basic biological parameters of individuals. The archaeological site is part of a large early Medieval settlement complex situated near the Eastern border of Poland. Among 186 skulls, CO was noted with a frequency of nearly 20% within the studied sample. In young adults (27%), the frequency of CO was significantly higher than in older age categories (12,8%) ($\chi^2=6.2479$; $p=0.012$). It is worth noting that CO occurred in 3 out of 4 juvenile individuals, which indicates that at a young age, biological stresses had a particularly strong impact in Gródek on the Bug River population. The reliable frequency of CC in the studied sample was difficult to assess due to the negative influence of taphonomic factors. The historical population from Gródek on the Bug River was economically diverse, and some of the individuals were buried dressed in silk robes and with additional burial equipment. However, they were not free from the negative influence of difficult living conditions.

Keywords: Nutritional deficiency, anemia, scurvy, economic diversity

Signs of diseases on a cremated child from the Roman city of *Augusta Firma Astigi* (Écija, Spain): Possibilities and limitations of a differential diagnosis

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The colony *Augusta Firma Astigi* (Écija, Spain), founded in the first century BCE, was one of the most important cities of the Roman province of *Baetica*. Its funerary area located in the western suburb of the ancient town, is currently under study, within the scope of the project *Funus Astigitanorum*. This paper aims to present the bone lesions found on a non-adult cremation burial, dated from the first century CE, reflecting on the feasibility of a differential diagnosis. Bone remains were subjected to macroscopic and metric analysis following guidelines for cremation contexts. Moreover, lesions were examined with the naked eye and through magnification. The estimated age at death of this child ranges between 3 to 5 years old. Abnormal cortical porosity, sometimes accompanied by new bone formation, was observed in bone fragments from the axial (temporal, ilium, ischium, and vertebrae) and appendicular skeleton (femur and tibia metaphysis). Further, hypervascularization was also noted in two vertebral bodies. The detected bone lesions could be associated with an infectious disease (e.g., tuberculosis), a neoplasm (e.g., leukemia), or metabolic disease (e.g., scurvy and rickets), among others. Although the nature and location of the lesions suggest a possible case of tuberculosis, the available paleopathological data, conditioned by the heat-induced bone changes and the incomplete skeletal representation, preclude a definitive diagnosis of the *infirmitas* of this Roman child.

Keywords: Porous lesions, mixed lesions, non-adult, cremation burial, Roman necropolis

The potential association between porous cranial lesions and cortical bone loss: A study on the Coimbra Identified Skeletal Collection

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Cribræ cranii (CC) and cribræ orbitalia (CO) are rather common in archaeological human remains. Anemia has been frequently associated with such lesions, but other conditions may cause the lesions whose pattern of causality is undoubtedly complex. A relationship between anemia and bone loss has also been suggested. This study aims to assess if there is an association of porotic cranial lesions and cortical bone mass. Cribræ cranii and CO were recorded as present or absent in a sample of 164 adult individuals (81 females and 83 males, ages-at-death: 20-96 years-old) of the Coimbra Identified Skeletal Collection (Department of Life Sciences, University of Coimbra, Portugal). Conventional radiogrammetry was employed to evaluate cortical bone parameters in the second metacarpal: diaphysis total width (DTW), medullary width (MW), and metacarpal cortical index (MCI). The frequency of CC and CO is similar in females (CC: 36.3%; 29/80; CO: 40.7%; 33/81) and males (CC: 36.1%; 30/83; CO: 30.5%; 25/82). Average ages-at-death of individuals presenting with and without porotic lesions are comparable. Cortical bone parameters are not statistically different between individuals with and without CO in each biological sex group; however, MW is significantly larger, and MCI is reduced in individuals with cranial vault porosity. Results thus suggest a link between medullary cavity expansion and cortical bone loss in the second metacarpal with CC (but not with CO) in both sexes. The observed association is possibly caused via an overload of the hematopoietic system, that is secondary to continuous blood cell production in anemia-afflicted individuals and plays a major role in bone loss.

Keywords: Cribræ cranii, cribræ orbitalia, anemia, radiogrammetry, second metacarpal

Possible β -Thalassemia *major* in an infant from 17th century Portuguese countryside (Flôr da Rosa, Crato)

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Hemolytic anemias are genetic conditions caused by malformations of the erythrocyte's membrane and enzymes, or of the hemoglobin protein that carries oxygen through the body. Nowadays, hemoglobinopathies (HGs), such as β -Thalassemia (β -Thal) and sickle cell disease (SCD), are the most prevalent hemolytic anemias in the Mediterranean basin. Yet, their record in past populations is uncommon. This study analyses a non-adult from 17th century Flôr da Rosa, Crato, Portugal. Teeth eruption of the individual under study led to an age-at-death estimation of ca. 1.5 years old, despite vertebral maturation and tibial growth indicating ≤ 1 year. Poor bone preservation impeded observing the orbits and facial bones, but cranial diploic hyperplasia, long bone porosity, and costal thickening were verified. Hair-on-end appearance and rib porosity, and thickening were recorded. Other non-specific skeletal lesions like endocranial bone growth and enlarged foramina of the hand's phalanges were also observed. The diagnosis of HGs in paleopathology is challenging due to the overlapping with most bone changes and the broad severity spectrum presented by thalassemic main types (*minor*, *intermedia*, and *major*). In the absence of skeletal necrotic signs, the diagnoses of SCD and compound heterozygosity HbS/ β -Thal can be ruled out. The exuberant lesions, the early age at death, and the maturation and development stages point to a possible β -Thal *major*, which requires regular blood transfusion for survival. β -Thal represents a valuable epidemiological testimony since it is associated with malaria, slavery, and the practice of consanguineous marriages.

Keywords: Hemoglobinopathies, hyperplasia, hypertrophy, radiography, porosity, non-adult

Parasite infections in the past: Investigating possible association with porotic hyperostosis and cribra orbitalia

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The possible association between the presence of parasites and cribra orbitalia (CO) and porotic hyperostosis (HP) has already been investigated in the scientific literature, but to our knowledge, no studies have been conducted on skeletonized individuals. The main objective of this study was to investigate a possible association between PH and CO and presence of parasites from rural medieval and *postmodern* Italian archaeological sites. A sample of 42 well-preserved skeletons was analyzed from three sites located in Northern Italy: The Cemetery of the Church of St. Biagio in Ravenna and Complex of "Osservanza" at Imola (both 17th-18th Centuries) and the Church of St. Maria Assunta in Arsiè (9th-13th century). The sample (17 females, 22 males, and 3 subadults) was macroscopically examined for PH and CO using the BOPLE scoring forms. Concerning paleoparasitological analyses, burial sediment retrieved from the pelvis and the skull was used to investigate the presence of eggs of intestinal parasites (following the methodologies proposed by Callen and Cameron (1960)). Overall, intestinal parasites' eggs were found in 24 individuals (in particular *Ascaris lumbricoides* and *Trichuris trichiura*). Of these, 14 presented PH and 3 CO. Overall, in the majority of individuals with PH, we have found eggs of intestinal parasites (p-value=0.001); no significant association was found between presence of intestinal parasites and CO. The association between parasites and PH could be linked to water contamination, like confirmed by historical sources. These preliminary data provided interesting and new insights into the health conditions, confirming the association between PH and presence of parasites.

Keywords: Paleoparasitology, helminths, metabolic disorders, rural communities

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Cribra orbitalia and age-specific mortality in Medieval and early Modern Aberdeen, Scotland

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The Medieval and early Modern periods (900-1800 CE) in Scotland were characterized by drastic political, economic, social, and climactic changes. This study examines the relationship between cribra orbitalia (CO) (used as an indicator of frailty) and an increased risk of death during these turbulent periods in history. To do this, human skeletal remains that date to the 12th-15th century (n=231) and the 16th-18th century (n=100) from the Kirk of St Nicholas in Aberdeen, Scotland, were macroscopically assessed. Survival analysis and odds ratios (OR) were conducted to explore relationships between age-at-death, sex, and time period. The overall prevalence of CO was higher in preadults (44%) than in adults (14%), and preadults were significantly more likely to die with CO than adults (OR=4.57, p<0.0001). Preadult individuals that died during the 12th-15th century were equally at risk of dying with CO as those that lived during the 16th-18th century. The odds of adults from the 12th-15th century having CO (17%) were higher than those that lived during the 16th-18th century (9%), but this was not a significant difference (OR=1.99, p=0.1668). Adult males and females were at equal risk of having CO during both time periods. These results indicate that CO is associated with increased mortality risk for preadult individuals but not for adults. The increased risk of mortality in preadults, as a highly vulnerable subset of the population, likely reflects the adversity experienced by northern communities as the result of ongoing conflict, social upheaval, and climate deterioration.

Keywords: Frailty, survival, cribrous lesions, Middle Ages

A macroscopic assessment of porosity and new bone formation on the inferior *pars basilaris*: Normal growth or an indicator of scurvy? ***

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The diagnosis of scurvy is the most direct bioarcheological method to determine chronic nutritional deficiency in non-adults (fetal to 3-years), enabling valuable interpretations of early childhood diet, feeding practices, and maternal health. Recent research has suggested that porosity on the inferior surface of the *pars basilaris* of the occipital is indicative of scorbutic hemorrhaging at the site of the *longus capitis* muscle. This diagnostic criterion has subsequently been applied in studies on non-adult skeletal remains, most notably to aid in the scurvy diagnosis of perinates. However, it has not been assessed in a large sample size of mixed-age non-adults, or in a control sample of individuals without scurvy, and therefore it cannot be excluded that this porosity is a marker of normal non-adult growth. This study divided the *pars basilaris* into six segments, recording porosity (micro and macro) and new bone formation on the inferior surface. A total of 172 non-adult individuals (36 gestational weeks to 3.5 years) from Roman (n=11), Iron Age (n=44), and post-Medieval (n=117) British populations were analyzed. Preliminary results indicate basilar microporosity is most prevalent around the *longus capitis* attachments. Individuals displayed a similar microporosity prevalence with (80%) and without (83.4%) skeletal evidence of scurvy. Furthermore, microporosity was more prevalent in individuals <1.5 years (93.8%) than in non-adults >1.5 years (61.7%). As such, this paper concludes that porosity on the inferior surface of the *pars basilaris* is primarily a marker of growth in non-adults, correlated with age, and caution should be practiced when using it as an indicator of scurvy.

Keywords: Non-adult, metabolic disease, bioarchaeology, hemorrhaging

Porous skeletal lesions in two young children from São Martinho church, Leiria, central Portugal (13th-16th century CE)

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This study describes the paleopathological features of two non-adult individuals exhumed from São Martinho, Leiria (Portugal), with widespread porous skeletal lesions. These individuals belong to a larger assemblage of 63 non-adults and 94 adults dated from the 13th-16th century CE. Our aim is to describe the lesions and develop a differential diagnosis. The first individual, with an estimated age of 1.5-2 years old, shows porosity on the *pars lateralis*, *pars basilaris*, ribs (head), vertebra (pedicle and process), and scapula (anterior body and supraspinous fossae). The second individual is about 3-4 years old and has endocranial hypervascularization (occipital), vascular impressions and a thin layer of new bone on the orbital roof, vascular impressions, and porosity within new bone formation on the upper maxillae and mandible, zygomatic bone, different vertebra, both scapula (anterior body and *supraspinous fossae*), ilium (medial) and ischium. Vascular impressions are observable on the rib visceral surface between the head and tubercle, and the rib nutritional *foramina* are enlarged. The bone of at least three rib heads is slightly enlarged, and the inferior border of two ribs is irregular. Active new bone formation with microporosity is also seen on the anterior tibia and porosity on the proximal end of the humerus and femur. Since porous skeletal lesions usually do not have a straightforward diagnosis, we developed here a differential diagnosis considering anemia, scurvy, or infectious diseases such as tuberculosis. Comorbidity cannot be excluded for the older individual.

Keywords: Chronic disease, anemia, scurvy, tuberculosis, children, Medieval

Nondestructive pXRF analysis of porous skeletal lesions: Interplay of sex, age, and cause of death ***

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In documented individuals, respiratory infections (RI) increased the odds of having cribra orbitalia (CO) and cribra cranii (CC). Yet, porous skeletal lesions' (PSL) etiology(ies) continues to be debated. Possible variations in bone elemental composition may help the discussion. This research hypothesizes that PSL, in non-adults, are associated with changes in bone elemental composition, also considering sex, age-at-death, and cause-of-death (COD). This study analyzed 107 individuals (56 females, 51 males) aged 0-20y.o. (\bar{X} =13.2, SD=5.8) from the Coimbra/Lisbon Identified Collections (19th-20th century). CODs were grouped: other infections (n=45), respiratory infections (n=41), non-infectious diseases (n=14), and external causes (ICD-11, n=7). The concentration of ten elements was analyzed by portable X-ray fluorescence (30 points/individual). Although diagenesis cannot be excluded, Ca/P ratio (1.99) suggests good preservation. Cribra femoralis was predominant (CF; 84.5%, 87/103), followed by CO (63.6%, 63/99), CC (41.9%, 39/93), and cribra humeralis (CH; 39.6%, 36/91). Biological sex did not influence bone elemental concentrations or the expression of PSL. Yet, P, Ca, Sr, and Pb (Cp1) levels increased with age-at-death, feasibly associated with the growth process and bioaccumulation of Pb. Higher content of Fe and lower of S (Cp2) increased the odds of presenting CC (OR=1.90; p=0.01), possibly as a result of differentiated absorption of heme and non-heme iron, effects of sideroblastic anemia, and malnutrition. Like other studies, RI as COD increased the odds of having CC (OR=2.91; p=0.05), CO (OR=2.76; p=0.04), and CF (OR=5.25; p=0.02). These results suggest that different nutrient deficiencies in co-morbidity with long-term infections may be the origin of PSL.

Keywords: Elemental composition, cribra, identified skeletal collections, multivariate approach, Portugal

Distinguishing cribra orbitalia from other lesion and pseudopathologies in Medieval populations from Silves, Southern Portugal ***

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Porous bone lesions can be found in different locations of the skeleton. When located in the orbital roof, it is often identified as cribra orbitalia, one of the most recorded porous lesions, but its etiology is an ongoing discussion. Despite being a well-known lesion, identification can be challenging at times. This work aims to evaluate cribra orbitalia and to present examples of doubtful porous lesions found in the orbital roof of individuals from two medieval necropolises in Silves, southern Portugal. Of the 78 individuals with at least one orbit preserved, 58 are adults (14 females, 35 males, 9 unknown), and 20 are non-adults. Three individuals (2 females and 1 non-adult) have cribra orbitalia. Other 13 individuals (4 females, 6 males, and 3 non-adults) show larger and coalesced pores with a slight labyrinthine pattern and grooves that appear to have been caused by vessels or by taphonomy. Porous lesions in the orbit can be mistaken for cribra orbitalia. Plant roots and biological organisms like fungi, bacteria, and algae can alter bones chemically and leave marks on their surface, similar to soil and water. Post-mortem damage during or after excavation may also hinder diagnosis. This study demonstrates challenges in identifying cribra orbitalia and distinguishing it from other lesions or destruction in this anatomical region.

Keywords: Taphonomy, labyrinthine pattern, postmortem, Islamic, Christian

The non-adult endocranium: Exploring physiological and pathological new bone formation and porosity

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Endocranial changes in non-adults (<18 years) have been a repeated topic of debate, with the etiology and diagnosis of this often non-specific new bone formation (NBF) and porosity being problematic. Since Lewis' seminal paper (2004), little dedicated attention has been paid to the non-adult endocranium, particularly for fetal, perinatal, and infant individuals, where distinctions between physiological and pathological NBF/porosity are notoriously complex to decipher. Analyzing 523 individuals (30 gestational weeks – 1 year) from 26 samples across the UK, Europe, and North America (4th century BCE to the 20th century), endocranial NBF and porosity to bones of the vault have been recorded macroscopically. This investigation utilizes a recording system devised by the author, amalgamating existing terminology and features whilst developing additional grading criteria. This method requires all endocranial changes to be documented and graded. Consequently, whilst results show elevated prevalence rates of NBF and/or porosity, particularly in the frontal bone (68%, n=227), parietal bone (48%, n=159), and occipital bone (43%, n=163), when grading is applied, where only grade 3 is considered clearly pathological, prevalence rates are drastically reduced (frontal bone 4% (n=14), occipital bone 2% (n=6), parietal bone 1% (n=3). Furthermore, endocranial NBF was typically recorded as lamellar in the frontal bone (72%, n=164) and parietal bone (80%, n=127), whereas, within the occipital bone, NBF was typically recorded as woven (83%, n=135). Thus, further analysis of variables, including location, age, severity, and type is required if endocranial changes are to be considered pathological indicators and not a consequence of normal growth.

Keywords: Fetal, perinate, infant, macroscopic, growth, grading

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Porous skeletal lesions in connection to metal pollution: Cases studies from Spain and Sweden

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Multiple-processes, interacting and complex etiologies need to be considered when reconstructing paleo-health through skeletal remains. Polluting metals incorporated into human bodies can be a contributory factor for many illnesses, especially during childhood. This paper tries to develop theoretical frameworks into the connection between toxic element incorporation - including lead, mercury, arsenic, and copper - and the development of porous skeletal lesions and other stress markers (e.g., dental enamel hypoplasia, DEH). Even at moderate exposures, toxic metals can induce or enhance anemia by decreasing hemoglobin production, and they can be related to environmental stress and malnutrition (even when resources are available). The possible connections between metal antemortem incorporation and PSL or DEH will be discussed, considering lifestyle factors such as diet or social status (reconstructed by stable isotopes and funerary deposits, respectively). Two case studies will be used to detect physiological stress induced by chronic low dose metal toxicity, i.e., toxicity-induced frailty. 1) A skeletal collection from Lanzada in NW Spain (1st to 7th century CE, two funerary areas) where high levels of lead and mercury pollution were detected in Roman individuals; 2) a skeletal assemblage from Sigtuna in central Sweden (10th to 16th century CE, three cemeteries) where a group of women with high levels of lead and arsenic were found.

Keywords: Copper, arsenic, lead, mercury, dental enamel hypoplasia, toxicity-induced frailty

Young but exuberant: Proliferative periosteal reactions on perinates and infants from an 18th-19th century sample of Lisbon (Portugal) **

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The analyses of porous bone alterations in the human skeleton have been a systematic challenge, especially when dealing with non-adults. This presentation results from an ongoing investigation focused on the growth and health of a recently recovered necropolis of approximately 2800 non-adult skeletons of very young ages from the 18th to the 19th century, Lisbon (Portugal). We intend to share the preliminary results of exuberant manifestations of proliferative periosteal reactions found in a sub-sample of 150 third-trimester fetuses and infants. A significant number of individuals (14%, n=21), with ages at death between 34 weeks of gestational age and 4.5 months, presented bone alterations that include the formation of thick layers of new bone, significant micro- and macroporosity, or loss of bone density. The distribution and severity were carefully recorded to facilitate the differential diagnosis, supporting the conclusion that the cranium and long bones are highly affected in all cases. Medical imaging is also being performed. These finds are indicative of the presence of infectious pathologies and metabolic disorders, presumably maternally acquired. Different diagnoses include congenital syphilis and congenital rickets. The paleopathological cases of this sample represent an excellent opportunity to improve our knowledge of the relationship between osteogenesis and the involvement of pathological conditions that affect the immature human skeleton.

Keywords: Non-adults, paleopathology, porosities, osteogenesis

Porous skeletal lesions in the riverside population (14th-19th century CE) of Sarilhos Grandes (Montijo, Portugal)

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Two different funerary areas associated with the Church of São Jorge and the chapel of Nossa Senhora da Piedade (14th to 19th century) in Sarilhos Grandes (Montijo, Portugal) were excavated in 2020. This study aims (1) to analyze the prevalence of cranial and postcranial cribra in the individuals exhumed and (2) to test if the prevalence of these lesions is higher in this site than in other Portuguese regions. Recent studies report higher prevalence of cribra orbitalia and femoralis in malaria-endemic regions, which may be the case of Sarilhos Grandes, located near the river Tagus. The sample consists of a minimum number of 181 individuals (including 20 articulated skeletons). The presence/absence of cribra was registered macroscopically. Prevalence of cribra cranii is high than in other Iberian populations, and significant differences were observed between sexes (males: 88.9%, 32/36, females: 67.7%, 21/31; Pearson $\chi^2=4.506$; d.f.=1; $p=0.034$). Similarly to other studies, cribra cranii is more frequent in adults (adults=75.9%, 60/79, nonadults=31%, 9/29) with statistical differences (Pearson $\chi^2=18.549$; d.f.=1; $p<0.001$), while cribra orbitalia (90%, 18/20, 40%, 22/55; Pearson $\chi^2=14.732$; d.f.=1; $p<0.001$) and femoralis (90.9%, 20/22, 26.7%, 40/150) are more common in nonadults with significant differences (Pearson $\chi^2=34.859$; d.f.=1; $p<0.001$). There are no differences related to age-at-death and cribra humeralis. These results indicate lower frequencies of cribra orbitalia and cribra femoralis in adults when compared to other regions but much higher in non-adults, suggesting the hypothesis tested is valid, although the co-occurrence of lesions couldn't be confirmed because most of the sample is composed of commingled bones.

Keywords: Malaria, cribra cranii, cribra orbitalia, cribra humeralis, cribra femoralis

Observer error: Another hole in the cribra evaluation

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Most studies on cribra only record its presence/absence, while scoring severity and healing have increased in recent years. To the authors' knowledge, just two studies specifically analyze the observation error, both on cribra orbitalia and cribra cranii, and none consider the error for the register of cribra humeralis and cribra femoralis. This study aims to estimate the intra and interobserver errors in the register of the four cribra and discuss the pitfalls of their assessment, namely when severity and healing are scored. Thirty well-preserved adult individuals (16 males, and 14 females, age-at-death between 21-76 years old) from the Coimbra Identified Skeletal Collection (19th-20th century, from Municipal Cemetery of Conchada, Coimbra) were analyzed. The presence or absence of cribra, severity, and healing was assessed by adapting Rinaldo et al. (2019) proposal. The intra and interobserver errors were estimated by computing the percentage of agreement (PA) and Cohen's kappa (k). The weighted Cohen's kappa was calculated for the variables severity and healing. The presence/absence results show good reproducibility for cribra orbitalia (CO) and femoralis (CF), both for intra ($k_{CO}=0.80$; $k_{CF}=0.76$) and interobserver ($k_{CO}=1.0$; $k_{CF}=0.82$) errors, while results for cribra cranii ($k_{intra}=0.4$; $k_{inter}=0.8$) and humeralis ($k_{intra}=0.50$; $k_{inter}=0.60$) are unsatisfactory. Regarding severity and healing, k values show low reproducibility for all lesions, particularly for the intraobserver error. Yet, a better agreement is somewhat achieved in the case of severity. Results highlight the subjectivity and the variety of decision-making in the recording process, which is particularly evident when the state of healing influences the recording of severity and vice-versa.

Keywords: Intraobserver, interobserver, severity, healing

Cranial porosity: Distribution and relationship between cribra cranii and cribra orbitalia across time in Italy

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The interpretation of porosity on the ectocranial surface (cribra cranii) and on the orbital roofs (cribra orbitalia) is a debated topic, as it is regarding the etiological factors implied in their onset and the relationship among them. In this research, cribra cranii (CC) and cribra orbitalia (CO) were investigated in various samples from the Italian peninsula across time, from the Roman age to the post-Medieval period (1st- 17th century CE), with the aim of comparing their distribution among groups (by sex and age) diachronically. The relationship between the two skeletal alterations was evaluated. The sample under study (n=353) was recovered in five Italian sites as follows: two Roman Imperial age urban (n=105) and suburban (n=60) necropolises from Rome, a late antique suburban necropolis from Pisa (n=66), a Medieval rural cemetery from Siena (n=85), and a Modern period urban cemetery from Lucca (n=37); the last three sites are located in Tuscany. The porosities were macroscopically evaluated in terms of severity and by reparative stage. Data analysis by sex and age indicated no significant difference between males and females in the prevalence of both CC (M=67.4%, F=60.0%) and CO (M=58.9%, F=53.3%), while significant differences were evidenced between adults and non-adults in some necropolis and in the total sample. Cribra cranii were more frequent in adults (63.4%) than in non-adults (50.0%); CO showed an opposite trend (adults=55.7%; non-adults=73.7%). Among the affected individuals, 36.5% of adults showed both CC and CO, while this association in non-adults was higher (60.5%). These results seem to confirm the absence of a direct relationship between CC and CO in the adult subsample. The diachronic comparison showed slight differences limited to a few historical periods.

Keywords: Stress markers, skeletal alteration, diachronic distribution, Italian necropolises

Porous skeletal lesions in identified fetuses and infants: Analysis by type, age-at-death, sex, and cause of death

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Porous skeletal lesions (PSL) are common in non-adult skeletons, yet the age onset of *cribrae* is still unknown. This research seeks to know the minimum age of the individuals from the identified osteological collection of *San José*, Granada (Spain) who present *cribrae*; to assess possible sex differences; and to test if there is a relation between registered causes of death (COD) and the presence/absence of cribra. From the 172 individuals (102 males, 70 females), with ages between 5 gestational months to 6 years ($\bar{X}=9.5$ months), 9.3% (16/172) presented at least one type of cribra, significantly more frequent in females ($\chi^2=5.8$, $p=0.02$). Cribra orbitalia (CO) was recorded in 1.9% of the individuals (3/162, all males), and cribra femoralis (CF) in 8.8% (15/170, 4 males, 11 females), with minimum ages-at-death of 2 years-11 months and 1 years-8 months, respectively. Two males exhibited co-occurrence of CO-CF (2 years-11 months, 5 years). None presented cribra cranii or cribra humeralis. From these data, it is hypothesized that physiological mechanisms need more time to develop and/or the length of illness (e.g., acute illness) was insufficient to produce macroscopic lesions. Most individuals with *cribrae* died from an infection, but this was also the COD for those without *cribrae*. Evaluation of cribra was not always easy due to porous new bone apposition on the orbit roof (9.3%, 15/162) and cranial vault (5.6%, 9/161), among other lesions. This study shows the need for more clinical and/or experimental data to understand bone pathophysiological behavior.

Keywords: Cribra orbitalia, cribra cranii, cribra humeralis, cribra femoralis, new bone formation

Quantifying the accuracy of anemia diagnosis using porous orbital lesions**

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In paleopathology, porous orbital lesions have long been linked to acquired anemia. However, other conditions also cause orbital lesions, and a researcher's ability to differentiate between sources of porosity and recognize lesions caused by marrow hyperplasia is crucial to anemia diagnosis. Evidence of marrow hyperplasia (e.g., enlarged trabecular spacing, cortical thinning, trabecular thinning) can be identified through visualization of internal marrow space microarchitecture. As part of previous work, detailed micro-CT evaluation of marrow hyperplasia was conducted on 42 non-adult orbits from 18th-19th century Quebec, and anemia was diagnosed based on evaluation of microarchitecture changes. The purpose of this study was to use comparisons between the assessed microarchitecture properties and external lesion appearance scoring to quantify the accuracy of diagnosing anemia via external lesion evaluation alone. Additionally, the amount of error when assigning sources of orbital porosity was also calculated. Participants assessed ten photographs of orbital porosity and assigned lesions sources and an anemia diagnosis following given diagnostic guidelines. They repeated these assessments with orbit micro-CT reconstructions from the same individuals. The rate of both false negatives and false positives for anemia diagnosis was approximately 30%, suggesting that individuals with no internal evidence of marrow hyperplasia were being diagnosed with anemia and that those with less developed porous lesions were being missed. Average observer agreement on lesion etiology was highest in participants with more experience. This research emphasizes that some caution is needed when diagnosing anemia based solely on porous lesion appearance and highlights the importance of careful anemia diagnosis.

Keywords: Micro-CT, interobserver error, lesion source, marrow hyperplasia

Now and then: porous cranial lesions in New Mexico

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Porous cranial lesions (PCLs) are a ubiquitous skeletal indicator of stress found in most bioarcheological studies. PCLs are often assumed to indicate that individuals are nutrient deficient or “anemic”. In the Southwest United States, they are attributed to iron-deficiency anemia, an interpretation stemming from pioneering work by El Najar and colleagues in the 1970s. However, this interpretation may stem partly from a misinterpretation of diet in the Ancestral Pueblo Southwest. My recent work explores these skeletal manifestations of stress in New Mexico in the past (AD 1000-1400) and present (AD 2011-2019). In this talk, I survey these projects and provide suggestions for future work.

Keywords: Cribra orbitalia, porotic hyperostosis, Southwest United States, anemia, stress, frailty

Porous skeletal lesions in a pre-Hispanic non-adult individual from Santiago Del Estero, Northwest Argentina

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The study of porous skeletal lesions in individual cases can provide insights into health and relationships with the environment during childhood, especially in regions such as Santiago del Estero, NW Argentina, where the finding of pre-Hispanic multiple burials is uncommon. This work aims to describe the porotic skeletal lesions identified in a non-adult individual from the Pie del Cerro Blanco site. The skeleton belongs to a 5-6 years-old individual; it was buried in a secondary position inside a pottery urn, and relatively dated to the first millennium CE. Highly severe active porotic lesions (following Mangas-Carrasco and López-Costas 2021, Rinaldo *et al.* 2019) were found on the left orbit (cribra orbitalia), both humeral necks (cribra humeralis) and the right femur neck (cribra femoralis); the left femoral neck and right orbit are not preserved. Thickened nutrient foramina with vascular imprints were also recorded in the glabellar region of the cranium, humeral and femoral shafts, while periosteal reactions were noted on the diaphysis of the tibiae. The porotic lesions point to a long homeostatic disruption, as well as intense dental enamel hypoplasias observed in upper permanent incisors, produced when the individual was about 3.5-4.5 years old. Information obtained from isotopic dietary reconstruction and images (multi Slice CT and conventional radiographs) is considered to address causality. The connection of the lesions with physiology, environment, and availability of resources is discussed. It is highlighted that this is the first paleopathological research carried out in the region.

Keywords: Cribotic lesions, childhood, enlarged foramina, periosteal reaction

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Scurvy in Bolivia? A case study of a pre-Columbian child

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The diagnosis of scurvy (vitamin C deficiency) in immature human remains is still challenging and there is yet a paucity of published cases in various geographical areas. This holds true for the Andean region, where reports of metabolic diseases come predominantly from Peruvian sites but are absent from Bolivia. In 2022, in the framework of the interdisciplinary Bolivian Mummy Project, pre-Columbian human remains housed at the National Museum of Archaeology in La Paz underwent a bioarcheological study. Here we present a differential diagnosis based on the well-preserved skull of a 9-12-month-old individual. While this individual's exact burial location is unknown, the general archaeological context of the anthropological collection suggests that this individual belonged to a pre-Columbian Bolivian population. Macroscopic investigation revealed multiple hypertrophic porous lesions on the frontal and occipital squamae and extensive lesions of the parietal bones, bounded by the temporal line, along with ectocranial porosity on the temporal bones, greater wing of the sphenoid, the orbital roofs, and maxillae. Computed tomography scanning allowed us to further investigate the extent of the macroscopically observed lesions, showing asymmetrical expansion of the diploic space in the frontal and parietal bones and radially oriented trabeculae, along with new bone formation in the orbits. Though differential diagnosis is constrained by the absence of postcranial skeleton, these findings are consistent with scurvy possibly comorbid with anemia. This first possible case of scurvy reported in Bolivia adds to growing evidence on patterns of metabolic diseases in the Andes and childhood health in ancient societies.

Keywords: Porotic lesions, vitamin C deficiency, ascorbic acid, nutrition, subadult

That's just full of holes! Critical exploration of PSL phenotypes and their paleopathological significance: Two case studies from Neolithic Northern Germany

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Working within the research framework of the CRC 1266 "Scales of Transformation", we are interested in diseases and biological stress as proxies for socioeconomic transformations in prehistory. Herewith we present a critical approach to the evidence for Porous Skeletal Lesions. Our research project focuses on two neolithic groups (ca. 3300-3100 cal BCE) from Northern Germany, sites of Sorsum (MNI: 106, farming lifestyle) and Ostorf (MNI: 36, aquatic foragers). Due to restricted access and the commingled nature of the bone collections, our study concentrates on the cranial regions. Here, PSL of the vault and cribra orbitalia occurred frequently and in a phenotypic broad spectrum. Preliminary analyses such as scoring presence/absence of the lesions show significantly higher occurrence at Sorsum than at Ostorf. The intra-site distribution raises questions on different subsistence strategies at the two sites during the Neolithic. Thus, we tested co-occurrence and correlation between the porotic lesions and a set of endocranial changes (periosteal appositions, abnormal blood vessels impressions, abnormally pronounced digital impressions, and granular impressions) to explore patterns in phenotypes, co-morbidities, and etiologies (e.g., biological stress, inflammation). This poster provides a timely contribution to the debate on the heterogeneous class of porous bone changes, calling for more awareness of their pathophysiological pathways in paleopathological *praxis*. Furthermore, we discuss methodological biases and resolution limits of non-specific indicators, such as PSL, as well as the potential of interdisciplinary approaches involving aDNA and stable isotope analysis.

Keywords: Cribra orbitalia, porotic hyperostosis, differential diagnosis, pathophysiology, biological stress, transformation

How porous lesions can further our understanding of infant and maternal health in Iron Age and Roman Britain

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Recent bioarcheological research highlights the importance of examining porous lesions to understand the lived experiences of past populations. Applying the Developmental Origins of Health and Disease (DOHaD) hypothesis allows for recognition of health, socio-economic conditions, and psycho-stress events in fetuses, perinates and infants aged within the first 1000 days after conception experience, via the analysis of porous lesions developed in response to their external environment. By viewing mothers and infants together as interlinked beings, bioarcheologists can understand how factors affecting early health may last for a lifetime and be passed on through subsequent generations. This paper aims to understand how marginalized individuals were generationally impacted by the Roman occupation of England through examining porous lesions across the skeleton, with specific interest in porotic hyperostosis, cribra orbitalia, and long bone lesions. A total of 368 Iron Age and Romano-British non-adults aged below 2.5 years and 250 women of childbearing age (20-45 years) were analyzed and compared. Preliminary results suggest that the rates of porous lesions increased during Roman occupation, indicating worsened health. In non-adults, Iron Age individuals (n=46/174, 26.4%) showed fewer porous lesions than both rural Roman (n=42/113, 37.2%) and urban Roman (n=41/81, 50.6%) populations. This pattern was also reflected in the adults, Iron Age women (n=55/177, 47.0%) had fewer pathological changes in comparison with rural (40/65, 61.5%) and urban areas (n=56/68, 82.6%) under Roman rule. Importantly, diseases identified by the study of porous lesions reveal that the Roman conquest of Britain had lasting, generational health effects on the population.

Keywords: Bioarchaeology, health, life course, non-adult, generational

Porotic phenomena in paleopathology: A holistic view from Medicine

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Cribra orbitalia (CO) is maybe the elemental lesion on which most literature has been published in Paleopathology. From its first description by Welcker in 1885 to the present, after 138 years of history, all the evolutionary periods through which this historical-medical discipline has passed have addressed different aspects of CO, from its prevalence and diagnosis in societies of the past to a wide variety of pathophysiological interpretations and controversies about its etiopathogenesis. Unlike other aspects of health and disease in populations of the past, which may have had periods of ostracism, the analysis of CO and the description of new porous skeletal lesions in osteoarcheological remains have remained a true archetype of paleopathological research. This paper provides a retrospective view of the evolution of scientific thought, as well as an assessment of the methods and etiological proposals regarding CO and other porotic phenomena described in the paleopathological literature from the last decade of the 19th century to the present. Finally, the identified osteological collections have as the main source to shed light on the etiopathogenesis is valued, and the concept of Porous Skeletal Lesions is proposed as a paleopathological sanitary marker of a population through which an indirect relationship could be established with economic and social development, environmental, nutritional, and sanitary conditions.

Keywords: Cribra orbitalia, historical-medical thought, etiopathogenesis, paleopathological sanitary marker

Erythropoiesis and skeletal lesions: A clinical perspective

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Red blood cell (RBC) disorders and bone marrow hyperplasia are major causes of skeletal lesions, with inefficient erythropoiesis and hemolysis being the underlying mechanisms. This work aims to review the physiopathology of the most common disorders causing bone lesions. In β -thalassemia moderate to severe phenotypes, erythropoiesis is increased but inefficient. β -thalassemia major anemia is severe and requires lifelong transfusions. Untreated, it leads to death within the first decade. β -thalassemia intermedia anemia is moderate, does not require regular transfusions. Both phenotypes may present extramedullary hematopoiesis, maxillary hyperplasia, dental malocclusion, and frontal bossing. Radiology: osteoporosis, lacy trabecular patterns in long bones and cranial vault with a 'hair-on-end' appearance. Hereditary hemolytic anemias are characterized by peripheral hemolysis and erythroid hyperplasia. Sickle cell disease (SCD) patients have recurrent cycles of vaso-occlusion, ischemia and reperfusion, hemolysis, and inflammation, producing severe pain. The common sites of pain are the back, chest, extremities, and abdomen. Radiology shows patchy sclerosis and cortical thickening of the affected bones. Avascular necrosis of the femoral and humeral heads and collapse of the vertebral end plates are also seen. In the absence of adequate healthcare, SCD is associated with high mortality in the first three years of life. Two other diseases are known to cause bone damages. Hereditary hemochromatosis, an iron overload disorder: loss of joint space and cartilage erosion in the metacarpophalangeal joints. Gaucher disease, a lysosomal storage disorder: osteopenia, lytic lesions, pathological fractures, and avascular necrosis due to bone marrow infiltration by "Gaucher cells". Recent advances in molecular biology will be the key to unraveling the etiology of many bone lesions in skeletal remains.

Keywords: Ineffective erythropoiesis, hemolysis, bone lesions, thalassemia, sickle cell disease, iron, Gaucher disease

Beneath the surface of eyebrows: Investigating the vermiculate pattern in Medieval central Italy

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The skull is affected by different porosities, being physiological, pathological, or alterations difficult to classify in terms of etiology, such as that related to the vermiculate pattern (VP). The VP is a distinct alteration morphologically characterized by grooves and pitting, and it has been described on the cortical surface of the brow region of fossil hominids, modern human populations from identified osteological collections, and non-human primates. Considering the poor knowledge of VP and its etiology as well as the scarce existing research on this topic, the aim of this study is to analyze the VP for the first time in a historical archaeological population. A sample of 118 adults from the medieval rural site of Pieve di Pava (Tuscany, 10th -12th century CE) was chosen. Gross examination of superciliary arches, supraorbital margins, and zygomatic bones revealed VP was significantly present ($\chi^2 = 25.124$, $d.f.=1$, $p < 0.001$) among the male subsample (94.0%, $n=67$) compared to the female subsample (54.9%, $n=51$); VP was present in both sexes across all age groups, but it was more frequently observed among individuals aged 35+ (84.9%, $n=73$). No clear trend was found when testing its correlation with other cranial lesions like cribra orbitalia ($r=0.13$) or chronic maxillary and frontal sinusitis ($r=0.07$ and $r=0.15$, respectively). Although further studies on imaging and histology of VP are needed to understand the underlying mechanism responsible for this alteration, this preliminary research represents one of the first attempts to investigate this condition in the osteoarcheological material.

Keywords: Brow region, frontal bone, Mediterranean, osteoarcheology, pitting, zygomatic bone

Issues in the assessment of porotic hyperostosis and cribra orbitalia in human skeletal remains: the need for a standardized data collection procedure

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In biological and forensic anthropology, several methods, scores, and forms have been proposed for the estimation of the biological profile and health status of skeletonized individuals. Consequently, there is a general lack of a standardized system for data collection, even if several but often unsuccessful attempts have been made. *Intra vitam* porous skeletal lesions (PSL) are one of the most reported skeletal lesions in human remains that are routinely used for health and nutritional status assessment. Even if PSL were first described by Angel in 1966, several inconsistencies are still present, both in terminology, etiology, and data collection procedures. Indeed, one of the main issues in PSL data collection regards the number of scores proposed to assess the degree of severity and healing, with no generally accepted classification system used by the scientific community. Moreover, despite the importance of PSL's degree of severity and healing for a complete understanding of the individual's health status, several scholars avoid collecting or publishing the data due to identification issues and the low inter-operator reliability and reproducibility. This lack of a standardized method might impair comparing data gathered from different epochs and ancestry and, consequently, creating a larger dataset that could help to increase our understanding of these lesions. This talk aims to discuss issues and possible solutions on assessment, data collection, and intra and interobserver reliability and reproducibility of the skull and *postcranium* PSL.

Keywords: Standardization, severity, healing, data collection, porous skeletal lesions

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Cribriform lesions, cribriform lesions, and cribriform lesions: Frequencies and possible association with malaria in the 14th century's ossuary from the deserted village of Geridu (Sardinia, Italy) **

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Skeletal porous lesions are emerging for their significance in understanding the impact of certain pathology on frailty and health status in the past. In this contribution, we present the study of the disarticulated human remains (non-adult MNI=125 / adult MNI = 52) from the medieval village of Geridu (Sardinia, Italy). Macroscopic analysis in non-adults showed a high prevalence of cribriform lesions (33.3%), cribriform lesions (57.8%), and cribriform lesions (54.3%). The analysis of prevalence and age at death suggests that CO and CF are more common in juveniles remains (birth-12 years old), while adolescents are less affected. The macroscopic examination of adult remains also shows a high presence of cribriform lesions (61.8%) and cribriform lesions (72.2%), while cribriform lesions has not been recorded. The specific etiology of these pathological features is unknown. Several causes have been proposed, including different types of anemia or other physiological stresses, such as infections or nutritional deficiencies. In the 14th century, the difficult living conditions, and poor nutrition of Geridu's people are attested by historical sources and confirmed by bioarcheological data. Although recent studies show the need for further evidence, some authors have suggested that CO, CC, and CF could be indicative of the presence of malaria. Considering the characteristics and location of the village, the endemic condition of Sardinia in the Middle Ages, and the presence of inherited anemias directly associated with a genetic response, malaria might be a suggestive explanation for the high rates of skeletal porous lesions in the medieval sample of Geridu.

Keywords: Health status, medieval sample, stress markers, porous lesions, etiology

Porous skeletal lesions during the late Iron Age: Morphological and genetic study of a non-adult individual of the Staggered Turriform of Son Ferrer (Balearic Islands, Spain) **

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The Staggered Turriform of Son Ferrer (TSF) is an archaeological site located in western Mallorca (Balearic Islands, Spain) that worked as a necropolis during the late Iron Age (650/550-123 BC). A minimum number of individuals (MNI) of 79 was found, being 64% of them younger than one-year-old. Porous skeletal lesions (PSL) are known to be more frequent in non-adult individuals as a result of skeletal growth. However, PSL have been also associated with several conditions, such as anemias, infectious diseases, or nutritional deficiencies, among others. Our aim is to present the case study of an infant individual that has a concentrated porosity in the intracranial surface of the lesser and greater wings of the sphenoid and cribriform orbitalia. The age of the individual was determined by dimensions of *pars basilaris*, ilium, and available long bones, and sex was genetically determined. Porosity was examined with a stereoscopic microscope. Moreover, paleogenomic analysis using a whole-genome shotgun has been conducted to search for the presence of infectious pathogens, and the most frequent polymorphisms in Mallorca for sickle cell anemia (rs334) and Beta-Thalassemia (rs1154907) will be analyzed. Age determination indicates that the individual is 6 to 9 months old, and sex assessment indicates a possible female individual. The aspect of the porosities attested suggests that they could be a reaction to a pathological condition, and hence, paleogenomic analysis is being conducted in order to look for a possible cause for these phenomena. We are currently finishing the analysis.

Keywords: Porosity, prehistory, Mallorca, infant, ancient DNA, paleopathology

Newborn bone porosity: A case study of infection in Iron Age (Vilars d'Arbeca, Spain) **

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Bone porosity in infants is very common due to their greater vascularization and rapid growth compared to adults. A complex issue is determining whether it is a normal or pathological porosity, which is extremely difficult to identify in perinatal skeletal remains. Therefore, it is essential to have all the possible information about the individual; in this case, the morphological analysis, combined with paleogenetic and dental histology, could help differentiate between normal and pathological variability. This work presents a possible case of infant death by infection of a 2-month-old child buried in the Iron Age Iberian site of Vilars d'Arbeca (northeast Spain). The chronological age determined by dental histology indicates that the individual died 36 to 63 days after birth. The morphological age based on osteometric methods (maximum lengths and widths of cranial and long bones) and dental development and maturation agrees with this determination. The skeleton presents some anomalies: significant porosity in several skull bones, especially in the basilar portion, that is not expected at this age, and two additional dental stress lines formed 18 and 8 days before death (determined by dental histological analysis). The paleogenetic study indicates that the individual is a male. The microbiome analysis of the shotgun-sequenced sample allows for detecting signs of *Acinetobacter lwoffii* bacteria. *A. lwoffii* has been increasingly reported as a pathogen associated with infections like septicemia, particularly neonatal sepsis, pneumonia, meningitis, urinary tract infections, and gastroenteritis. All the combined information suggests that an infection was probably the cause of the individual death.

Keywords: Osteology, *Acinetobacter lwoffii*, dental histology, ancient DNA, infant mortality

Complex connections? The correlation and association of different porous skeletal lesions

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Porotic skeletal lesions such as cribra orbitalia, cribra humeri, and cribra femoralis are often encountered in archaeological skeletons and are commonly linked to physiological stress in childhood. For all lesions, marrow hyperplasia associated with anemia is considered to be a likely cause, yet there are other conditions that can result in a porous appearance of bone as well. Moreover, while these porous skeletal lesions have a similar macroscopic appearance, it is not yet clear if they are indeed caused by the same condition, as the strength of the correlation and association between these lesions is highly variable with age and with the context of the human remains. Additionally, the CT appearance of the various porous skeletal lesions does appear to differ, which would potentially suggest a disassociated etiology. Thus, the relationship of these different lesions is far from clear-cut. Therefore, this paper will discuss the evidence from published research on the correlation and association of cribra orbitalia, humeri, and femoralis, as well as CT data to investigate potential patterns that may provide information on 1) if a shared etiology exists and 2) why differences in correlation between individuals and populations occur taking into account demographic variables as well as contextual factors.

Keywords: Cribra orbitalia, cribra humeri, cribra femoralis, CT imaging, etiology, demographic patterns

Cribr orbitalia in a Portuguese late Neolithic population: The sample of Cova das Lapas

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Cova das Lapas (Alcobaça) is a small cavity located in the Limestone Massif of Estremadura that was intensively used as a sepulchral space in the Late Neolithic. The cave seems to be a primary place of depositions, extremely disturbed due to a complex sequence of management of the sepulchral space, resulting in commingled but exceedingly well-preserved skeletal samples. The sequence of absolute dating and votive artifacts indicates that it was used in a short period of time, between 3245-3263 and 3036-2913 BCE. Preliminary estimation of the minimal number of individuals is 49 (11 non-adults and 38 adults). Among the observed pathologies or lesions, the presence of cribr orbitalia (CO) stands out since this condition is rarely documented for coeval samples. The aim of this work is to document the prevalence of CO in the non-adult and adult sample from Cova das Lapas and to explore the possible co-occurrence with signs of infections in the cranial remains. CO was recorded in 36.4% (4/11) of the non-adults and 21.0% of the adults (5/24). Severity was greater in non-adults. Among the adults, all observed lesions were remodeled with one exception. Co-occurrence with signs of infections was observed and further investigated.

Keywords: Porous skeletal lesions, orbital roof, Prehistory, infection diseases

Cranial porotic lesions in enslaved African individuals (Valle da Gafaria, Lagos, Portugal)

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Physical and structural violence resulting from forced labor, life in captivity, and physical punishment, inevitably have repercussions on the health of enslaved individuals, which may be reflected in bone lesions. An example of this is porotic lesions, observable on the skull and roof of the orbits, which are closely related to different forms of hereditary and nutritional anemia, as well as vitamin deficiencies. This study aims to analyze porotic lesions, namely cribra cranii (CC) and cribra orbitalia (CO), in adult enslaved individuals (n=76) who lived between the 15th and 17th centuries and recovered from Valle da Gafaria (Lagos, Portugal). For this purpose, an adaptation of the BoPLE (Bone Porous Lesion Evaluation) parameters was used. It was found that 97.3% of individuals had CC and 71% CO. The highest frequency of CC was observed in the occipital (95.7%) and the lowest in the frontal (81%). Regarding CO, it was more observed in the left orbital roof (62.2%) than in the right (56%). As for the severity of the lesions, it was found that 57% of the cases were degree 1 (presence of small holes). When assessed by quarters, CC was most frequently recorded in quarter 1 (parietal zone between the sagittal and lambdoid suture) of the left parietal (76.3%). Following up on this study, it will be assessed the presence (or not) of porosity remodeling. These preliminary results are suggestive of poor living conditions, which is in line with historical sources.

Keywords: Pathology, cribra cranii, cribra orbitalia, slavery, Portuguese maritime expansion

Hypertrophic porous lesions and endosteal skeletal alterations: A possible case of treponematosi in an infant from Prehistoric Brazil

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Macroscopic observation of non-adult osteological remains is essential in Paleopathology, but a reliable differential diagnosis usually requires further approaches. This study aims to achieve a more refined differential diagnosis through internal skeletal assessment using radiography and computed tomography (CT) scans. The skeleton under evaluation (Ind.9) belongs to a Middle Holocene hunter-gatherer infant individual (6,220±50 to 6,610±40 years BP) from *Toca do Enoque*, Piauí (Brazil). Ind.9, aged 9±3 months, estimated by tooth eruption, allowed inferring ante and postmortem interpersonal care either by a remarkable funerary treatment or by his/her resilience to disease(s), denoted by the set of distinctive pathological alterations. In a previous study, the massive porous bone proliferation recorded on the ecto- and endocranial surfaces and on all long bone diaphysis was associated with a possible systemic infectious and/or nutritional condition(s). Diaphyseal radiographs (GE-XR6000) and CT scans (Philips Ingenuity 128, voxel width and height: 0,45mm; voxel thickness: 0,9 mm) revealed extensive endosteal new bone formation on the humeri, radii, and tibiae. The left tibia was the most affected bone, with a large saber-shaped bony deformation derived from the massive periosteal proliferation, along with cortical (osteitis) and marrow (osteomyelitis) rarefaction. The co-occurrence of such imaging and macroscopic changes resembles some type of treponemal infection. In addition, the age at death of Ind.9 makes it congruent to hypothesize about a possible case of early congenital syphilis. Other cases of congenital syphilis have been identified in the country also dated back to the Middle Holocene.

Keywords: Differential diagnosis, non-adult individual, interpersonal care, massive proliferative bone alterations, CT, radiography

Trying to get to the bottom of the hollow: Porous skeletal lesions and their potential for mapping rare bone diseases

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Over the past decade, bone-muscle crosstalk has been a vital component for clinical research regarding the treatment of musculoskeletal pathologies, particularly those of a chronic degenerative nature. Within this discourse, the impact of oxidative stress on homeostasis and our body's inflammatory responses have been frequently reported, but the association with the formation of porous bone lesions is still underappreciated when it comes to their pathophysiological pathways. Recent investigations into immune responses and skeletal manifestations of rare musculoskeletal disorders, a complex area in palaeopathology, have resulted in uncovering interesting connections between biochemical and neurological markers of homeostatic imbalances and biomechanical effects that may provide insights into the formation of porous skeletal lesions, a common observation associated with enthesal and degenerative changes, metabolic and inflammatory conditions, and physiological aging. This study explores available biomedical, clinical, and skeletal evidence relevant to the understanding of the biological mechanisms and impact of these systemic disturbances and proposes an evidence-based interpretation of our observations of porous lesions occurring at the enthesal interface in various rare neurodegenerative disorders. Considering the role of oxidative stress-induced osteolysis might provide a better and more comprehensive understanding of underlying disease mechanisms and facilitate the analysis of complex disorders from the skeleton. Regarding chronic neurodegenerative disorders, this paves the way towards a novel, multidimensional appraisal of diseases and lives that so far often remain invisible in our record. Understanding better what lies beneath the porosity lends us a toolset for a more rigorous pathological interpretation of lesion patterns in skeletal analysis.

Keywords: Enthesal changes, oxidative stress, bone-muscle crosstalk, rare diseases, neurodegenerative disorders

Cribræ sunt e pluribus unum: 3D- μ CT and thickness mapping confirms that more than one process can cause cribræ orbitalia* *

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Cribr   orbitalia (CO), which was identified at the end of the 19th century and defined at the beginning of the 20th century, has long been the subject of macroscopic studies. Interest was revived in the 1980s as researchers began to use radiography to analyze the bone's internal architecture and associated CO with diploic space hyperplasia due to anemia. Other studies have used paleohistological methods or non-destructive analysis of CT and μ CT slices and assessed CO to other etiologies (for instance, inflammation, infection, tuberculosis, or growth variation). Here, we propose the use of μ CT technology in combination with 3D reconstruction followed by thickness mapping (implemented on TIVMI^{  } software). The thickness mapping is specifically used on children's orbital roofs as a tool to study orbital porosities and related changes in the bone microarchitecture. Our data come from immature individuals with preserved orbital roofs from the osteoarcheological collection of Cognac-Saint-Martin (Dordogne, France). We retained six individuals exhibiting CO (aged from 10,5 months to 5,5 years old, who lived between the 13th and the 18th century), representing nine preserved orbits, and two control individuals whose age at death was under five years old, representing two preserved orbits. In keeping with other researchers, our results show that these porotic lesions are not consistently associated with diploic hypertrophy. They suggest that several pathophysiological processes (short or long in time) are involved and could be differentiated. Cribr   orbitalia thus appears as an osteological expression of several causes rather than a single paleopathological entity synonymous with anemia.

Keywords: Orbital roof, children, anemia, microtomodensitometry, diploic space, porous cranial lesions

The contribution of bone collagen stable isotope analysis in the study of cranial porotic lesions

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Stable isotope analysis ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) of bone and dentine collagen provides important information on diet as well as on the timing of weaning and can also help identify the presence of physiological stress episodes occurred during childhood. The aim of the present study is to verify whether the analysis of stable isotopes can shed light on the etiology of cranial porosities. For this purpose, a preliminary examination was conducted on non-adult individuals from the site of Vaste (Apulia, Italy, 4th-8th century CE). Macroscopical examination of cribra cranii and cribra orbitalia was conducted in a sample of 15 non-adults (aged 1-12 years), of which six exhibited porosities of the ectocranial surface of the skull and/or of the orbital roof. The analysis of bone collagen was performed on all non-adults to reconstruct the timing of weaning and diet; moreover, a comparison with paleodietary data of adults from the same site was also performed. Finally, the analysis of dentine serial sections was conducted for seven of the 15 non-adults under study to accurately investigate the timing of weaning and to detect the presence of physiological stress during early childhood. The results showed that weaning started around one year old in Vaste, and this process was completed around 3/4 years old. Moreover, episodes of stress that occurred prior to the death of individuals have been identified. It was, however, difficult to establish whether bone collagen nitrogen values were influenced by weaning or the occurrence of episodes of stress and disease influenced the observed patterns.

Keywords: Cribra orbitalia, cribra cranii, skeletal stress indicators, non-adults

Two decades of searching for malaria in Asia-Pacific: What we've learnt (or rather unlearnt) when it comes to porosity

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In the tropics, two major factors significantly influence the underlying disease profile in the archaeological record—and both have the potential to cause skeletal porosity. These are malaria and its anemic *sequelae* and helminthiasis. In this presentation we will focus on how porosity (both non-specific and in relation to the diagnosis of hemoglobinopathy) has contributed to the pre-contact evidence of malaria in tropical Asia and the Pacific. The sites in this review span assemblages from across the region we have collectively assessed since Hallie Buckley's Ph.D. in 1998. In addition, we will present specific cases from both anatomical and ancient assemblages in this region that have 'muddied the waters' regarding identification of the cause of porosity. Specifically, we will present instances of sphenoidal porosity seemingly unrelated to scurvy, the association of endocranial porosity in absence of ectocranial porosity in thalassemic cases, and a unique case wherein a combination of scurvy, rickets, and thalassemia appear to have all contributed to the overall porosity of the skeleton in a child. We present these cases in hopes of opening up further discussion on the definition and identification of porosity given the variable disease burdens observed in tropical versus temperate regions of the world.

Keywords: Anemia, porotic hyperostosis, thalassemia, scurvy, rickets, tropics

Frequency of probable scurvy within adults from the outskirts of an early Modern (16th-19th century CE) Wrocław (Poland) **

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Scurvy is a disease resulting from continued vitamin C deficiency. Information about the frequency of this condition in a given population allows for an attempt to determine living conditions and health status. In non-adult individuals, because of their rapid development and active apposition growth, lesions are more pronounced. Nevertheless, non-specific lesions associated with scorbutic deficiency allow for a probable diagnosis of this deficiency in adults. Adult individuals (N=144) from a 16th-19th century cemetery near Czysty square in Wrocław (Poland) were studied for the occurrence of subperiosteal new bone formation and abnormal porosity. In total, 20 localizations on cranial and postcranial skeletons were examined for the presence of scurvy-like lesions (Snoddy *et al.*, 2018; Vlok, 2023). Macroscopic analysis was accompanied by the use of an endoscopic tool for the endocranial examination. Weighted threshold diagnostic criteria were used, and suggestive and diagnostic features (e.g., abnormal porosity of the greater wing of sphenoid) were examined to arrive at a probable diagnosis. Almost half (48.6%) of all individuals were diagnosed with probable scurvy, with males and females being similarly affected. The most often observed diagnostic features were abnormal porosity within parietal and/or occipital bones (30.9%) and subperiosteal new bone formation within infrascapular fossa of scapula (27.3%). The high frequency of probable scurvy within the studied individuals corresponds well with the context of the individuals buried in the cemetery, as they were of various social statuses but were often derived from poor communities from the outskirts and outside the city.

Keywords: Subperiosteal new bone formation, abnormal porosity, nutritional deficiency, endoscopic tool

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