

# PALEOPATHOLOGY ASSOCIATION

## SCIENTIFIC PROGRAM

41<sup>st</sup> Annual North American Meeting  
CALGARY, ALBERTA  
April, 2014

**PALEOPATHOLOGY ASSOCIATION**

41<sup>st</sup> Annual North American Meeting

**CALGARY, ALBERTA**

April 8 & 9, 2014

**SCIENTIFIC PROGRAM**

**Monday, April 7<sup>th</sup>**

**Registration (6.00pm – 9.00pm)** *Grand Foyer, Hyatt Regency Calgary*

**Tuesday, April 8<sup>th</sup>**

**Registration (7.45am – 5.00pm)** *Third Floor, Hyatt Regency Calgary*

**Student Action Committee Raffle (7.45am – 5.00pm)** *Third Floor, Hyatt Regency Calgary*

**Morning Session (8.30 – 11.30am):**

**Workshop I:** *Imperial Ballroom 1/2*

8.30 – 11.30 **Digitised Diseases: 3D Visualisation of Pathological Lesions**

Organized by Andrew Wilson and Jo Buckberry

**Workshop II:** *Stephens AB*

8.30 – 9:45 **How to Get Published (Ethically!) in Scientific Journals**

Presented by Jane Buikstra, Charlotte Roberts, and a panel of IJPP Associate Editors

10:15 – 11.30 **Thinking about 21st Century Paleopathology: Confronting Interdisciplinarity**

Presented by Jane Buikstra

Discussion

**11.30 – 1.30 LUNCH**

**Afternoon Symposium (1:30 – 5:00pm)**

**Podium Presentations** *Imperial Ballroom 5/7*

**CANCER AND NEOPLASTIC DISEASE IN BIOARCHEOLOGY: ESTABLISHING A DIALOGUE FOR FUTURE RESEARCH.** Organized by The Palaeo-oncology Research

Organization: Kathryn J. Hunt, Jennifer L. Willoughby, Casey L. Kirkpatrick, & Roselyn A. Campbell

**Symposium, Part I (1.30 – 2.55pm) Chair: Casey L. Kirkpatrick**

1.30 INTRODUCTION. Kathryn J. Hunt

1.40 WHERE HAVE ALL THE TUMOURS GONE? Tony Waldron

1.55 READING BETWEEN THE LINES: A COMPARISON OF BIOARCHAEOLOGICAL AND LITERARY EVIDENCE FOR CANCER. Roselyn Campbell \*\*\*

2.10 METHODOLOGICAL CONSIDERATIONS FOR ANALYZING NEOPLASTIC DISEASE IN JUVENILE ARCHAEOLOGICAL REMAINS. Jennifer L. Willoughby

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

- 2.25 DIAGNOSTIC DIFFERENCES OF METASTATIC CARCINOMA AND MULTIPLE MYELOMA IN A BIOARCHAEOLOGICAL CONTEXT. Brittany Walter
- 2.40 THE EFFICACY OF USING A MODERN SKELETAL COLLECTION TO AID IN THE IDENTIFYING OF CANCEROUS LESIONS IN ARCHAEOLOGICAL BONE. Thomas Siek

**2.55 – 3.25 Break**

**Symposium, Part II (3.20 – 5.00pm) Chair: Jennifer Willoughby**

- 3.25 LINKING THE PAST WITH THE PRESENT: THE SYNOPTIC RESULTS OF A PALAEO-ONCOLOGICAL META-ANALYSIS. Kathryn J. Hunt & Charlotte Roberts
- 3.40 CANCER IN ANCIENT EGYPT: A SKELETON WITH METASTATIC CARCINOMA FROM AMARA WEST, UPPER NUBIA (3200BP). Michaela Binder & Charlotte Roberts
- 3.55 ABNORMAL GROWTHS AND TUMOURS OF THE SALIVARY GLANDS: A BIOARCHAEOLOGICAL PERSPECTIVE. Casey L. Kirkpatrick \*\*\*
- 4.10 DIFFERENTIAL DIAGNOSIS OF A GIANT CALCIFIED ABDOMINAL MASS. Carolyn Rando & Tony Waldron
- 4.25 PALEO-ONCOLOGY RESEARCH IN THE DAKHLEH OASIS, EGYPT: NEW CASES AND A PALEO-EPIDEMIOLOGICAL PERSPECTIVE. El Molto & Peter Scheldrick
- 4.40 DISCUSSION – Leader: Roselyn Campbell
- 5:00 Announcements

**5.15 – 6.15 Student Action Committee Imperial Ballroom 5/7**

**Discussion Panel Chair: Chris Stantis**

**THE PAST TEACHING THE PRESENT: APPLICATION OF PALAEOPATHOLOGY IN UNDERSTANDING MODERN HEALTH.** Panelists: Brenda Baker, Charlotte Roberts, & Susan Pfeiffer

- 6.30 Cash Bar, followed by Association Business Meeting and Buffet Dinner  
*Imperial Ballroom 1/2/3*

**Wednesday, April 9<sup>th</sup>**

**Registration (8.00 – 12.00 noon) Third Floor, Hyatt Regency Calgary**

**Student Action Committee Raffle (8.00am – 5.00pm) Third Floor, Hyatt Regency Calgary**

**Morning Session I (8.00 – 9.20am) Chair: Elizabeth Uhl**

**Podium Presentations Imperial Ballroom 1/2**

- 8.00 Announcements
- 8.05 **A BIOCULTURAL INVESTIGATION OF RATES AND LOCATION OF DENTAL DISEASE AND TREATMENT IN A TURN OF THE CENTURY LOW SES SAMPLE FROM THE HAMANN-TODD COLLECTION.** Jamie M. Gomez \*\*\*

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

- 8.20 RICHARD III: RECONSTRUCTING THE LIFE AND DEATH OF THE LAST PLANTEGENATE KING OF ENGLAND (1483-85).** P.D. Mitchell, J. Appleby, S. Hainsworth, G. Ruddy, A. Brough, R. Earp, B. Morgan, C. Robinson, T. King, R. Buckley
- 8.35 GENOTYPES OF HISTORIC STRAINS OF *MYCOBACTERIUM TUBERCULOSIS* FROM ARCHAEOLOGICAL REMAINS.** Terry Brown, Romy Müller, & Charlotte Roberts
- 8.50 CONTRIBUTION OF 3D IMAGING TO WAR PALEOTRAUMATOLOGY (MASS GRAVE OF NAPOLEONIC SOLDIERS, KÖNIGSBERG, DECEMBER 1812).** Olivier Dutour, Hélène Coqueugniot, Bruno Dutailly, Pascal Desbarats, & Alexandra Buzhilova
- 9.05 EXPLORING LIVED IDENTITIES VIA BIOARCHAEOLOGICAL ANALYSIS: LOCAL BIOLOGIES AND SOCIAL IDENTITIES OF THE ALAMANNI.** Nivien Speith  
+++

**9.20 – 10.35 Break & Poster Session I** *Telus CC Exhibit Hall E*

Posters in place all day but authors of odd numbered posters will be present during this break. Poster titles & authors listed at the end of the program.

**Morning Session II (10.35 – 11.50am) Chair: Nancy Lovell**

**Podium Presentations** *Imperial Ballroom 1/2*

- 10.35 DEATH BY TWINS: AN EARLY CASE OF DYSTOCIC CHILDBIRTH IN NEOLITHIC SIBERIA.** Angela R. Lieveise, Vladimir Ivanovich Bazaliiskii, & Andrzej W. Weber
- 10.50 ACCOMMODATING DIFFERENCE IN THE PREHISTORIC PAST: REVISITING THE CASE OF ROMITO 2 FROM A BIOARCHAEOLOGY OF CARE PERSPECTIVE.** Lorna Tilley +++
- 11.05 IDENTIFICATION OF TORTICOLLIS IN AN ENSLAVED MAN FROM 18<sup>TH</sup> CENTURY CONNECTICUT AND ITS SIGNIFICANCE FOR PUBLIC BIOARCHAEOLOGY.** Jaime Ullinger & Kristen Hartnett +++
- 11.20 ENDOCRANIAL LESIONS IN INFANTS AND CHILDREN: EVIDENCE FOR HEALTH IMPACTS IN ANCIENT EGYPT.** Tosha Dupras & Lana Williams
- 11.35 YOU ARE NOT WHAT YOU EAT DURING PHYSIOLOGICAL STRESS: ISOTOPIC EVALUATION OF HUMAN HAIR.** Lori D’Ortenzio, Megan Brickley, & Tracy Prowse \*\*\*

**12.00 – 1.55 Lunch – Let’s Do Lunch** (James Joyce Irish Pub and Eatery – see map at back of program)

**Student Action Committee Silent Auction (2.00 – 5.00pm)** *Grand Foyer, Hyatt Regency Calgary*

**Afternoon Session I (2.00 – 3.00pm) Chair: Lorna Tilley**

**Podium Presentations** *Imperial Ballroom 1/2*

- 2.00 AN INTERESTING TURN OF EVENTS: WHEN OSTEOLOGY INFORMS HISTORY.** Gillian M.M. Crane-Kramer
- 2.15 FRACTURES, SPLINTS, AND TRACTION: WHAT DO POORLY REDUCED FRACTURES TELL US ABOUT ACCESS TO MEDICAL CARE?** J. Christopher Dudar

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

- 2.30 ANALYSIS OF HISTORICAL *MYCOBACTERIUM TUBERCULOSIS* FROM 18<sup>TH</sup> CENTURY VÁC, HUNGARY BY METAGENOMICS AND CELL WALL LIPID BIOMARKERS.** Helen D. Donoghue, Mark Spigelman, Ildikó Pap, Ildikó Szikossy, Oona Y-C Lee, David E. Minnikin, Gurdyal S. Besra, Andrew Millard, Martin J. Sergeant, Jacqueline Z-M Chan, & Mark J. Pallen
- 2.45 RESORPTION OF MANDIBULAR ALVEOLAR BONE FOLLOWING *ANTE MORTEM* LOSS OF MOLAR TEETH: A BONY RESPONSE TO A COMMON DENTAL PATHOLOGY.** Simon Mays

**3.00 – 4:15 Break & Poster Session II** *Telus CC Exhibit Hall E*

**Posters in place all day but authors of even numbered posters will be present during this break. Poster titles & authors listed at the end of the program.**

**Afternoon Session II (4.15 – 5.00pm) Chair: Ryan Harrod**  
**Podium Presentations** *Imperial Ballroom 1/2*

- 4.15 SKELETAL AND DENTAL PATHOLOGY IN A COMPARATIVE COLLECTION OF WOLVES AND COYOTES.** Diane M. Warren
- 4.30 BIOARCHAEOLOGICAL EVIDENCE FOR LIFE HISTORY TRADE-OFFS IN RESPONSE TO EARLY LIFE STRESSORS USING INCREMENTAL MICROSTRUCTURES OF ENAMEL.** Daniel H. Temple
- 4.45 ANCIENT MYCOBACTERIAL LIPIDS AS REFERENCE BIOMARKERS IN CHARTING THE EVOLUTION OF TUBERCULOSIS.** David E. Minnikin, Oona Y-C. Lee, Houdini H.T. Wu, Vijayashankar Nataraj, Gurdyal S. Besra, Apoorva Bhatt, Bruce M. Rothschild, Richard Laub, Mark Spigelman, & Helen D. Donoghue
- 5.00** Closing Remarks and Announcements, Award of Cockburn Student Prize and Early Career Prize, Announcement of SAC Raffle and Silent Auction Winners  
Cash bar reception

## POSTER PRESENTATIONS

(Number refers to poster board number) An author of the poster should be present at the poster during their assigned poster session. Authors of odd numbered posters should be present at the first poster session (Wednesday, April 9, **9.20 – 10.35am**), and those of even numbers posters should be present at the second session (Wednesday, April 9, **3.00 – 4.15pm**).

1. **INVESTIGATING PATTERNS OF INTERPERSONAL VIOLENCE USING FREQUENCY DISTRIBUTIONS OF CRANIAL VAULT TRAUMA.** Armando Anzellini & J. Marla Toyne \*\*\*
2. **THE IMPACT OF INDUSTRIALIZATION ON HEALTH IN LONDON: UNDERSTANDING THE AETIOLOGY OF HYPEROSTOSIS FRONTALIS INTERNA.** Jelena Bekvalac, A.G. Western, & Michael Farmer
3. **MA'AT IN THE BONES: AN OSTEOBIOGRAPHY OF A NON-ROYAL WOMAN FROM AKHETATEN.** Alissa Bandy \*\*\*
4. **TOOTH WEAR AND TASK ACTIVITY IN A ROMAN MARITIME COMMUNITY IN ITALY.** Sean C. Brown & Nancy C. Lovell
5. **DIFFERENTIAL DIAGNOSIS OF A COLD CASE SKELETON.** Lauren Bennett & Lesley Gregoricka \*\*\*
6. **COMBINING PALEOPATHOLOGY WITH BONE CHEMISTRY ANALYSES TO RECONSTRUCT A LIFE HISTORY.** Jennifer F. Byrnes, Joyce E. Sirianni, & Peter J. Bush \*\*\*
7. **HEALTH AT MEDIEVAL FISHERGATE HOUSE: AN EXAMINATION OF THE RELATIONSHIP OF DIET, GROWTH, AND SINUSITIS.** Nicole M. Burt +++
8. **PALEOPATHOLOGY OF ARTIFICIAL CRANIAL DEFORMATION: HISTORY AND SOCIAL SIGNIFICANCE OF HEAD-SHAPING IN THE LAMBAYEQUE VALLEY, PERU.** Callie M. Chapman & Haagen D. Klaus
9. **ON THE CUSP OF CHANGE: IMPACTS OF SUBSISTENCE STRATEGY CHANGES ON THE HEALTH OF A WADI SUQ (2200-1300 BC) POPULATION FROM RA'S AL-KHAIMAH, UAE.** Alyson Caine, Charlotte A. Roberts, & Derek Kennet \*\*\*
10. **A STUDY OF DENTAL REMAINS FROM THE XII-XVI CENTURY CATHEDRAL CEMETERY IN ZAFRA, SPAIN.** Pedro Colino-Gallardo, Diego Peral-Pacheco, Elena Labajo-González, & David Llinares
11. **LEGION OF LESIONS- EXPLORATION OF SCORBUTIC CRANIAL LESIONS FROM A ROMANO-BRITISH CEMETERY.** Tyler Cargill \*\*\*
12. **BRINGING FIELD RADIOGRAPHY INTO THE 21<sup>st</sup> CENTURY.** Gerald Conlogue & Mark Viner
13. **THE ROADS OF ANATOMY AND PALEOPATHOLOGY: TWO UNIQUE LESIONS FROM THE ROMAN IRON AGE IN DENMARK.** Larissa Collier +++
14. **3D PALEOPATHOLOGICAL REAPPRAISAL OF THE MIDDLE PALAEOLITHIC QAFZEH 11 ADOLESCENT SKULL.** Hélène Coqueugnot, Olivier Dutour, Baruch Arensburg, Henri Duday, Bernard Vandermeersch & Anne-Marie Tillier

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

15. **ANKYLOSING SPONDYLITIS AND HLA-B27 IN THE PRE-CONTACT ILLINOIS RIVER VALLEY: A CASE STUDY OF PROLIFERATIVE LESIONS IN THE AXIAL SKELETONS OF THREE INDIVIDUALS.** Adam Crane, Della Collins Cook, & Frederika Kaestle \*\*\*
16. **MUSCULOSKELETAL STRESS MARKERS AT TELL EL-AMARNA.** Heidi Suzanne Davis
17. **SPINAL CHANGES AS EVIDENCE OF RIDING USE IN ARCHAEOLOGICAL HORSES.** Pamela J. Cross \*\*\*
18. **TAPHONOMIC EVIDENCE OF ANCIENT CARNIVORE MODIFICATION IN A CHULLPA MACHAY TOMB FROM THE SITE OF HUALCAYAN, CALLEJON DE HUAYLAS VALLEY, IN PERU'S NORTHERN HIGHLANDS.** Elizabeth DiGangi
19. **CONGENITAL CONFUSIONS: ASSESSING DIAGNOSTIC DISCREPANCIES IN SPINAL MALFORMATIONS.** Kori Lea Filipek-Ogden \*\*\*
20. **NON-ADULT MORBIDITY AND MORTALITY IN NEOLITHIC SYRIA.** Sean. P. Dougherty
21. **PATTERNS OF VIOLENCE AT MOUNDVILLE: A PRELIMINARY ANALYSIS OF OBSERVED RATES OF TRAUMA IN THE WEST OF MOUND P CEMETERY.** J. Lynn Funkhouser \*\*\*
22. **CRIME OF PUNISHMENT? AN ANALYSIS OF CRANIAL TRAUMA FROM MONGOLIA.** Bruno Fröhlich, Judith Littleton, Tsend Amgalantugs, & Paul Morrow
23. **FORM FOLLOWS FUNCTION: ASSESSING METHODS FOR RECORDING ENTHESES AND OSTEOARTHRITIS ON HUMAN SKELETAL REMAINS.** Ryan P. Harrod & Alyssa Y. Willett +++
24. **GENETIC DISORDER, CHRONIC INFLAMMATION, OR HORMONAL DYSFUNCTION? DIAGNOSING BONE DISEASE IN POORLY PRESERVED HUMAN REMAINS.** Katharina Fuchs & Julia Gresky
25. **ARCHAIC NATIVE AMERICAN DENTAL HEALTH IN THE OHIO RIVER VALLEY.** Alesia King \*\*\*
26. **MORBIDITY, MORTALITY AND MOBILITY IN MEDIEVAL DENMARK: LINKING OSTEOLOGICAL AND STABLE ISOTOPIC INTERPRETATIONS.** Julia A. Gamble, Hilary Gough, Jesper Boldsen, Mostafa Fayek, & Robert D. Hoppa
27. **RECONSTRUCTING THE IMPACT OF MEDIEVAL BLACK DEATH ON THE IMMUNE SYSTEM OF HUMAN POPULATIONS (I): THE IMPACT OF *YERSINIA PESTIS* IMMUNE SUPPRESSION ON THE SUBSEQUENT IMMUNE RESPONSE TO PERIODONTAL PATHOGENS.** Chris Klaes, Matthew Lawrenz, Sharon DeWitte, & Fabian Crespo \*\*\*
28. **A MULTI-MODALITY IMAGING STUDY OF A SKELETON DIAGNOSED WITH VON RECKLINHAUSE'S NEUROFIBROMATOSIS.** Ramon Gonzalez, Gerald Conlogue, Mark Viner, & Jelena Bekvalac
29. **DENTAL CARIES IN NEADERTALS AND EARLY MODERN HUMANS IN WESTERN EURASIA.** Sarah A. Lacy \*\*\*

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

30. **A PROBABLE CASE OF TREPONEMATOSIS IN CABEÇUDA SHELL MOUND, SANTA CATARINA, BRAZIL.** Victor Guida, Silva Reis, Adilson Dias Salles, & Claudia Rodrigues-Carvalho
31. **DISSECTION MATERIAL FROM AN 1850s HOSPITAL CEMETERY IN COPENHAGEN, DENMARK.** Niels Lynnerup & Mitchell James Flies
32. **TO GROW STRONG: HEALTH ANALYSIS OF THE CHILDREN FROM THE CABEÇUDA SHELLMOUND, SANTA CATARINA STATE, BRAZIL.** Silvia Reis, Victor Guida, Adilson Dias Salles, & Claudia Rodrigues-Carvalho
33. **NUTRIENT FORAMEN VARIATION IN HUMAN LONG BONES: POSSIBLE EFFECTS FROM STRESS DURING DEVELOPMENT.** Kendall B. McCullough, D. Troy Case, & Ann H. Ross \*\*\*
34. **TRAUMA OF TAPHONOMY? A POSSIBLE CASE OF CRANIAL IMPALEMENT IN THE SACRIFICIAL CONTEXT OF MATRIX 101, HUACA LAS VENTANAS, PERU.** Jenna Hurtubise, Derrick Nuesmeyer, Haagen Klaus, José Pinilla, & Carlos Elera
35. **HEALTH IN A PREHISTORIC NORTH CAROLINA ALGONKIAN POPULATION: THE PIGGOT OSSUARY (31CR14).** Emily McDowell \*\*\*
36. **NOT JUST A PAIN IN THE NECK: ELONGATED TEMPORAL STYLOID PROCESS IN POST-MEDIEVAL AMBEL, ARAGON, NE SPAIN.** Tina Jakob & Joe Wallace Walser III
37. **POROTIC HYPEROSTOSIS AND CRIBRA ORBITALIA AT THE GINEFAB SCHOOL SITE, SUDAN.** Annie Laurie Norris & Brenda J. Baker \*\*\*
38. **NO STONE UNTURNED: THE PRESENCE OF KIDNEY STONES IN A SKELETON FROM 19<sup>TH</sup> CENTURY PEORIA, ILLINOIS.** Thomas Jaskowiec, Michael Lee, Sean Rajnic, & Anne Grauer
39. **BASI-VERTEBRAL FORAMEN REACTION AND EXPANSION: AN INDICATOR OF SYSTEMIC BLOOD INFECTION.** Jennifer K. Odien & Jennifer F. Byrnes \*\*\*
40. **ATHEROSCLEROSIS OF THE AORTA AND CORONARY ARTERY IN A 17<sup>TH</sup> CENTURY KOREAN FEMALE MUMMY CASE USING A MULTI-DISCIPLINARY APPROACH.** MyeungJu Kim, Yi-Seok Kim, Chang Seok Oh, Jai-Hyang Go, In Sun Lee, Won-Kyu Park, Jongha Hong, & Dong Hoon Shin
41. **ENTHESEAL CHANGES AT THE LATE PREHISTORIC WOODLAND RIDGE (12C335) SITE, INDIANA.** Rachel Perash \*\*\*
42. **RETHINKING POROTIC HYPEROSTOSIS ON THE NORTH COAST OF PERU: A NEW LOOK AT ANEMIA IN THE LATE PRE-HISPANIC AND HISTORIC ERAS.** Rachel Larsen & Haagen D. Klaus
43. **LA JOLLAN MOBILITY AND BEHAVIOR.** Tori Randall +++
44. **THE EGYPTIAN MUMMY AUTOPSY: A HISTORY OF THE PRACTICE AND PRESERVING THE AUTOPSY CONTEXT.** Melissa Miller, Vicki Cassman, Molly Gleeson, & Karen Rosenberg

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

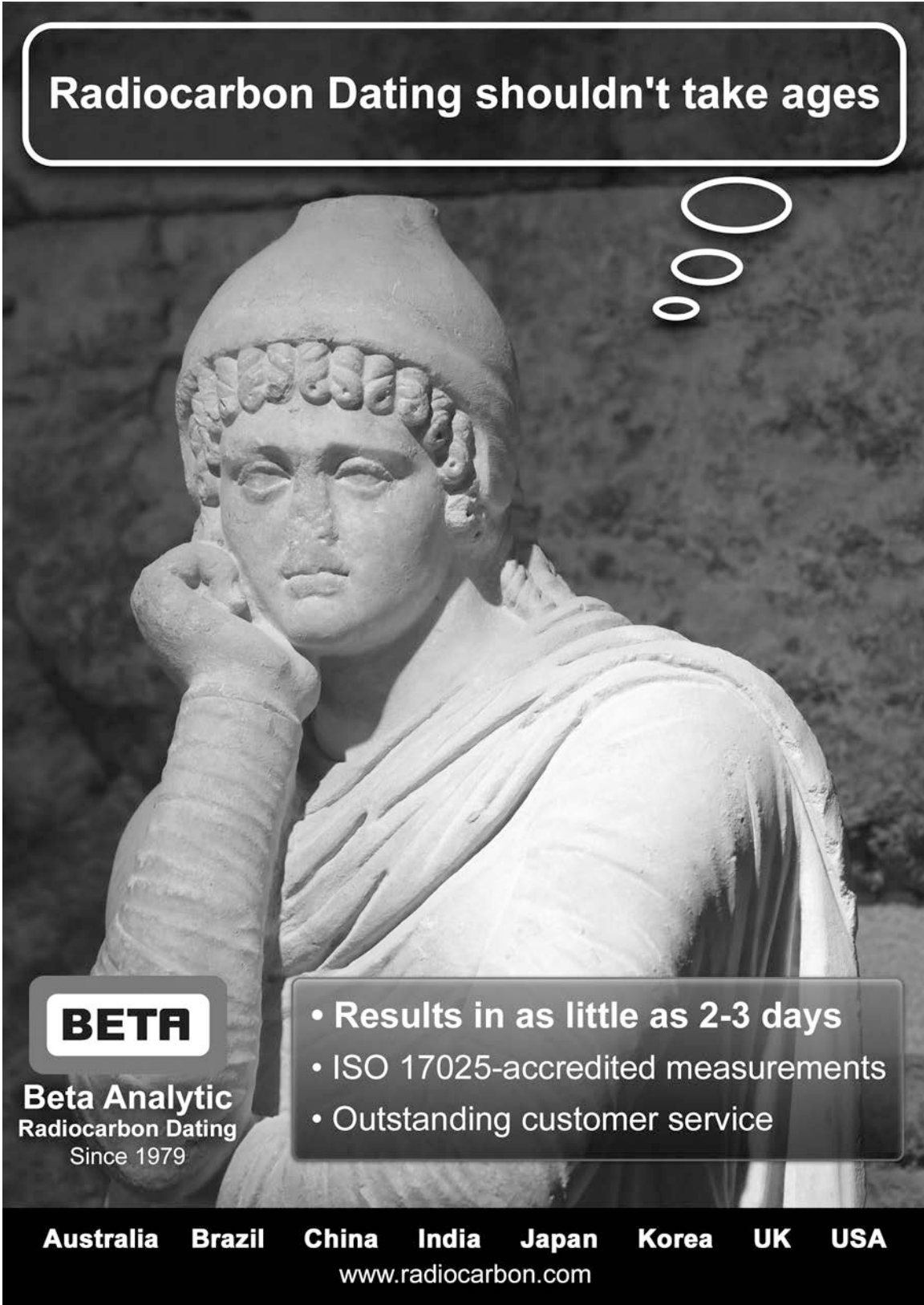


45. **NON-SPECIFIC STRESS INDICATORS AND GROWTH IN ANCIENT EGYPTIAN CHILDREN FROM TELL EL-AMARNA AND HIERAKONPOLIS.** Ashley E. Shidner & Kathleen Kuckens
46. **IRRESISTIBLE CORRUPTION: A PALEOPATHOLOGICAL EXAMINATION OF LEAD POISONING AND ITS SHAPING OF THE MORTALITY AND MORBIDITY PROFILE OF AN URBAN INDUSTRIAL PERIOD QUAKER POPULATION IN NORTH-EAST ENGLAND.** Thomas Ostrander, Charlotte Roberts, Janet Montgomery, & Chris Ottley
47. **AN ANALYSIS OF POROTIC LESIONS IN MODERN EAST AFRICAN SKELETONS.** Nicole E. Smith \*\*\*
48. **OPTIMIZING MDCT PROTOCOLS FOR MUMMIFIED REMAINS.** Natalie Pelletier, Gerald Conlogue, Tania Grgurich, & Robert Lombardo
49. **A THE MYSTERIOUS ELDER: A BIOARCHAEOLOGICAL ANALYSIS OF BURIAL 61 AT TELEKFALVA, HARGHITA ROMANIA.** Jennifer Stuck, Sarah Wallace, Jonathan Bethard, Andre Gonciar, & Zsolt Nyaradi \*\*\*
50. **PATHOLOGY AND TRAUMA AT CUSIRISNA CAVE, NICARAGUA.** Kendra L. Philmon & Clifford T. Brown
51. **MADLUNG'S DEFORMITY AND POSSIBLE DYSCHONDROSTEOSIS: TWO CASES FROM ONE TOMB AT THE LATE INTERMEDIATE PERIOD SITE OF MARCAJIRCA, DEPARTMENT OF ANCASH, PERU.** Anne R. Titelbaum, Bebel Ibarra, & Stephan Naji +++
52. **WALKING THE LINE: A RE-EVALUATION OF HARRIS LINES AND THE IMPACT OF RADIOGRAPHIC POSITIONING ON THEIR IDENTIFICATION AND INTERPRETATION.** Amy B. Scott & Robert D. Hoppa
53. **AN ARCHAEOLOGICAL CASE OF THE BEATEN COPPER SKULL: A DIFFERENTIAL DIAGNOSIS.** Natasha Vang \*\*\*
54. **CO-OCCURRING VERTEBRAL ANOMALIES AND SUPERNUMERARY TEETH IN AN ADULT BURIAL FROM A COLONIAL SLAVE CEMETERY IN BARBADOS - A POSSIBLE CASE OF EHLERS-DANLOS SYNDROME?** Kristrina A. Shuler
55. **DIAGNOSTIC DIFFERENCES OF METASTIC CARCINOMA AND MULTIPLE MYELOMA IN A BIOARCHAEOLOGICAL CONTEXT.** Brittany S. Walter \*\*\*  
**OSTEOBLASTIC INTRACRANIAL MENINGIOMA EN PLAQUE: A CURIOUS CASE FROM THE ERIE COUTNY POORHOUSE CEMETERY.** Joyce E. Sirianni, Jennifer F. Byrnes, & Jennifer K. Odien
56. **LINEAR ENAMEL HYPOPLASIA FREQUENCY AND DURATION IN A PATHOLOGICAL COLLECTION FROM OTTOMAN PERIOD TELL EL-HESI.** Ariane Thomas & Jaime Ullinger
57. **BROKEN BODY: A CASE OF MULTIPLE SKELETAL FRACTURES IN A JUVENILE FROM ANCIENT EGYPT.** Sandra Wheeler, Tosha Dupras, & Lana Williams +++
58. **EVALUATING THE SENSITIVITY OF SKELETAL GROWTH PARAMETERS TO ENVIRONMENTAL EFFECTS: A CASE STUDY FROM CIS-BAIKAL, EASTERN SIBERIA.** Joshua Thompson & Daniel H. Temple

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

59. **IDENTIFICATION OF A NEOPLASM FROM COMMINGLED REMAINS.** Katie N. Woods \*\*\*
60. **A CONTEXT-LED APPROACH TO DIAGNOSING OSTEOMALACIA IN SKELETAL POPULATIONS: PROBLEMS AND PROSPECTS.** Khrystyne Tschinkel & Rebecca Gowland
61. **HEALTH AND STRESS AT THE TURN OF THE CENTURY: A BIOARCHAEOLOGICAL ANALYSIS OF SKELETAL STRESS IN THE TERRY COLLECTION.** Kristina M. Zarenko \*\*\*
62. **SPONDYLOSIS IN PRE-COLUMBIAN NEW WORLD AND MODERN DOGS: A COMPARATIVE STUDY.** Elizabeth W. Uhl, Michelle L. Osborn, & Jeffrey P. Blick



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## **PRESENTATION ABSTRACTS**

**Anzellini, Armando (University of Central Florida) \*\*\***

### **INVESTIGATING PATTERNS OF INTERPERSONAL VIOLENCE USING FREQUENCY DISTRIBUTIONS OF CRANIAL VAULT TRAUMA**

The purpose of this research is to develop a quantitative approach to examining lethality using frequency distributions for location of trauma on the cranium in order to model patterns of interpersonal violence. This is accomplished through the study of a skeletal sample, from the prehispanic Chachapoya (A.D. 800 – 1535), discovered at the site of Kuelap in the northern Peruvian Andes. Metric data were gathered from 81 individuals exhibiting clear traumatic lesions including 42 males, 8 females, 1 undetermined adult, and 30 subadults. The data consisted of precise location of traumatic injury measured from anatomical landmarks in each of five standard two-dimensional views of the cranium (Buikstra and Ubelaker, 1994) as well as estimated diameter of impact for all lesions. The lesions were separated into perimortem (lethal) and antemortem (non-lethal) categories in order to explore patterns of lethality that correlate with location of injury. These data were subsequently tested for patterns of location using Student's t-tests and Fisher's Exact tests with varying parameters as well as creating two-dimensional plots of location of injury for each standard view. A statistical significance ( $p > 0.05$ ) was determined for location of injury with perimortem injuries occurring more frequently on the posterior aspect of the cranium and antemortem injuries occurring more frequently on the anterior aspect for this sample. These results show that a quantitative approach to location of injuries to the cranial vault can reveal new patterns of violent interactions and aid in the study of violent behavior.

**Bandy, Alissa (University of Arkansas) \*\*\***

### **MA'AT IN THE BONES: FINDING THE TRUTH OF AKHETATEN IN OSTEOBIOGRAPHIES OF THE INHABITANTS**

The skeletal remains of over two hundred inhabitants from the non-royal cemeteries of Akhetaten, the city of the Pharaoh Akhenaten, have been analysed so far as part of the Amarna Project, headed by Barry Kemp and Jerome Rose. This Project seeks to combine osteology, archaeology, and history to reveal the secrets of these ancient lives in Akhenaten's short-lived capitol city. Osteobiographies provides important information about life in the past by reading the stories of pathology, trauma, muscle markers, and diet written in individual human skeletons. I present the osteobiography of a single individual, a 25-35 year old woman who lived and died at Akhetaten. Her os coxae and sacrum present possible cancerous lesions, but I will take into account differential diagnoses. Most of the individuals at Akhetaten who are buried in the non-royal cemetery show signs of stress and heavy work-loads. I will compare the condition of her skeleton to others in order to theorize about the difficulty of her life and its contribution to her death at a relatively young age. By combining paleopathological analysis with information from Egyptian medical papyri and other sources, I reconstruct what her life would have been like in Akhetaten.

**Bekvalac, Jelena (Centre for Human Bioarchaeology, Museum of London), A.Gaynor Western (Ossafreelance), and Mark Farmer (Cranfield University)**

### **THE IMPACT OF INDUSTRIALISATION ON HEALTH IN LONDON: UNDERSTANDING THE AETIOLOGY OF HYPEROSTOSIS FRONTALIS INTERNA**

Hyperostosis Frontalis Interna (HFI) is a pathological condition that is often recorded in human skeletal remains, yet its aetiology is still poorly understood and it has received little attention in the palaeopathological literature. Recently, clinical research has been undertaken to clarify the relationship between HFI, age and sex in order to elucidate the causative factors and expression of the condition, due to the fact that HFI is now being seen in record numbers of patients in modern populations. These new studies point to an over-exposure to oestrogen during the life-time of the individual as potentially playing a significant role in the manifestation of HFI, particularly in females. HFI has also been observed in males, though generally more moderate in expression and often in co-occurrence with other conditions linked to hormonal imbalances. The recent increase in HFI has been theoretically linked to the process of 'industrialisation' of society. Macroscopic observations of HFI in Industrial Period skeletal populations, however, can be impeded by the completeness of crania and, as a result, comparative studies of the condition have been limited. This preliminary study, based on examination of the 18-19<sup>th</sup> century skeletal population from St. Bride's Crypt, Fleet Street, London, endeavours to clarify the observability and the prevalence rates of HFI using digital radiography with the aim of providing a historical perspective on the aetiology of the disease, taking into account demographic profile, longevity and parity.

**Bennett, Lauren, and Lesley Gregoricka (University of South Alabama) \*\*\***

### **DIFFERENTIAL DIAGNOSIS OF A COLD CASE SKELETON**

Skeletal anomalies observed in an unidentified, modern individual were examined as part of a differential diagnosis. The individual was estimated to be a male of Asian or Native American descent between the ages of 18-24 years old, and was 5'4"- 5'7" in stature. Defects present include an unusually small sacral (S3) segment, incomplete closure along the median crest on the posterior aspect of the S1 segment, pinching on the posterior aspect of several vertebral bodies (T1-T12, L1-L3), mild scoliosis, and extensive ossification of the ligamentum flavum (T3-T12, L1-L2) and supraspinous ligament (T4-T7). Despite such ossification, the absence of ossification of the anterior longitudinal ligament likely precludes a diagnosis of diffuse idiopathic skeletal hyperostosis (DISH). Fracture was also ruled out as the cause of the S3 defect after reviewing radiographs of the sacrum, as was hemivertebrae and sacral agenesis. The defect along the S1 median crest is possibly the result of a cleft in the neural arch, although the majority of the arch is intact. Spinal stenosis does not appear to be the cause of the pinched vertebral bodies due to a lack of narrowing of the vertebral foramen. Subsequently, the majority of defects present in this individual are likely developmental in nature.

**Binder, Michaela, and Charlotte A. Roberts (Durham University)**

### **CANCER IN ANCIENT EGYPT: A SKELETON WITH METASTATIC CARCINOMA FROM AMARA WEST, UPPER NUBIA (1200BC)**

Skeletons and mummies from Ancient Egypt account for a large proportion of evidence for metastatic cancer in antiquity. However, the majority of these reports derive from the early days of excavation and research, which can leave doubts as to diagnosis. Moreover, most examples are represented by isolated skulls or post-cranial elements. Therefore, the number of convincing cases of cancer predating the 1<sup>st</sup> millennium AD is still low. This paper presents a male, young-adult individual from the archaeological site of Amara West (Upper Nubia). Founded around 1300BC, the settlement served as the capital of the Egyptian province of Upper Nubia during the second half of Pharaonic occupation of Nubia (1300-1070BC). Excavated in 2013, the intact, well-preserved skeleton was recovered from a non-elite chamber tomb dating to c. 1200BC. Multiple, mainly osteolytic, lesions (0.4-1.6cms) were detected in the vertebrae, ribs, sternum, clavicles, scapulae, pelvis, and humeral and femoral heads. Radiographic, microscopic and scanning electron microscopic (SEM) examination of the lesions confirms a pathological origin. Based on size, distribution and morphological appearance of the pathological changes a diagnosis of metastatic carcinoma secondary to an unknown soft tissue cancer is suggested.

The bone changes in the remains of this young man from Amara West are believed to represent one of the earliest comprehensive examples of metastatic carcinoma worldwide. Being set within a well-documented archaeological, socio-economic and cultural context drawn from ongoing archaeological and bioarchaeological research in the cemeteries and associated settlement, he further allows insights into potential causes of cancer in the past.

**Brown, Terry (University of Manchester), Romy Müller (University of Manchester), and Charlotte Roberts (Durham University)**

### **GENOTYPES OF HISTORIC STRAINS OF *MYCOBACTERIUM TUBERCULOSIS* FROM ARCHAEOLOGICAL REMAINS**

The evolutionary history of the *Mycobacterium tuberculosis* complex (MTBC) has previously been studied by analysis of sequence diversity in extant strains, but not addressed by direct examination of strains in archaeological remains. We applied a rigorous analytical regime to the detection of MTBC DNA in 77 bone and tooth samples from 70 individuals from Britain and continental Europe, spanning the 1<sup>st</sup>-19<sup>th</sup> centuries AD. We identified 12 samples that gave definite evidence for the presence of MTBC DNA, and another 22 that we classified as 'probable' or 'possible'. We then used ancient DNA sequencing to type 11 single nucleotide polymorphisms and two large sequence polymorphisms in the MTBC strains present in ten samples. The results enable us to assign the strains to groupings and lineages recognized in the extant MTBC. We show that there has been a temporal succession in strain genotypes in Britain during the last 2000 years, and that the pattern of this succession agrees with the evolutionary scheme inferred from studies of extant MTBC strains. At least during the 18<sup>th</sup>-19<sup>th</sup> centuries AD, strains of *M. tuberculosis* belonging to different genetic groups were present in Britain at the same time, possibly even at a single location, and we present evidence for a mixed infection in at least one individual. Our study shows that ancient DNA typing applied to multiple samples can provide

sufficiently detailed information to contribute to both archaeological and evolutionary knowledge of the history of tuberculosis.

**Brown, Sean C., and Nancy C. Lovell (University of Alberta)**

### **TOOTH WEAR AND TASK ACTIVITY IN A ROMAN MARITIME COMMUNITY IN ITALY**

The site of the late Roman imperial city of Erculia is located on the western coast of southern Italy. Its proximity to the anchoring point of the Roman navy at ancient Misenum has led some scholars to believe its cemetery is the resting place of naval veterans, either those who died in shipwrecks on the coast or those who retired to the maritime community. Salvage excavations at the site provided us with a sample of 12 adult males. The dentitions of each individual are well preserved and all exhibit pronounced asymmetrical oblique wear on the occlusal surfaces of the teeth (affecting all tooth classes); some of the wear was extreme and apparently led to infection of pulp cavities and antemortem loss of teeth, as well as arthritis at the temporomandibular joint. We propose that the men were local fishers and that the tooth wear results from using the teeth as a “third hand”, perhaps in weaving/repairing netting, cordage, or sails. The rigours of their activities may also be linked to pathological conditions in the skeleton, such as severe expressions of osteoarthritis at the knees, hips, and spine, and fractures of the hip and elbow. Thus, our interpretation of the geophysical and sociocultural contexts of the site, based on ancient texts, archaeological finds, and human remains suggests that the cemetery belongs to a working-class maritime community. The data we report here provide rare details about the lives of individuals who are not usually described in traditional histories of the period.

**Burt, Nicole M. (Harvard University) +++**

### **HEALTH AT MEDIEVAL FISHERGATE HOUSE: AN EXAMINATION OF THE RELATIONSHIP OF DIET, GROWTH, AND SINUSITIS**

Weaning age (2 years) and peak mortality (4-6 years) are decoupled at Fishergate House. After infancy, weaning is generally considered the most dangerous part of early childhood. At Fishergate House this may not be the case. This poster examines the relationships of diet (stable isotope analysis), growth, and sinusitis at both a population and individual level as a proxy for health at the site. Weaned children had a diet rich in high trophic level proteins such as marine fish and pig ( $\delta^{15}\text{N} = 12.4\text{‰}$ ).  $\text{C}_3$  grain diets are typical of contemporary children from rural areas and could indicate that the specific weaning foods used at Fishergate House are helping children survive past the initial weaning period. There is no indication that chronic illness or weaning food quality is causing the mortality peak at 4-6 years. Growth and non-specific indicators of stress were analyzed at the site to better understand this unusual pattern. The prevalence of sinusitis is quite high at Fishergate House, particularly when compared to contemporary Wharram Percy (41% vs. 7.5%). This is particularly true during the 4-6 year period when children would be accompany their mothers to a factory work environment or would be left at home with an unknown level of supervision. Fishergate House was known to suffer from seasonal flooding, which could pose a major threat to health in the community. Poor air quality and environmental conditions stemming from the urban environment are likely contributing the unique mortuary pattern at the site.

**Byrnes, Jennifer F., Joyce E. Sirianni, and Peter J. Bush (University at Buffalo) \*\*\***

### **COMBINING PALEOPATHOLOGY WITH BONE CHEMISTRY ANALYSES TO RECONSTRUCT A LIFE HISTORY**

The Erie County Poorhouse and associated hospital was situated on what is now the South Campus of the University of Buffalo. In the summer of 2012, infrastructure improvements on the campus necessitated removal of human skeletal remains associated with the Erie County Poorhouse Cemetery (1851-1909). The excavation and analyses of 369 burials provides an opportunity to assess the life histories of these individuals. In addition to collecting basic demographic data and assessing pathological conditions, the skeletons were analyzed using portable X-ray Fluorescence spectroscopy. Although these are a variety of interesting life stories 'remembered' in the bones and teeth of men and women buried in the cemetery, one individual stands out. He is a middle-aged male with bilateral slipped capital femoral epiphyses, which lead to multiple complications. As well, multiple traumatic injuries at varying stages of healing were observed. This individual was well preserved, and we were able to analyze different locations of the skeleton using X-ray Fluorescence spectroscopy which yielded extraordinarily high levels of strontium throughout the skeleton, ranging from 2200-5900 ppm (0.2-0.5%). Other burials and soil samples from the cemetery were well below this range. However the strontium concentrations from this individual's teeth fell in the normal range, 150-550 ppm. The aberrantly high strontium concentrations in the bones of this one individual may be explained by the ingestion of strontium salts that were commonly prescribed during the late-nineteenth century for numerous ailments.

**Caine, Alyson, Charlotte A. Roberts, and Derek Kennet (Durham University) \*\*\***

### **ON THE CUSP OF CHANGE: IMPACTS OF SUBSISTENCE STRATEGY CHANGES ON THE HEALTH OF TWO WADI SUQ (2200-1300 BC) POPULATIONS FROM RA'S AL-KHAIMAH, UAE**

Transitions in economic or cultural structure impact health and manifest as markers of stress on the skeleton. The Wadi Suq period is characterized by a transformation in economic organization and subsistence strategy; resulting from the collapse of trade routes and contacts with the Persian Gulf. A study of one Wadi Suq population, tomb 6, dating to the early Wadi Suq from Ra's al-Khaimah in the UAE, was conducted. A minimum of 145 individuals was analyzed for pathological conditions. This paper investigates the evidence of period transitions observed through health profiles of one Wadi Suq population on the cusp of change.

Pathological analysis conducted in this study revealed that Tomb 6 population's health profile was similar to one transitioning between the Umm an-Nar and Wadi Suq period. A prevalence of 21% was identified for infectious disease on fibulae in Tomb 6, which supports the prevalence observed in sedentary populations of the Umm an-Nar period. However, cribra orbitalia was identified in the same population with a 39% prevalence in both orbits, which is affiliated with the Wadi Suq period. The health profiles observed in Tomb 6 exhibit skeletal evidence common in communities experiencing subsistence changes. Studies on subsistence strategies in prehistoric Arabian populations can enlighten the impacts of these transitions on past health profiles of these populations.

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize



**Campbell, Roselyn A. (University of California, Los Angeles and Palaeo-oncology Research Organization) \*\*\***

### **READING BETWEEN THE LINES: A COMPARISON OF BIOARCHAEOLOGICAL AND LITERARY EVIDENCE FOR CANCER**

The evidence for cancer in ancient societies is often sparse at best. Research has been hampered for many reasons, not least of which is the common misconception that cancer is predominantly a disease of modern populations. Poor preservation of skeletal remains, frequent non-survival of soft tissue (and thus a lack of evidence for soft-tissue tumors), a lack of standardized methodology, and an imperfect understanding of the causes and manifestations of cancer have prevented a thorough study of the disease.

Much information may be gained through the examination of ancient medical texts and bioarchaeological evidence. However, many societies did not recognize cancer as a specific disease, and often did not (or could not) distinguish between benign growths and malignant tumors. This paper presents an analysis of literary and bioarchaeological evidence for cancer in ancient populations to explore potential indications of neoplasms and metastatic growths.

The literary component of this research addresses linguistic evidence for possible cases of cancer (such as words for tumors and swellings), and also analyzes word choice and perceptions of cancer in ancient societies. Palaeo-epidemiological evidence is utilized to provide indications of cancer that may not have been apparent to past medical practitioners. Only with such a multi-disciplinary approach is it possible to understand the broader patterns of neoplastic diseases, as well as the perceptions and treatments of cancer. This analysis also illuminates how cancer might have affected the lives of past peoples, and will contribute to a broad-spectrum study of cancer in the past and present.

**Cargill, Tyler (University of Exeter) \*\*\***

### **LEGION OF LESIONS – EXPLORATION OF SCORBUTIC CRANIAL LESIONS FROM A ROMANO-BRITISH CEMETERY**

The development of scurvy is a result of a Vitamin C deficiency, which may be brought on upon by poor dietary conditions, genetics, or weaning. Because Vitamin C is necessary for collagen synthesis and production of strong blood vessel walls, a deficiency results in porosity in several areas of the skull, e.g., eye orbits, mandible and sphenoid. In the examination of a skeletal collection (N=90) from Roman Gloucester, dating to the mid 3rd-early 4th century CE, five adult burials were found to exhibit evidence of scurvy. In addition to traditional markers of the condition, one young adult male also showed a series of narrow parallel lesions similar to a "hair combing" appearance, which ranged from 30-170 mm in length and ran medio-laterally on both parietal bones.

The location of these lesions correlates to the region of the cranium associated with *M. temporalis*, an area of soft tissue, and suggests they might have been the result of hemorrhage from blood vessels. Further examination of the series showed a total of three individuals to have similar lesions. While clinical descriptions of scorbutic lesions on the parietal bones in adults are near non-existent, comparative cases at the Museum of London and Hunterian museum of cases of known scurvy in adults also exhibited "hair combing" lesions. While the porosity could be suggestive of anemia, the

location of the lesions, in addition to presence of alveolar resorption, is also consistent with Vitamin C deficiency. Further support from the historical and archeological records will be discussed.

**Chapman, Callie M. (Utah Valley University), and Haagen D. Klaus (George Mason University and Museo Nacional Sicán, Peru)**

### **ARTIFICIAL CRANIAL DEFORMATION DURING THE LATE PRE-HISPANIC AND COLONIAL PERIODS: SOCIAL SIGNIFICANCE AND DIACHRONIC HISTORY OF HEAD-SHAPING IN THE LAMBAYEQUE VALLEY, PERU**

Artificial cranial deformation has been studied ever since the early days of paleopathology, having evolved from being a perceived pathological oddity to a deformation often full of social information. In the southern Central Andes, osteological studies have revealed deformed head shapes communicated social identities, but this practice was abruptly terminated following Spanish conquest. Loose analogies often attribute similar social meanings to fronto-occipital deformation styles on the north coast of Peru, but the local meaning and history of the practice has remained largely unexplored. In this study, we ask: (1) did north coast Peruvian cultures inscribe social messages in pathologically altered head shapes, and; (2) was artificial cranial deformation also rapidly terminated in coastal Colonial Peru?

Cranial deformation was scored in the crania of 1,270 individuals who lived in the Lambayeque region of north coast Peru from the late pre-Hispanic to Colonial periods (~ A.D. 900-1750). Paleoepidemiological comparisons show this pathological condition cross-cut all known socioeconomic groups and cultures. Head shape likely did not communicate meaningful social information, but probably were produced as an unintentional pathological byproduct of a childcare strategy (cradleboard use). Colonial-era abandonment of artificial cranial deformation occurred rapidly in some Lambayeque communities, but in others, the practice lingered for decades. This work espouses a historical and social paleopathological approach to the history and significance of cranial deformation on the north coast of Peru, and cautions against uncritical cross-cultural analogies in the study of Andean cranial deformation.

This work was funded since 2001 by grants to HDK by the National Science Foundation, the Wenner-Gren Foundation for Anthropological Research, Utah Valley University, and The Ohio State University.

**Colino-Gallardo, Pedro (University of Extremadura), Diego Peral-Pacheco (University of Extremadura), Elena Labajo-González (University Complutense of Madrid), and David Llinares (University of Extremadura)**

### **STUDY OF DENTAL REMAINS FROM THE LARGE SQUARE IN ZAFRA**

From the XIII to the XVI centuries, the old Iglesia de Santa María de la Candelaria and its cemetery was located in the large square of the city of Zafra; after that time, this church was replaced by a new one. Fifteen tombs belonging to the old cemetery were excavated. The aim of our study is to analyse the maxillo-mandibular morphological, metric, and pathological characteristics of the human remains from these tombs. The 15 tombs contained a MNI of 36 individuals; however, only 28 skulls were identified, including 16 maxillae and 19 mandibles and a total of 210 teeth.

For each mandible, the height of the ramus, the gonial angle, and the length of the body was measured. A tooth count in both the maxilla and mandible was made for each individual, in order to establish the best and least well represented areas of the mouth in our sample. Both antemortem and postmortem tooth loss were recorded: 8.2% of the teeth had been lost postmortem and 54.3% had been lost antemortem, leaving only 37.5% (210/560) present. The area with the greatest number of teeth was the mandibular molar region, with 44 molars (20,9%); by contrast, the maxillary canine region had no teeth present. This result is surprising, as maxillary canines have relatively long roots and are amongst the last of the secondary dentition to replace their primary predecessors. Similar studies in Spain (Atapuerca and deposit of Urratxa, Bizkaia) have shown similar patterns of high and low representation of different tooth types. We used dental metric data and observations of dental wear to help determine the sex and age of the individuals in our sample.

**Collier, Larissa (Alabama College of Osteopathic Medicine) +++**

### **THE CROSSROADS OF ANATOMY AND PALEOPATHOLOGY: TWO UNIQUE LESIONS FROM THE ROMAN IRON AGE IN DENMARK**

In Denmark at the beginning of the Roman Iron Age, cattle production and animal husbandry governed much of the village life and would for the next 400 years. This close proximity to cattle would lead to an increased risk for occupationally related trauma. As part of this study, 373 skeletal remains from the island of Sjælland were macroscopically analyzed for trauma. Two individuals demonstrate lesions unique in both the medical and paleopathological literature. The first lesion is an antemortem fracture of a left intermediate cuneiform with a corresponding dislocation on the left navicular. This lesion can be caused by severe plantar flexion that disrupts the ligament attachments on the plantar surface of the bone. Without that opposing force, the dorsal attachments will pull the cuneiform dorsally. The second lesion is an antemortem avulsion fracture at the insertion site for brachioradialis on a distal humerus. This lesion is a likely a result of the violent contraction of the brachioradialis muscle and subsequent separation of the bone at the supra-epicondylar ridge. In order to understand the mechanisms and pathology of these two cases, the analysis must include an assessment of the anatomical relationships of these specific bones and regions. With an understanding of these relationships, a more complete picture of the pattern of trauma and process of injury can be built. The possible etiologies of these cases will be discussed in relation to the culture context of the time period and comparisons to causation in the medical literature will be explored.

**Conlogue, Gerald (Quinnipiac University), and Mark Viner (Cranfield University)**

### **BRINGING FIELD RADIOGRAPHY INTO THE 21<sup>ST</sup> CENTURY**

Film has been the principle medium for recording radiographic images for more than one hundred years. In medical radiography, two forms of digital recording, direct digital radiograph (DR) and computed radiography (CR) began to replace film over the past two decades. The transition away from film has been much slower in field paleoimaging. The following presentation examines the use of both types of digital imaging in studies conducted over the past four years in London, UK, Quito, Ecuador and New York, USA by the Bioanthropology Research Institute at Quinnipiac University. The

value of plain radiography and the difficulties associated with adapting the new technological advantages into field applications will be discussed. The advantages and disadvantages of each of the digital approaches will be considered. In order to demonstrate the advantages of digital imaging, selected anomalies and pathological conditions, such as Harris' Line, were radiographed. Several types of film based systems, computed radiography and direct digital radiography were used. Digital data also affords the possibility of almost instant collaboration with specialist, such as radiologists, at distant locations. Several examples will be presented where radiologists in the United States and Hungary simultaneously examined various pathologies and arrived at a diagnosis by consensus. Finally, the lessons learned about optimizing the equipment set-up for multiple applications will be described.

**Coqueugnot, Hélène (Université Bordeaux and Max Planck Institute for Evolutionary Anthropology), Olivier Dutour (Université Bordeaux, Max Planck Institute for Evolutionary Anthropology, and University of Western Ontario), Baruch Arensburg (Tel Aviv University), Baruch; Henri Duday (Université Bordeaux and Laboratoire d'Anthropologie Biologique Paul Broca, Ecole Pratique des Hautes Etudes), Bernard Vandermeersch ((Université Bordeaux) and Anne-Marie Tillier (Université Bordeaux and University of Pennsylvania)**

### **3D PALEOPATHOLOGICAL REAPPRAISAL OF THE MIDDLE PALAEOLITHIC QAFZEH 11 ADOLESCENT SKULL**

The Qafzeh site (Galilee, Israel) has yielded one of the largest Middle Palaeolithic hominin sample known from a single site in the Levant, dated to ca. 90-100 ka BP. Reappraisal of a bone lesion caused by trauma on one of the individuals provides insights into adaptation patterns and social behavior of these nomadic hunter-gatherers. Qafzeh 11, circa 12-13 yrs old at death, presents a right frontal bone lesion previously attributed to a healed trauma. Tomodensitometric data of this adolescent skull and three-dimensional imaging methods were recently used to explore inner bone lesion, to evaluate the impact on soft tissues and to estimate volumetric data, while they contribute to fossil reconstruction and preservation.

The 3D approach allows a better understanding of this complex skull fracture observed on Qafzeh 11: besides a growth delay revealed by an endocranial volume smaller than expected for dental age, this depressed fracture might have caused furthermore personality and neurological troubles related to brain lesions in the right frontal area. Interestingly, this young individual benefited of a unique funerary practice among south-western Asian burials dated to Middle Palaeolithic. This specific treatment applied to a young individual who experienced a severe skull trauma can be interpreted as reflecting elaborated social behaviour among these early anatomically modern humans.

**Crane, Adam, Della Collins Cook, and Frederika Kaestle (Indiana University) \*\*\***

### **ANKYLOSING SPONDYLITIS AND HLA-B27 IN THE PRE-CONTACT ILLINOIS RIVER VALLEY: A CASE STUDY OF PROLIFERATIVE LESIONS IN THE AXIAL SKELETONS OF THREE INDIVIDUALS**

An association between ankylosing spondylitis (AS) and the polymorphic histocompatibility gene HLA-B27 has been documented in modern and historical populations (Leden et al 2009; Khan

2010). Because HLA-B27 occurs at high frequencies in extant Native American populations relative to other groups globally, genetic study of ancient Native American remains with suspected AS presents an opportunity to test this association in older contexts (Walsh et al 1998). At the AAPA meeting in 2013 we presented two adults from Pete Klunk Mound Group (11C36-4 and 11C43-7) as potential cases of AS. Rib samples were taken for aDNA analysis and Native American mtDNA has been recovered, demonstrating aDNA preservation. We have since expanded the study to include 11C35-26, an adult from Pete Klunk Mound Group; F14-46, an adult from Morton Mound 14; and Ld1-56, an adult from the Ledders site. Each individual exhibits varying degrees of ankylosis of vertebral articulations, including the costovertebral, costotransverse, and sacroiliac joints. The lesions of each individual were evaluated using Resnick's (2002) clinical criteria for diagnosis of AS in living individuals and various osteological descriptions of the condition in skeletal remains, and rib samples were taken for aDNA analysis. In each individual the lesions were found to be consistent with a diagnosis of AS, and in the case of F14-46 underdevelopment of the femora and involvement of peripheral joints suggested juvenile onset of the condition (Burgos-Vargas 1989). Given these diagnoses, completion of ongoing aDNA analysis to demonstrate the presence or absence of HLA-B27 could confirm the gene's association with AS in pre-contact Illinois River Valley contexts or prompt reevaluation of the condition's diagnostic criteria in skeletal remains.

Supported by NSF grant BCS-09 25111 to Kaestle and Cook.

**Crane-Kramer, Gillian M.M. (State University of New York at Plattsburgh)**

### **AN INTERESTING TURN OF EVENTS: WHEN OSTEOLOGY INFORMS HISTORY**

Written sources have traditionally provided the primary narrative concerning life in the historic past. However, recent discoveries within the field of Paleopathology are beginning to challenge many long-held historic tenets. This paper will focus upon a discussion of two controversial issues within medical history: the origins and antiquity of syphilis and the segregation practices for Medieval lepers. Medieval chroniclers unanimously establish the New World as the source of venereal syphilis. They considered the disease to be completely absent from the Old World until the return of Christopher Columbus and his crew at the climax of the 15<sup>th</sup> Century. This New World origin for the disease remained unchallenged for over five centuries. However, increasing osteological evidence of pre-Columbian treponemal disease in the Old World now makes this historic position untenable, and directly challenges the veracity of this documentary evidence. Furthermore, the typical historic depiction of the Medieval leper is of a miserable, sinful creature relegated to the shadows of the leprosaria as a social outcast. Skeletal evidence of leprosy indicates that there was not a unified treatment of the afflicted in England, and that urban and rural populations practiced different traditions based upon formal Ecclesiastical or Royal (De Leproso Amovendo) proclamations. It appears that in many instances in rural communities where close social relationships were maintained, leprous individuals often remained within the village and were buried in village churchyards. It is in the larger settlements like town and cities that strict segregation practices were instituted and monitored.

**Cross, Pamela J. (University of Bradford) \*\*\***

### **SPINAL CHANGES AS EVIDENCE OF RIDING USE IN ARCHAEOLOGICAL HORSES**

This paper considers the area of activity-related skeletal change and evaluates the application of these techniques in identifying riding in archaeological horses. Being able to reconstruct the lives and activities of past individuals is a cornerstone of palaeopathological research. To do this, morphological changes, called musculoskeletal stress markers (MSMs), are used to identify possible activities. These changes typically include evidence of osteolytic lesions, ossification of soft tissues (entheso-/osteophytic development), asymmetry, and/or changes in robusticity. Interpretation of these changes as activity-related is controversial. Aetiology is often multivariate, and may involve issues relating to specific individuals including: age, sex, and conformation. Additionally, it is difficult to identify only one activity associated with a morphological change. The identification of evidence for riding is one of the most important and debated goals in the study of human-horse relationships. In archaeological literature, riding use has been inferred from tooth wear, limb pathology and/or changes to the spine, particularly the lumbar vertebrae. A number of archaeological publications examine the connection between spinal changes and riding. The specimens presented typically exhibit ankylosing spondylitis in the caudal spine with little or no evidence of lytic pathology. The conclusions reached are evaluated in light of veterinary/zoology studies on spinal pathology in equids, bovids, canids, and hominids. The data indicates that this type of pathology has a low occurrence within populations, is found typically in males, appears within a diverse set of species, probably has a genetic component, and cannot be reliably used as an MSM for riding.

**D'Ortenzio, Lori, Megan Brickley and Tracy Prowse (McMaster University) \*\*\***

### **YOU ARE NOT WHAT YOU EAT DURING PHYSIOLOGICAL STRESS: ISOTOPIC EVALUATION OF HUMAN HAIR**

The metabolic balance of an individual can impact the isotopic signal in tissues that are formed during periods of metabolic 'stress'. Isotopic variation in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values can be assessed to understand not only diet, but also the influence of physiological factors on stable isotope ratios in human hair. Fluctuating nitrogen values can be associated with physiological stressors such as infection, injury, or pregnancy that alter an individual's metabolism. This paper examines metabolic balance in hair from both modern and archaeological samples by analyzing variation in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values along sequentially segmented hair in individuals who have observable skeletal pathology or known chronic illness versus those without. Results on hair samples from ten archaeological individuals (19<sup>th</sup> century, Belleville, Ontario), four modern cadavers (two with cancer and two that died suddenly), and two living pregnant women indicate that  $\delta^{15}\text{N}$  values are approximately 1‰ higher in individuals with a pathological condition (e.g., infection, fracture, or cancer) and are 1‰ lower during pregnancy. Higher nitrogen values may represent the recycling of nitrogen derived from the breakdown of existing proteins in the body, whereas lower  $\delta^{15}\text{N}$  values are related to increased utilization of dietary and urea nitrogen for tissue synthesis during pregnancy. The findings from this study suggest that short term fluctuations of  $\delta^{15}\text{N}$  values may be the result of changes in an individual's metabolic balance, and that metabolic imbalance of an individual poses a confounding factor to ancient dietary studies when using tissues such as hair.

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

**Davis, Heidi Suzanne (University of Arkansas)**

### **MUSCULOSKELETAL STRESS MARKERS AT TELL EL-AMARNA**

The pharaoh Akhenaten moved the capital of Egypt to Akhetaten, now known as Tell el-Amarna, in 1353 BCE. Akhenaten deliberately chose this location because this land had not been previously occupied or connected to any god, providing a new pure location for the worship of the god, Aten. The creation of a new city required extensive labor efforts throughout the 17 year occupation in its construction, expansion, and maintenance. My research focuses on skeletal markers of activity related stress experienced by the non-royal people of Akhetaten. The skeletons from the South Tombs Cemetery at Amarna exhibit high rates of traumatic injury, degenerative joint disease, and high scores of musculoskeletal involvement. The daily lives of many of Akhetaten's residents appear to have been filled with strenuous exertion that resulted in painful fractures, muscle related injuries, and degenerative disease processes. For this poster, I examine rates of degenerative joint disease, musculoskeletal stress markers and enthesopathic lesions, and fracture patterns within a subset of this skeletal population. My goal in this study is shed greater light on the daily lives and health experiences of the people of Akhetaten and how this line of research can assist our understanding of how labor activities can impact overall health.

**DiGangi, Elizabeth A. (Binghamton University)**

### **TAPHONOMIC EVIDENCE OF ANCIENT CARNIVORE MODIFICATION IN A CHULLPA MACHAY TOMB FROM THE SITE OF HUALCAYAN, CALLEJON DE HUAYLAS VALLEY, IN PERU'S NORTHERN HIGHLANDS**

Recently, a Chullpa-Machay tomb was discovered at the site of Hualcayán by the *Proyecto de Investigación Arqueológico Regional Ancash* (PIARA). As extensive looting had taken place, surface collection was undertaken in two chambers to protect the tomb and its contents. Several hundred human bones were recovered, with a minimum of 24 adults and six subadults. Six adult bones (three clavicles, two humeri, one tibia) show evidence of perimortem carnivore modification. The clavicles have several puncture marks at the acromial ends with evidence that the bone was still fresh when the marks occurred (i.e., "hinging" of bone fragments inside the puncture mark). The altered humeri and tibia show scalloped and crushed margins on the epiphyseal ends as well as possible scoring marks. These indicators are consistent with carnivore chewing during the perimortem period (around the death event, while the bone was still wet or fresh). The shoulder joint is the most attractive one to carnivores, dogs in particular, as its anatomy allows easy disarticulation. Evidence of carnivore modification on bones inside the tomb indicates that dogs had access to the tomb after the placement of bodies or that bodies were first placed elsewhere where they were modified and later moved into the tomb. The importance of taphonomy in archaeological contexts to uncover human and non-human behavior will be discussed, as will proper differential diagnosis to include the most likely causative agents or pathogens for marks seen on skeletal remains.

**Donoghue, Helen D. (University College London and Tel Aviv University), Mark Spigelman (University College London and Hungarian Natural History Museum), Ildiko Pap (Hungarian Natural History Museum), Ildiko Szikossy (Hungarian Natural History Museum), Oona Y-C. Lee (University of Birmingham), David E. Minnikin (University of Birmingham), Gurdyal S. Besra (University of Birmingham), Andrew Millard (University of Warwick), Martin J. Sergeant (University of Warwick), Jacqueline Z-M. Chan (University of Warwick), and Mark J. Pallen (University of Warwick)**

### **ANALYSIS OF HISTORICAL *MYCOBACTERIUM TUBERCULOSIS* FROM 18<sup>TH</sup> CENTURY VÁC, HUNGARY BY METAGENOMICS AND CELL WALL LIPID BIOMARKERS**

Tuberculosis is prevalent in the 18<sup>th</sup> century Hungarian Vác mummies. One family, a mother and two daughters, each contained a different strain of *Mycobacterium tuberculosis* (MTB) (Fletcher *et al.* AJPA 2003, 120: 144-152; Microbiology 2003, 149: 143–51). Direct analysis of non-amplified material provides global coverage of the genome. Metagenomics, with open-ended sequencing of DNA recovered directly from samples, detects minority genetic sequences and showed the older daughter was co-infected with MTB of two distinct genotypes. These fall within the cluster of the MTB Haarlem European lineage and resemble strains currently found in Germany (Chan *et al.* NEJM 2013, 369:289-290). Very little human aDNA was detected, indicating that MTB aDNA is more robust. MTB ancient DNA in an abdominal sample from her mother was less well preserved, and an unrelated man who died in a house fire gave no evidence of MTB without amplification. MTB cell wall lipid biomarkers are specific and survive for thousands of years (Lee *et al.*, PLoS ONE 2012, 7(7):e41923). Lipid analysis showed a strong profile of total mycolic acids for the daughter and a similar, but weaker, trace for her mother. None were detected in the fire victim. Selected ion monitoring negative ion chemical ionisation gas chromatography mass spectrometry analysed mycolipenate/ mycocerosate fractions from the three Vác mummy specimens. Again, lung tissue from the daughter gave a strong result, with mycolipenate and the major mycocerosates characteristic of *M. tuberculosis*. In contrast, only relatively weak signals were recorded for the two other mummy extracts.

**Dougherty, Sean P. (Milwaukee Area Technical College)**

### **NON-ADULT MORBIDITY AND MORTALITY IN NEOLITHIC SYRIA**

The deleterious effects of the agricultural transition on health have been well documented. Much of this research is derived from New World archaeological contexts, with contributions from the Near East being relatively infrequent. Excavations at the Pottery Neolithic cemetery at Tell el-Kerkh in northwest Syria provide insight into the effects of the agricultural transition in this less examined region. Although preservation was often poor, 237 individuals were examined for general indicators of childhood morbidity, such as enamel defects, cribra orbitalia, and porotic hyperostosis. The available mortality profile demonstrates high non-adult mortality. Nearly half of the sample (47.3%) is comprised of non-adults. Of these, 28% died within the first year, if not earlier, with a second mortality peak between 1-3 years. Thirty-six individuals were observed with enamel defects, with one individual expressing 37. Estimations from mandibular canines reveal that most developmental disruptions occurred between the ages of 3-6 years. Eleven individuals (9 non-adults) exhibited cribra orbitalia. Active porotic hyperostosis was observed on five non-adults. The high rate of infant death, which



includes endogenous mortality, suggests the presence of harmful factors effecting maternal health, and may represent a confluence of culturally embedded reproductive demands, such as high parity, and limited dietary resources. The high frequency of juvenile mortality and morbidity likely represents heterogeneous resistance to acute and chronic disease, parasite loads, and malnutrition. At Tell el-Kerkh, agricultural intensification, and the population changes that followed, did not come without penalties to health, and the most frail were often at the greatest risk.

**Dudar, J. Christopher (Smithsonian Institution)**

### **FRACTURES, SPLINTS, AND TRACTION: WHAT DO POORLY REDUCED FRACTURES TELL US ABOUT ACCESS TO MEDICAL CARE?**

Osteological evidence of trauma can provide inference into past occupational hazards and lifeways, and signs of medical intervention can assist in the reconstruction of access to, and perhaps quality of, health care. Western medicine, especially trauma care and surgery, was revolutionized by technological discoveries such as, ether and chloroform anesthesia in the 1840's; the antiseptic technique in surgery in the 1860's; as well as broader implementation of autopsy procedures to learn from the dead. Access to medical care by pioneer agriculturists in 19<sup>th</sup> Century Upper Canada has been called into question largely based on the presence of poorly reduced fractures (those producing an overlap of broken ends), but is this an accurate proxy measure? The medical history and technology of fracture resolution will be explored, and comparisons made between healed fractures found in Upper Canadian pioneer cemeteries, Native American archaeological skeletal series, and anatomical collections from the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. Poorly reduced fractures are found in all three groups prior to the advent of more modern orthopedic intervention. I argue that medical views romanticizing the hardships of pioneer lifestyle are not relevant to many aspects of 19<sup>th</sup> Century Upper Canadian medical experience.

**Filipek-Ogden, Kori Lea (Durham University) \*\*\***

### **CONGENITAL CONFUSIONS: ASSESSING DIAGNOSTIC DISCREPANCIES IN SPINAL MALFORMATIONS**

The congenital disorder spina bifida is caused by a neural tube defect that results in a lack of fusion of the neural arch with laminal distortion in the affected area. This condition is frequently reported in archaeological contexts, but it has been argued that both forms, occulta and cystica, are often misdiagnosed, and what is in fact present is congenital failure of fusion resulting in a cleft neural arch (Barnes 1994, 2012). Moreover, this hypothesis has gained some support in the clinical realm, which has accused palaeopathology of creating a 'diagnostic dilemma' surrounding interpretations of spinal malformations (Kumar and Tubbs 2011). This bibliometric analysis assesses the reported cases of 'spina bifida' in three major journals (*Antiquity*, *American Journal of Physical Anthropology*, and *International Journal of Paleopathology*) to evaluate which condition is actually present in the literature using the criteria provided by Barnes (1994, 2012) and Kumar and Tubbs (2011). Of the reported cases (n=39), 37 articles attributed the observed spinal defects to spina bifida, and two offered a cleft neural arch as an alternative. From the information presented in these articles, only eight of the descriptions/photographs

were indicative of spina bifida, whereas 17 were suggestive of a cleft neural arch. The remaining articles (n=14) did not provide sufficient descriptions or photographs of the spinal malformations. This discrepancy highlights the importance of not only providing detailed descriptions for differential diagnoses in palaeopathology, but the need for continual review of previous evidence to make more relevant interpretations of health in the past.

**Frohlich, Bruno (National Museum of Natural History), Judith Littleton (University of Auckland), Tsend Amgalantugs (Mongolian Institute of Archaeology), and Paul Morrow (National Forensic Pathology Service of New Zealand)**

### **CRIME OR PUNISHMENT? AN ANALYSIS OF CRANIAL TRAUMA FROM MONGOLIA**

Pastoral societies are often associated with frequent interpersonal violence attributed to the prevalence of raiding among rival groups. Among remains from the early Bronze Age, Mongolia (c3000-2500 BP) we have identified four individuals with extensive sharp force injuries to the cranium. The individuals (all young adult males) come from two areas: Hovsgol in Northern Mongolia and Khovds in the west of the country. In this paper we analyse the sequence of injuries and similarities between them. These injuries seem to be part of a wider pattern of violence in early communities of Central Asia. We debate, however, the cause of that violence and explore two options: whether the injuries are sustained during activities such as raiding or whether they are part of a community sanctioned punishment. In doing so we draw upon the pattern of pathology, the archaeological context, and the wider regional history.

**Fuchs, Katharina (Albrechts University), and Julia Gresky (German Archaeological Institute)**

### **GENETIC DISORDER, CHRONIC INFLAMMATION OR HORMONAL DYSFUNCTION? DIAGNOSING BONE DISEASE IN POORLY PRESERVED HUMAN REMAINS**

This poster presents a case study of human skeletal remains from the Bronze Age cemetery of Kudachurt 14 (2200-1500 BC), which is located in the Karbadino-Balkarian Republic, Russia. Anthropological investigations were part of a broader investigation of regional Bronze Age populations. The case study involves the remains of a 30 to 40 year old probable female individual from grave 168 that shows severe changes due to a metabolic disorder. However, the skeletal remains are sparse, with only a few fragments of the crania and midshaft portions of the femur and tibia. None of the bone fragments show physiological differentiation in cortical and spongy structures. Instead, they were replaced by very fine, dense bone, which also comprised the outer surface. The cross-sections of cranial fragments are thickened up to 12 mm, while fragments of long bones are fragile and light in weight. In the case of such extensive bone remodelling we must consider several different diseases. They all affect the bone metabolism, as they cause an imbalance of osteoblast and osteoclast activity. This imbalance can be due to disorders in the endocrine system (*Hyperparathyroidism*), a chronic inflammation of the bone (e.g. *Paget's Syndrome*) or a genetic defect (*Fibrous dysplasia*). This poster discusses methodological options including macroscopic, histological and radiometric analyses when very little skeletal material is present. Taking all available data into account, a diagnosis was made for the

individual from Kudachurt 14. Furthermore, the presented case represents a rare disorder in the archaeological context from an extraordinary locality within Europe.

**Funkhouser, J. Lynn (University of Alabama) \*\*\***

### **PATTERNS OF VIOLENCE AT MOUNDVILLE: A PRELIMINARY ANALYSIS OF OBSERVED RATES OF TRAUMA IN THE WEST OF MOUND P CEMETERY**

The Moundville site, located in West-Central Alabama, served as an important political and ceremonial center in the period preceding European contact. This research focuses on patterns of trauma observed among adult individuals recovered from a cemetery located to the west of Mound P at the site. Of the 252 total individuals recovered from this area, only 91 individuals are able to be assigned age and sex; 52 females and 39 males. An additional 32 adults of indeterminate sex are of sufficient preservation to be included in the analysis of the sample. In assessing trauma, 24 individuals evidence traumatic injury including seven females, 11 males, and six individuals unable to be assigned sex. Patterning among females is generally limited to rib and hand fractures, while males tend to display a broader spectrum of injuries that include, but are not limited to, fractures of the ulnar midshaft and compression fractures of the thoracic and lumbar vertebrae. Comparing this cemetery to others located near-mounds, the Mound P sample is found to be atypical in that so few individuals, only 47, are interred with grave goods. The infrequency of included mortuary accoutrements and the spatial location of the cemetery sample suggest that the population represented by the west of Mound P sample was one composed of primarily non-elite individuals; the prevalence and anatomical distribution of trauma in this sample also matches elite/non-elite comparisons elsewhere at the site.

**Gamble, Julia A. (University of Manitoba), Hilary Gough (University of Manitoba), Jesper Boldsen (University of Southern Denmark), Mostafa Fayek (University of Manitoba), and Robert D. Hoppa (University of Manitoba)**

### **MORBIDITY, MORTALITY AND MOBILITY IN MEDIEVAL DENMARK: LINKING OSTEOLOGICAL AND STABLE ISOTOPIC INTERPRETATIONS**

Episodes of demographic pressure, economic stress, famine, and disease characterized the Late Medieval Agrarian Crisis across Europe. In Denmark, this period saw economic growth during the 11<sup>th</sup> to 13<sup>th</sup> centuries followed by population crisis in the 14<sup>th</sup> century. Unlike many other regions, burials in this time did not change and all members of a community, during times of prosperity and crisis, would have been buried in the same cemetery. An osteological study of two samples from the region in and around the Medieval town of Horsens (Jutland, Denmark) was undertaken: Ole Wormsgade (urban), and Sejet (rural) both dating between the 12<sup>th</sup> and 16<sup>th</sup> centuries. Incorporating evidence for time period associated with burial position within the cemeteries, disease specific changes in morbidity were observed over time and between the two sites. Mortality differences were also apparent between sites. In addition, a subsample of individuals was investigated for  $\delta^{18}\text{O}$  values from enamel, using a revised method for  $\text{Ag}_3\text{PO}_4$  precipitation as a means of phosphate-bound oxygen isolation, to identify any individuals with a different isotopic signature. The isotopic composition of meteoric water was available as a local proxy based on Global Network of Isotopes in Precipitation data. Limited regional variation

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

within central Denmark did not provide for the identification of movement between sites. However, three individuals exhibiting lower oxygen isotope values were identified. Possible sources of this variation include potential movement from other Baltic or Scandinavian locations. Further details regarding their osteological profiles are discussed in light of these observations.

**Gomez, Jamie M. (Western Michigan University) \*\*\***

### **A BIOCULTURAL INVESTIGATION OF RATES AND LOCATION OF DENTAL DISEASE AND TREATMENT IN A TURN OF THE CENTURY LOW SES SAMPLE FROM THE HAMANN-TODD COLLECTION**

Some factors that influence dental health include age, sex, gender, race, socioeconomic status (SES), and geographical region. These factors have resulted in inequalities and sexual differences in rates and location of dental diseases. The influence of biological (age, sex) and cultural factors (SES, gender, race) will be investigated using a sample from the Hamann-Todd collection (N=280; 150 males, 130 females; 145 White, 135 Black; died 1911-1927). These individuals had a low SES background with documented information (age at death, date of death, sex, race). A comparison of rates and location of dental diseases (carious lesions, antemortem tooth-loss [AMTL], abscesses, plaque, wear) and treatment could help understand the effect of biological and cultural factors.

Preliminary results show high rates of dental disease among the low SES sample (3.23 teeth affected by carious lesion(s)/person, 9.47 AMTL/person, 0.68 abscesses/person, 25% of people affected by plaque, 13.21% of people affected by wear). Rates of AMTL, abscesses, and wear increased with age, and a similar trend was seen for carious lesions except for white females (whose rates decreased from young to mature adulthood, then increased into old adulthood). Sexual differences and/or gender inequalities were seen in rates of AMTL (6.41/male vs. 13/female). Racial differences between Whites and Blacks, respectively, were seen in dental treatment (0.53/person vs 0.096/person), plaque (11.03% vs. 40% of people affected), wear (17.24% vs. 8.89% of people affected), AMTL (11.39/person vs. 7.44/person), and carious lesions (16.24% vs. 12.67% of teeth affected). A further investigation of location is required.

**Gonzalez, Ramon (Quinnipiac University), Gerald Conlogue (Quinnipiac University), Mark Viner (Cranfield University and St. Bartholomew's Hospital, London), and Jelena Bekvalac (Centre for Human Bioarchaeology, Museum of London)**

### **A MUTLI-MODALITY IMAGING STUDY OF A SKELETON DIAGNOSED WITH VON RECKLINHAUSE'S NEUROFIBROMATOSIS**

As part of an ongoing project that started in 2010, the Bioanthropology Research Institute at Quinnipiac University, Inforce Foundation, Cranfield Forensic Institute at Cranfield University and the Centre for Human Bioarchaeology at the Museum of London, began an radiographic survey of the skeletal remains within the crypt under St. Bride's Church, Fleet Street, London. Because of the existence of biographical data and detailed parish records, the 18<sup>th</sup> and 19<sup>th</sup> century skeletal remains of approximately 227 named individuals represent a unique assemblage. One of the objectives of the project was to provide radiographic images of the skeletal material that could be incorporated with the

data previously recorded on WORD (Wellcome Osteological Research Database). Conducting the imaging study within the crypt not only resulted in minimal disruption of the remains, but also provided the opportunity to select stable skeletal components that demonstrated particularly interesting pathology as candidate for advanced imaging procedures, such as multi-detector computed tomography. The following presentation provides an example of one such skeleton that was reported to demonstrate von Recklinghausen's neurofibromatosis. Digital radiographs of the skull, mandible and post-cranial elements are reviewed and compared with multi-planar and three-dimensional images acquired with multi-detector computed tomography. The recent imaging findings are then compared with the earlier study.

**Guida, Victor, Silvia Reis, Adilson Dias Salles, and Claudia Rodrigues-Carvalho (National Museum, Federal University of Rio de Janeiro)**

### **A PROBABLE CASE OF TREPONEMATOSIS IN CABEÇUDA SHELL MOUND, SANTA CATARINA, BRAZIL**

Cabeçuda was one of the biggest shell mounds in Laguna city, South of Santa Catarina State, Brazil. The first archaeological excavations attempted to recover data during industrial exploitation of the region in 1950/1951. Intensively destroyed by human activity, the site remained unstudied for decades until since 2010 when a multi-institutional team resumed archaeological investigation. New dates suggest an occupation range between 4410 - 4080 cal BP to 1830 - 1620 cal BP. In 2012, an individual was found at the excavation area 1, *locus* 1, with clear signs of pathology on the tibia. During laboratory analysis, multiple similar lesions on other bones were encountered. In order to identify the pathological condition being observed, a differential diagnosis was performed, considering infectious disorders such as leprosy, tuberculosis, treponematosis and non-specific infections, all of which exhibit characteristic lesions resembling those found in the skeleton under study. Lesion distribution and appearance suggests a case of treponematosis, and the nonspecific stress markers also point toward a probable infection. This burial is the first to present a case of treponematosis at Cabeçuda shell mound, which suggests that there may be other individuals affected since its transmission is associated with hygiene levels and demographic pressure. As a result, the skeletal remains recovered at the Cabeçuda shell mound in the mid-1950s are currently being re-evaluated.

**Harrod, Ryan P., and Alyssa Y. Willett (University of Alaska, Anchorage) +++**

### **FORM FOLLOWS FUNCTION: ASSESSING METHODS FOR RECORDING ENTHESES AND OSTEOARTHRITIS ON HUMAN SKELETAL REMAINS**

For thousands of years, researchers in medicine have postulated that the activity we do in life leaves traces on our bodies. Booth and Hargreaves (2011:1199) cite records indicating that practitioners Sushruta (650 BC) and Hippocrates (450 BC) had observed this phenomenon. In the early 1900s, medical references (e.g., orthopedic surgery) asserted that degenerative changes because of activity and lifestyle were a well-accepted fact (Taylor et al. 1909:6-7). In the 1960s, J. Lawrence Angel emphasized this relationship in paleopathology with the discovery of the "atlatl elbow" (Welzein 2007:19). Recently however, there has been a surge in research that argues against the ability to link changes on the bones with the daily activities people were performing. The focus of this project was to: (1) analyze the

relationship between life activities and the effect these activities have on an individual's bones; and (2) address limitations, as well as suggest, improved methods of recording degenerative changes on the skeleton.

Criteria for identifying and quantifying degenerative change were developed from a survey of clinical literature on their etiology and manifestation, which were then tested on pre-contact U.S. Southwest burial samples (n = 66) and a historic Chinese immigrant burial sample from Carlin, Nevada (n = 12). Preliminary results indicate that degenerative changes are not simply a product of the age or size of an individual but a complex interaction between numerous variables including activity. This finding supports the argument for continued research on how degenerative changes can provide some insight into differential patterns of activity.

**Hunt, Kathryn J., and Charlotte A. Roberts (Durham University)**

### **LINKING THE PAST WITH THE PRESENT: THE SYNOPTIC RESULTS OF A PALAEO-ONCOLOGICAL META-ANALYSIS**

Exploring the impact of cancer on society in the past, and investigating the evolution of the disease may provide researchers with insight into the behavior of cancer in response to human genetic developments, cultural shifts, and environmental transitions. However, current publications focusing on cancer in bioarchaeology are infrequent, and are often difficult to access. These studies are essential to the progress of palaeo-oncological research. This paper attempts to draw inferences based on a comparison of such studies in order to identify patterns, contradictions, or other relationships between published case studies of cancer.

This paper presents a summary of findings from a meta-analysis of case studies recording cancer in published bioarchaeological literature. It facilitated the creation of a database containing over 230 individuals exhibiting skeletal evidence of cancer spanning 9,000 years and six continents. Each case has been evaluated for a wide range of variables in the topical areas of time, geography, demography, analytical methodology, and diagnostic procedures. The subsequent database allows for the cross-reference of over 25 variables, resulting in a unique resource for comparing possible cases of cancer over wide geographic and temporal ranges.

Results of this investigation reveal patterns of younger than expected age distributions, clustered geographic frequencies, and a lack of consistency in the application of diagnostic methods. This paper explores preliminary patterns revealed by the meta-analysis and potential interpretations of those patterns, emphasizing the need for further study into both focused and broad perspectives.

**Hurtubise, Jenna (Louisiana State University), Derrick Nuesmeyer (Utah Valley University), Haagen Klaus (George Mason University and Museo Nacional Sicán, Peru), José Pinilla (Museo Nacional Sicán, Peru), and Carlos Elera (Museo Nacional Sicán, Peru)**

### **TRAUMA OR TAPHONOMY? A POSSIBLE CASE OF CRANIAL IMPALEMENT IN THE SACRIFICIAL CONTEXT OF MATRIX 101, HUACA LAS VENTANAS, PERU**

Paleopathologists are often faced with the need to differentiate between behavioral versus natural forces that can cause bone breakage. Various taphonomic processes can affect the preservation of

burials, and in some cases, cause pseudopathological alterations of bone. From 2011-2013, the National Sicán Museum and the Lambayeque Valley Biohistory Project recovered some 200 individuals from a 900 year-old mass sacrifice context designated Matrix 101. Burial 212 was a skeleton of an adult male, first observed in situ and then reconstructed in the lab was what appeared to be a penetrating fracture posterior to the left malar region which corresponded to a massive, unhealed, and externally beveled U-shaped fracture of the posterior right parietal bone. Hinging and vaulting of adhering fragments was also noted. Here, we weigh differential diagnoses of various taphonomic and traumatic causes for these defects in Burial 212. We suggest these fractures may be most consistent with the entry and exit wounds produced by forceful perimortem impalement through the cranium, possibly with a spear-mounted bronze punta, or similar object. This case tentatively identifies impalement as a form of ritual violence never before seen in pre-Hispanic Lambayeque, and highlights the multiple challenges and ambiguities that can face documentation and differential diagnosis of complex and ambiguous bone fractures in the field and laboratory.

Utah Valley University and the Unidad Ejecutora 005 Naymlap-Lambayeque generously supported this work.

**Jakob, Tina (Durham University), and Joe Wallace Walser III (University of Iceland)**

### **NOT JUST A PAIN IN THE NECK: ELONGATED TEMPORAL STYLOID PROCESS IN POST-MEDIEVAL AMBEL, ARGAON, NE SPAIN**

This poster aims to review palaeopathological and clinical studies of elongated temporal styloid process (ETSP) and presents two individuals from the parochial church of San Miguel de Ambel, Zaragoza, dated to the post-medieval period (16<sup>th</sup>-18<sup>th</sup> century AD) with ETSP. Both styloid processes of skeleton 16 (male, 26-35 years) measured 45mm in length, while the right styloid process of skeleton 25 (female, older adult) was at least 40mm long, but showing postmortem damage. A total of 26 styloid processes from 18 individuals (11 males, 6 females and one non-adult) were available for measurements, but none other than three styloid processes exceeded 40mm in length (the cut-off for pathological elongation), providing a true prevalence rate of 11.5%.

Few palaeopathological studies of ETSP have been published, because extensive postmortem damage to this anatomical element is likely to occur in archaeological skeletons. However, it has also been argued that ETSP is predominantly asymptomatic and might therefore be neglected due to its perceived irrelevance. Nevertheless, clinical studies of symptomatic ETSP, termed Eagle syndrome or styloid-carotid artery syndrome, have described a number of health problems ranging from facial, ear and neck pain, sore throat, tinnitus and dysphagia (difficulty in swallowing). The elongated styloid process can also compress the internal carotid artery and may lead to a transient ischemic event. We provide a detailed anatomical description of the two individuals from Ambel and evaluate the possible health consequences their unusually long styloid process might have had by drawing comparisons with clinical examples.

**Jaskowiec, Thomas (Loyola University, Chicago), Michael Lee (Loyola University, Chicago), Sean Rajnic (University of Illinois Medical School), and Anne Grauer (Loyola University, Chicago)**

### **NO STONE UNTURNED: THE PRESENCE OF KIDNEY STONES IN A SKELETON FROM 19<sup>TH</sup> CENTURY PEORIA, ILLINOIS**

The 2009 excavation of the Peoria City Cemetery (ca. 1839-1886) in Peoria, Illinois, yielded 86 individuals of wide demographic age ranges and economic means. One individual, a female aged 20- 25 years old, displayed multiple large bilateral renal calculi, ante-mortem tooth loss, enamel hypoplasia, and gracile morphology. Clinical literature indicates that untreated kidney stones, especially those referred to as “staghorn stones”, lead to kidney destruction, renal failure, sepsis, and mortality in up to 40% of the cases within five years of diagnosis. Archaeologically, the condition is rarely reported. Through evaluation of the etiology and pathogenesis of kidney stones, along with the historical context of this case, the possible causes of the condition and importance to paleopathology are explored.

**Kim, MyeungJu (Dankook University College of Medicine), Yi-Seok Kim (Ewha Women’s University School of Medicine), Chang Seok Oh (Seoul National University College of Medicine), Jai-Hyang Go (Dankook University), In Sun Lee (Seoul National University College of Medicine), Won Kyu Park (Chungbuk National University), Jongha Hong (Seoul National University College of Medicine), and Dong Hoon Shin (Seoul National University College of Medicine)**

### **THE ATHEROSCLEROSIS OF AORTA AND CORONARY ARTERY IN THE 17TH CENTURY KOREAN FEMALE MUMMY CASE BY USING MULTI-DISCIPLINARY APPROACH**

Since 2002, 16th to 18th century mummies were accidentally discovered in Korea and were mostly examined to reveal the clue of ancient disease by applying computerized tomography (CT) and post-factum dissection. In the 17th century Joseon female mummy, multiple aortic calcifications were found in CT radiography and samplings were performed by post-factum dissection for further confirmation. Meanwhile, various pathological signs of atherosclerosis such as atheromatous plaque and ruptured hemorrhage were confirmed by histological staining etc. The necrotic centers in the atheromatous plaque of intimal thickening consistently corresponding to the calcifications on the CT images were noted. Likewise, in a coronary artery, especially the left anterior descending artery, the intimal thickening and partial obliteration were markedly observed, which suggests the possibility that the individual might have severely suffered from coronary artery disease. Although several atherosclerosis cases in mummy including Egyptian mummies were reported by using CT image, atherosclerosis of mummy by post-factum dissection like this study, has heretofore only rarely been studied. This will be the first report of such trials in Asia. Thus, it will be meaningful to introduce this study to paleopathology group around the world.

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2013R1A1A2009688).



**King, Alesia (University of Indianapolis) \*\*\***

### **ARCHAIC NATIVE AMERICAN DENTAL HEALTH IN THE OHIO RIVER VALLEY**

This study focuses on the dental health of Archaic Period (10,000-3,000 BP) Native Americans from the Ohio River Valley. The sample included 88 adults, all of which were scored for caries. Eighty-five individuals had maxillae and/or mandibles available for scoring antemortem tooth loss (AMTL). All of the specimens are housed at the Ohio Historical Society, Columbus, OH. Caries determination followed standard osteological procedures including the use of a 10X hand lens and were calculated for premolars and molars. AMTL was determined if a crypt was completely obliterated. For AMTL analysis, all available dental crypts were studied. Of the 268 premolars and 444 molars, 3.7% and 11% were carious, respectively. Of those individuals with at least one lesion (30.7%), the average person had two carious lesions. For AMTL, 38.8% of the people had at least one tooth lost. Of those having lost at least one tooth, the average person lost 4.7 teeth before death. The high level of AMTL is likely from extreme macrowear rather than caries, supported by higher macrowear scores for those with higher AMTL. Sex was not a factor, but age was; AMTL in particular was greater for older individuals. Caries rates between young and middle/old adults were not significantly different. In general, the low rate of caries is consistent with a foraging diet and indicates regional dietary continuity.

**Kirkpatrick, Casey L. (Western University) \*\*\***

### **ABNORMAL GROWTHS AND TUMOURS OF THE SALIVARY GLANDS: A BIOARCHAEOLOGICAL PERSPECTIVE**

The salivary glands perform a function essential to digestion and the maintenance of oral health, yet they are often overlooked in bioarchaeology due to a lack of surviving soft tissues in the archaeological record. This paper will present a comprehensive review of clinical literature regarding neoplastic disease and other abnormal growths affecting the salivary glands. Afflictions will be described in detail and considered with regard to diagnostic features useful for the development of differential diagnoses in skeletal and mummified human remains. The importance of clinical studies and current medical consensus will be emphasized for their essential role in revisiting and redefining diagnostic criteria and prevalence rates for the identification of neoplastic disease in human remains.

The importance of research regarding rare neoplastic disease, like salivary gland tumors, will also be emphasized, as it is essential for the development of accurate differential diagnoses. The reliance of differential diagnoses on updated, reliable and relevant prevalence rates will also be discussed, as this study concluded that these rates can vary significantly according to epidemiological methods, differences in epigenetic factors within specific study samples, and advances in medicine and diagnostic technology.

Additionally, sialolithiasis (a condition where a calcified mass, or sialolith, develops within a salivary gland) will be discussed in relation to the difficulties of differential diagnosis and the possibility for confusion between neoplastic diseases and non-neoplastic growths. This study aims to facilitate the improvement of differential diagnosis, while promoting discussion about the challenges associated with differential diagnoses for neoplastic disease.

**Klaes, Chris (University of Louisville), Matthew Lawrenz (University of Louisville), Sharon DeWitte (University of South Carolina), and Fabian Crespo (University of Louisville) \*\*\***

### **RECONSTRUCTING THE IMPACT OF MEDIEVAL BLACK DEATH ON THE IMMUNE SYSTEM OF HUMAN POPULATIONS (I): THE IMPACT OF *YERSINIA PESTIS* IMMUNESUPPRESSION ON THE SUBSEQUENT IMMUNE RESPONSE TO PERIODONTAL PATHOGENS**

Pathogens can overcome the host immune response by different mechanisms, but one common mechanism is immunosuppression (IMS). During an epidemic event, populations face a potential novel immunological challenge that can generate a shift in the systemic immune response. The Black Death (BD; 1347-1351 AD) was one of the most devastating pandemics in human history and represents an ideal evolutionary model to understand the impact of infectious diseases on the human immune system. The objective of this study is to determine if *Yersinia pestis* (the bacterium that caused the BD) IMS impacts subsequent immune response against chronic periodontal pathogens. Our current hypothesis is that *Y. pestis* induces IMS that affects the subsequent inflammatory responses against the oral pathogen *Porphyromonas gingivalis*. To test our hypothesis, we examined how *in vitro* interaction of *Y. pestis* (whole lysate and specific antigens) with human peripheral blood mononuclear cells and immortal cell lines (Jurkats and THP1) changes the balance of the immune response and its impact on a secondary infection produced by *P. gingivalis* (active bacteria). Our preliminary results show that the balance of pro- and anti-inflammatory cytokines is altered when immune cells are exposed to *Y. pestis* and subsequently affecting the immune response when those same cells are exposed to *P. gingivalis*. While not all immunological changes correspond to a permanent IMS, a shift in the immune response against *P. gingivalis* is observed after exposure to *Y. pestis*.

**Lacy, Sarah A. (Washington University)**

### **DENTAL CARIES IN NEANDERTALS AND EARLY MODERN HUMANS IN WESTERN EURASIA**

Dietary research in the Late Pleistocene has used a number of research lines (e.g., phytoliths, isotopes) to identify taxonomic and regional differences. Oral health has not been included in these discussions, but could elucidate both differential diet and health. A project was designed to analyze dental remains from both Neandertals (N teeth=668) and early modern humans (N=1246) in Western Eurasia for evidence of caries, hypothesizing that regional variation in diet would be reflected in differential caries prevalence. Each specimen was measured, photographed, and radiographed and organized into three broad regions (Atlantic, Continental, and Mediterranean) as well as assigned to a latitude and climatic cycle. The Mediterranean region overall has more than double the caries prevalence of regions further north in the Late Pleistocene (4.6% vs. 1.6%). No caries were identified from above 43°N latitude in the Middle Paleolithic, though examples of caries increase over time above this latitude in the Upper Paleolithic. Overall caries trend negatively with latitude. Taking climatic cycle into account, caries were significantly more common from temperate sites than cold ones (3.7% vs. 1.9%). This research confirms regional dietary differences suggested by other studies. The temporal pattern also suggests that diets were changing over time within regions, but not always towards increasing caries. An Epi-Paleolithic Natufian sample had a lower caries prevalence (2.4%) than Middle Paleolithic modern

\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize

humans (7.7%) from the same area. It is likely that whatever carries-permissive cultural or climatic factors occurring at lower latitudes initially expanded northward through the Upper Paleolithic.

**Larsen, Rachel (Utah Valley University), and Haagen D. Klaus (George Mason University and Museo Nacional Sicán, Peru)**

### **RETHINKING POROTIC HYPEROSTOSIS ON THE NORTH COAST OF PERU: A NEW LOOK AT ANEMIA IN THE LATE PRE-HISPANIC AND HISTORIC ERAS**

The conditions of cribra orbitalia and porotic hyperostosis have long been attributed to anemia. They have served as central health-related variables in the ongoing characterizations in childhood diet and biological stress on the north coast of Peru, and past work has shown increased prevalence following European conquest. However, research over the last decade has called into question earlier notions involving the pathogenesis and etiology of such lesions. The practice of lumping orbital and vault lesions together as “anemia” may also be questioned.

Here, we scored and differentially diagnosed porotic lesions of the vault and orbits of 1,400 individuals from the Lambayeque Valley in Peru, including new data from Colonial Eten and several recently excavated late pre-Hispanic sites. We test the hypothesis that porotic hyperostosis and cribra orbitalia co-occur and represent overlapping pathologic phenomenon. Multiple, age, sex, and contextual comparisons using odds ratios demonstrate that during both the late pre-Hispanic and Colonial periods, orbital and vault lesions appear statistically unrelated and pathologically decoupled. The new data also challenge our previously reported increases in anemia in postcontact Lambayeque; vault lesion patterning increases in some locations, but appears localized and a context-dependent condition, associated with some Lambayeque microenvironments but not others. This work helps to further clarify the complexity of anemia-related lesions in archaeological skeletal remains, and leads to new questions regarding anemia and its impacts on the people of the north coast of Peru.

This work was funded since 2001 by grants to HDK by the National Science Foundation, the Wenner-Gren Foundation for Anthropological Research, Utah Valley University, and The Ohio State University.

**Lieverse, Angela R. (University of Saskatchewan), Vladimir Ivanovich Bazaliiskii (Irkutsk State University), and Andrzej W. Weber (University of Alberta)**

### **DEATH BY TWINS: AN EARLY CASE OF DYSTOCIC CHILDBIRTH IN NEOLITHIC SIBERIA**

Despite presumably high mortality associated with pregnancy and childbirth in the past, confirmed cases of fatal dystocia are exceptionally rare in archaeological contexts, particularly in the absence of preserved soft tissue. Here we present not only one of the oldest archaeologically documented cases of death during childbirth, but also, possibly, the earliest confirmed sets of ancient human twins. The remains are those of a young adult female from the Baikal region of Siberia (Russian Federation) found with the partial skeletons of two full-term fetuses located in her pelvic basin and between her thighs. Radiocarbon dates obtained from both the mother and infant(s) place the remains firmly within the early Neolithic period (i.e., 8000 to 7000/6800 cal. BP). It is likely, if not certain, that

all three individuals died together and from complications associated with a twin birth. This case adds to the small but growing bodies of literature on archaeological cases of maternal/perinatal death and on the occurrences of and risks associated with human twinning in prehistory.

**Lynnerup, Niels, and Mitchell James Flies (University of Copenhagen)**

### **DISSECTION MATERIAL FROM AN 1850's HOSPITAL CEMETERY IN COPENHAGEN, DENMARK**

At an excavation in Copenhagen, Denmark, 299 skeletons were recovered from a temporary cemetery, which was in use during 1842-1858 AD. The cemetery was used by the Copenhagen poverty hospital. It is known from historical sources that patients who died in the hospital, or corpses brought to the hospital, were used for dissection and teaching of surgical procedures. We here present the osteological lesions and discuss the probable procedures.

We found sawn bone elements in 54 of the individuals. We found that most of the procedures could be divided into three general categories: 1) dissection; 2) surgical procedures; and 3) making anatomical study specimens. Dissection procedures are exemplified by calvarial opening (N=18) and sternal midline through-cuts (N=4); surgical procedures by trepanations (N=2) and the sawing over of both upper and lower limb bones (N=111 total); and the making of anatomical specimens by mandibular incisions and through-cuts (N=8) and longitudinal splitting of long bones (N=5). Other bones as vertebrae, clavicles and ribs are also present in the material. No healing was found in any of the bone lesions.

It was not possible in every case to ascertain the nature or aim of a given procedure, nor if, e.g., an amputation was performed in vivo (albeit no healing), or due to practicing amputation techniques on cadavers. We compare our material to a like material from London, described by Fowler & Powers (2006), and note certain similarities, not least in terms of osteological evidence of dissection.

**Mays, Simon (English Heritage)**

### **RESORPTION OF MANDIBULAR ALVEOLAR BONE FOLLOWING ANTE MORTEM LOSS OF MOLAR TEETH: A BONY RESPONSE TO A COMMON DENTAL PATHOLOGY**

*Ante mortem* tooth loss is a common pathology in palaeopopulations. Resorption of alveolar bone occurs following tooth loss. The aim here is to quantify this phenomenon, and to investigate its relationship to age and sex. The study population is a 19<sup>th</sup> century skeletal collection of known age at death from Zwolle, The Netherlands (N=92 adult individuals). Mandibular corpus height was measured at the three different molar positions on each side of the mandible, both in those individuals retaining all mandibular molar teeth and in those showing *ante mortem* loss of one or more molars. Results showed that, among females, there was a reduction of corpus height with age at each molar position showing *ante mortem* loss of the tooth. In both sexes, a relationship was found between age at death and a simple composite measure of posterior mandibular corpus height in those individuals showing *ante mortem* loss of one or more mandibular molars. The age correlation with this composite measure of corpus height was stronger, and the alveolar bone height-for-age was less, in females than males, but in both sexes the age relationship appeared approximately linear, and alveolar bone loss continued until at least the ninth

decade of life, the oldest cohort in the study group. The greater resorption of alveolar bone following tooth loss in females may be connected with sex differences in the timing of molar loss or may be a manifestation of osteoporosis, which is characteristically more severe in females.

**McCullough, Kendall B., D. Troy Case, and Ann H. Ross (North Carolina State University) \*\*\***

### **NUTRIENT FORAMEN VARIATION IN HUMAN LONG BONES**

The nutrient foramen is a key landmark used in some long bone measurements; however, while it is documented as the point of ossification, its overall stability in position and occurrence is not fully explored in a stressed population. The purpose of this project was to evaluate the occurrence and position of the nutrient foramen in a documented skeletal collection. Conducted under the precept that long bones of the limbs grow differentially from the center(s) of ossification, therefore stress during development should present in varying placement of the foramen and may affect the number of foramina. The sample consists of 52 adult European American males and 48 females from the Terry Collection. Standard metric measurements were taken for the humerus, radius, femur, tibia, 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> metacarpals. In addition, non-standard measurements to evaluate the position of the nutrient foramen and number of foramina (0 – 3) were used. Childhood stress was assessed via the presence of LEH (Linear Enamel Hypoplasias) and the relative lengths of the elements. Positional information of the nutrient foramina were cross referenced with the approximated stress level of the individual to determine if position and occurrence were affected. Results suggest that elements are differentially affected by stress as are the nutrient foramina. However, not all long bones were affected equally; for example the foramen was found to be relatively stable in its location relative to bone length and in number on the tibia, while there were greater variations in the other elements such as the femur.

**McDowell, Emily (North Carolina State University) \*\*\***

### **HEALTH IN A PREHISTORIC NORTH CAROLINA ALGONKIAN POPULATION: THE PIGGOT OSSUARY (31CR14)**

Health indices are imperative in establishing demographic information about archaeological populations. However, these studies are rarely done on commingled remains because the majority of health index methodologies are performed on the individual to make inferences about the population and not on the population as a whole. Considering ossuaries comprise the majority of burials on the east coast during the Late Woodland period, this leaves a large gap in the archaeological record. This study aims to explore the health of the Piggot ossuary (31CR14) a prehistoric coastal North Carolina Native American Algonkian speaking population. Because of coastal erosion and economic development few studies have been conducted on these coastal populations and thus, this study could help fill this important gap in the literature. Sex estimation for the Piggot will be assessed using newly developed long bone (e.g. humerus, femur, and tibia) sectioning points for males and females using the Tennessee Averbuch, a geographically and temporally appropriate reference sample. Length measurements were recorded and were used to assess the degree of sexual dimorphism within the population (Neves and Costa 1998). A canonical variates analysis (CVA) was used to assess the level of variation of these length measurements between males and females. An index of sexual dimorphism (ISD) was used to

further examine the level of sexual variation and to make the study more comparative to other populations. Because females are generally better able to canalize stress than males, it can be hypothesized that there would be a lesser degree of sexual variation between males and females in an unhealthy population.

**Miller, Melissa (University of Delaware), Vicki Cassman (University of Delaware), Molly Gleeson (University of Pennsylvania Museum), and Karen Rosenberg (University of Delaware)**

### **EGYPTIAN MUMMY AUTOPSY: A HISTORY OF THE PRACTICE & PRESERVING THE AUTOPSY CONTEXT**

In 1973 Aidan and Eve Cockburn founded the Paleopathology Association. Just one year prior, this dynamic duo began a project with several colleagues and associations, including Dr. Michael Zimmerman, Robin Barraco, William Peck, Theodore Reyman, and the University of Pennsylvania Museum of Archaeology and Anthropology to investigate, via autopsy, a series of mummies known as PUM (Philadelphia University Museum) 1 through 4. My research focuses on PUM 1, the first mummy autopsied by this research group. According to radio carbon dating, this artificial, Egyptian mummy dates to approximately 800 BCE, during the Third Intermediate Period. PUM 1 is also believed to be non-pharaonic due to the researcher groups' discovery that the organs were left inside the body.

My project addresses the issue of preserving not only their research on PUM 1, but the context of their autopsies, and by example other 20<sup>th</sup> century mummy autopsies. By gathering and/or locating the physical remains (i.e. tissue samples, body parts), associated documentation (i.e., autopsy records, notes, sketches, film, photographs, x-rays, etc.), and oral histories (i.e., interviews and memories of those involved) one can then to a certain extent reconstruct the autopsy. In addition, by conducting a literature review and interviews on the history and development of the autopsy technique in the field of paleopathology we can better understand the autopsy context in general. Ultimately, the aim is to better preserve these mummified individuals and their personal histories, while simultaneously making them more accessible for future researchers and museum-going audiences.

**Minnikin, David E. (University of Birmingham), Oona Y-C. Lee (University of Birmingham), Houdini H. T. Wu (University of Birmingham), Vijayashankar Nataraj (University of Birmingham), Gurdyal S. Besra (University of Birmingham), Apoorva Bhatt (University of Birmingham), Bruce M. Rothschild (University of Kansas), Richard Laub (Buffalo Museum of Science), Mark Spigelman (Hebrew University), and Helen D. Donoghue (University of Birmingham)**

### **ANCIENT MYCOBACTERIAL LIPIDS AS REFERENCE BIOMARKERS IN CHARTING THE EVOLUTION OF TUBERCULOSIS**

A scenario for the evolution of tuberculosis involves a transformation from an environmental organism, such as *Mycobacterium kansasii*, to a diverse group of tubercle bacilli, currently labeled "*Mycobacterium canettii*". These ancestral strains are still extant in limited geographical locations, but all lineages of modern human and animal tuberculosis appear to have emerged after a "bottleneck" around 30 – 20ka BP. (Supply *et al.* 2013 Nature Genetics; 45:172). Before the bottleneck, there is

minimal evidence for the presence of tuberculosis in humans, but the widespread dissemination of the disease in Pleistocene megafauna is evident. The manifestations of tuberculosis in megafauna are very characteristic lesions undermining the articular surfaces of metacarpals. For a 17ka BP bison tuberculosis was confirmed by the detection of DNA and specific lipid biomarkers (Lee *et al.* 2012 PLoS ONE 7:e41923). The lipid biomarkers involved are long-chain compounds, principally mycolic, mycolipenic and mycocerosic acids along with members of the phthiocerol family. Our current strategy pinpoints lesions in megafaunal metacarpals and records them with computerized tomography. Novel metagenomic approaches are used to attempt to determine genotypes for the infecting organisms (Chan *et al.* 2013 New Eng. J. Med 369:289). The residues from such DNA extractions are used for lipid biomarker determinations. Specimens successfully investigated include mastodons (Hiscock Site, NY), bison (Natural Trap Cave Wyoming; Idaho; North Sea) and cattle (40ka BP, Kent's Cavern, UK). Lipid profiles are correlated with those of standard mycobacteria, perceived to be in the evolutionary chain; there are indications of particular lipids characteristic of ancestral lineages.

**Mitchell, Piers D. (University of Cambridge), Jo Appleby (University of Leicester), Sarah Hainsworth (University of Leicester), Guy Ruttly (University of Leicester), Alison Brough (University of Leicester), Richard Earp (University of Leicester), Bruno Morgan (University of Leicester), Claire Robinson (University of Leicester), Turi King (University of Leicester), and Richard Buckley (University of Leicester Archaeology)**

### **RICHARD III: RECONSTRUCTING THE LIFE AND DEATH OF THE LAST PLANTEGENATE KING OF ENGLAND (1483-85)**

In September 2012, skeletal remains were excavated from a council car park in Leicester, the location of a Greyfriars Friary in the medieval period. A subsequent programme of archaeological, osteological, and genetic analysis alongside radiocarbon dating and isotope studies has allowed them to be identified as Richard III, the last king of England to die in battle (1485). The unearthing of the skeleton has enabled long-standing questions about Richard's physical deformities and his manner of death to be answered.

The alignment of the spine at excavation coupled with the morphology of the vertebrae suggests that he suffered with a pronounced adolescent onset idiopathic scoliosis. We discuss the implications of this for his function during life. Analysis of soil from the pelvis shows that he suffered with roundworm (*Ascaris lumbricoides*) infection in his intestines. In addition, we will explore significant peri-mortem trauma to the cranial and post-cranial skeleton. The ten weapon injuries have been investigated with plain radiographs and CT scans, and wounds compared to other medieval battle victims. These suggest a combination of battle wounds and post-mortem mutilation of the body. It seems likely that this high-profile individual would not only have had a challenging life coping with physical deformity, but also faced a harrowing and brutal death and an undistinguished burial, as evidenced from his skeletal remains.

**El Molto, J. (University of Western Ontario), and Peter Sheldrick (Dakhleh Oasis Project)**

### **PALEO-ONCOLOGY FROM THE DAKHLEH OASIS, EGYPT: CASE STUDIES**

This paper details four probable cases of cancer from the Dakhleh, Oasis, Egypt. Three of the cases are from Ain Tirghi (31/435-D5-2), a post New Kingdom Cemetery that dates to the Third Intermediate and/or Late Periods, and from Kellis 2, a Roman period cemetery dating circa 50-450 A.D. The Ain Tirghi cases likely represent three cases of carcinomas in a male estimated to be in his mid to late 30s and females both likely in their fourth decades of life. Specific diagnoses are not possible although a range of differentials are provided. The Kellis case most likely represents acute lymphocytic leukemia in a child estimated to be 3-5 years of age. This is the first case of this disease in antiquity. The determination of cancer prevalence in this ancient Egyptian population is not possible, although these cases definitely contrast recent literature which has suggested that cancer is a modern disease and was absent in ancient Egypt.

**Norris, Annie Laurie, and Brenda J. Baker (Arizona State University) \*\*\***

### **POROTIC HYPEROSTOSIS AND CRIBRA ORBITALIA AT THE GINEFAB SCHOOL SITE, SUDAN**

Porotic hyperostosis and cribra orbitalia are often used in general assessments of population stress. Although questions concerning the etiology remain, both lesions have been associated frequently with anemia, particularly iron-deficiency anemia. In this investigation, 100 individuals from the Ginefab School Site, a Late Meroitic to Christian era Nubian population (c. A.D. 0-1400) from the 4th Cataract region of Sudan, were examined for the presence, location, degree, and healing status of porotic hyperostosis and cribra orbitalia. The lesions were assessed as active, mixed, or healed status. Results show that the majority of the skeletal sample (95%) was afflicted with either porotic hyperostosis or cribra orbitalia, with both lesions present in a majority of cases (54%). Two patterns in age distribution were statistically significant: occurrence of cribra orbitalia only was more prevalent among children, and occurrence of porotic hyperostosis was far more common among adults. Healing status of lesions was strongly associated with age, with active lesions among young children only. Mixed reactions, however, were observed among adults as well as children, predominantly in young adults. It has been hypothesized that cribra orbitalia represents a childhood condition, but the presence of mixed active and healed lesions in adults suggests otherwise. Several factors could have contributed to these high lesion frequencies, including high rates of parasitic infection and nutritional deficiency. The biocultural context of the Ginefab School site and comparison with other ancient Nile Valley samples provides insight into cultural and environmental factors influencing the occurrence and patterning of these lesions.



**Odien, Jennifer K., and Jennifer F. Byrnes (University at Buffalo) \*\*\***

### **BASI-VERTEBRAL FORAMEN REACTION AND EXPANSION: AN INDICATOR OF SYSTEMIC BLOOD INFECTION**

Due to the complexity of the venous and arterial networks surrounding the vertebral bodies, the majority of existing evidence for pathological reactions involving the vertebral column focuses mainly on processes that cause structural collapse or diffuse lesions. During skeletal analyses on the Erie County Poorhouse Cemetery (in use from 1851-1909) exhumed from Buffalo, NY, numerous skeletons exhibited expansion at the basi-vertebral foramen and adjacent area with associated sclerotic lining. The basi-vertebral foramen is the foramen present at the midline of the posterior vertebral body wall. It is through these foramina that the basi-vertebral venous system sends branches into the vertebral bodies. In order to record this reaction, we devised a method that scores the proportion of the posterior body wall affected between the pedicles. A three category system was used for expansion width: less than 1/3, between 1/3- 2/3, and greater than 2/3. To record depth, the basi-vertebral foramen is either a sclerotic lined concave surface or sclerotic lined foramen entering the vertebral body. Approximately a third of the 315 adult and juvenile skeletons examined had at least one vertebral body with reaction. The most common site of this reaction was observed within the thoracic vertebrae, while the cervical and lumbar vertebrae were less often affected. Almost all of the individuals with basi-vertebral foramen reaction had visceral rib lesions and/or abscesses. We hypothesize that the basi-vertebral expansion may be an indicator of a systemic infection involving the blood supply.

**Ostrander, Thomas (Unaffiliated), Charlotte Roberts (Durham University), Janet Montgomery (Durham University), and Chris Ottley (Durham University)**

### **IRRESISTIBLE CORRUPTION: A PALEOPATHOLOGICAL EXAMINATION OF LEAD POISONING AND ITS SHAPING OF THE MORTALITY AND MORBIDITY PROFILE OF AN URBAN INDUSTRIAL PERIOD QUAKER POPULATION IN NORTH-EAST ENGLAND**

This study examined the prevalence, degree and effect of lead poisoning amongst people buried at the Quaker cemetery site of Coach Lane, North Shields, Newcastle-upon-Tyne (1711-1857). Tooth enamel samples of fifty individuals were analyzed using ICP-MS. The level of lead incorporated into the enamel may be analogous to the level of lead circulating in the blood stream during formation, though further study into this is required. Levels were contextualized through comparison to modern clinical toxicology reports. Based on clinical data, possible osteological expressions related to lead exposure were recorded in this population: reduced stature, dental caries, Harris lines, anemia (cribra orbitalia), vitamin D deficiency (rickets) and vitamin C deficiency (scurvy). A very large proportion (96%) of people had clinically defined lead poisoning as non-adults. Statistically significant relationships were found between severe lead poisoning and rickets ( $p=0.0025$ ), and scurvy ( $p=0.0473$ ); an inverse correlation was found between lead levels and residual rickets in adults ( $p=0.0001$ ). In addition those over the age of 40 did not experience severe lead poisoning as non-adults. Conversely, all individuals examined who were under the age of seven, except one, showed levels indicating severe lead poisoning.

This study suggests endemic lead poisoning throughout an urban industrial period population. The correlations found between severe lead poisoning, juvenile mortality and metabolic disease bear consideration when examining health in industrial period contexts, and may relate to social class, occupation, and aid the identification of migrants. The results regarding rickets frequency suggest that

lead poisoning might not have been the direct cause of vitamin D deficiency, though it heavily influenced survival of the state.

**Pelletier, Natalie, Gerald Conlogue, Tania Grgurich, and Robert Lombardo (Quinnipiac University)**

### **OPTIMIZING MDCT PROTOCOLS FOR MUMMIFIED REMAINS**

A protocol is a series of factors, such as the penetrating power of the x-ray beam, and quantity of radiation delivered, that are set by the technologist to acquire the computed tomography scan data. In medical imaging, equipment manufacturers have installed preset protocols for various examination and/or body parts in order to minimize the radiation dose to the patient, while attempting to maintain image quality without compromising diagnostic potential. However, in paleoimaging, since radiation dose is not a factor, maximizing image quality is of ultimate importance. The following presentation examines several elements, such as kilovoltage, millamperage, pitch, and field-of-view, which comprise multi-detector computed tomography protocols in order to optimize the image quality. For each parameter, multiple settings were compared during the examination of a mummified individual. In addition, protocols were formulated that minimize the output and extend the life of the equipment without a loss of image quality. In order to demonstrate the problems associated with medical protocols, images of two individuals, the mummified remains of a female diagnosed by the CDC with small pox and the skull of a male thought to have neurofibromatosis, will be discussed. The mummified remains of an individual with calcified mediastinal nodes will be used to establish the optimized computed tomography protocol.

**Perash, Rachel M. (University of Indianapolis) \*\*\***

### **ENTHESEAL CHANGES AT THE LATE PREHISTORIC WOODLAND RIDGE (12C335) SITE, INDIANA**

Enthesal changes are caused by tendons and ligaments acting on bone via muscular activity; they provide an important context for interpreting pathology by indicating behaviors associated with the expression and/or patterning of particular conditions. The author examined commingled adult humeri, ulnae, and radii from the maize agricultural Woodland Ridge site (MNI = 19), which is located in northern Indiana and dates to AD 1200-1300. Age, sex, and enthesal change scoring followed standard procedures with observations made of both proximal and distal entheses on the humeri and ulnae and proximal entheses on the radii. Three of the four male left humeri showed proximal enthesal changes with one being severe; two of the observable male left humeri showed distal enthesal changes with one being severe. Of the female left humeri, 80% (n=4) showed proximal enthesal changes while 25% (n=1) showed distal changes, none were severe. Of the ulnae, 100% (n=14) had proximal enthesal changes with four left and two rights having severe changes. For the radii, 22% right and 29% left (n=4) showed proximal enthesal changes with one left being severe. Arthritic conditions were expected to be present, but slight eburnation on a few joint surfaces was the only indication seen. Based on the patterning of enthesal changes, the people of Woodland Ridge engaged in activities that worked their shoulders and elbows extensively and commonly on their left sides. Triceps brachii and the rotator cuff

were in particular demand; by contrast, insertions for Biceps brachii led to almost no enthesal changes. Thus arm extension and shoulder rotation were important motions. Many explanations are considered including agricultural activities and bow and arrow use.

**Philmon, Kendra L. (Kalispel Tribe of Indians), and Clifford T. Brown (Florida Atlantic University)**

### **PATHOLOGY AND TRAUMA AT CUSIRISNA CAVE, NICARAGUA**

Bioarchaeological analysis of remains from a cave burial revealed insights into the lives and health of those individuals. Osteological remains from Cusirisna Cave, Boaco, Nicaragua, were recovered in the 1870s by Dr. Earl Flint, an explorer for Harvard's Peabody Museum. The well-preserved human remains were found in association with shell and greenstone beads, *guacales* (bowls made from *jícaras*), and a wooden *duho*. One of those artifacts, a *guacal* used to hold the crania, was dated by radiocarbon assay, yielding a date of cal A.D. 1450 with a 2-sigma calibrated interval (95% probability) of Cal AD 1430 to 1483 (Beta-315973). The commingled osteological collection (n=82, MNI=9) exhibits a number of pathologies, including osteoarthritis, osteoporosis, porotic hyperostosis, Osgood-Schlatter disease, and nonspecific periosteal reactions. Cranial and dental pathologies include mandibular and occipital osteoarthritis, antemortem tooth loss, mandibular resorption and remodeling, periostitis, caries, abscesses, and two instances of supernumerary incisors. In addition to those pathologies, four of the eight crania exhibit perimortem fractures and blunt force trauma, and five crania display cranial modification. Here we use the framework of pathology and trauma as a means of interpreting mortuary function at Cusirisna Cave.

This study was supported by Sigma Xi and the Florida Atlantic University Department of Anthropology Ann Adams Maya Fund.

**Randall, Tori D. (San Diego Museum of Man and San Diego City College) +++**

### **LA JOLLAN MOBILITY AND BEHAVIOR**

The lifestyle and behavior of a group of prehistoric southern Californians has been investigated for the purposes of this research project. This group is known as the La Jolla skeletal collection, and it is made up of 87 individuals housed at the San Diego Museum of Man in California. Aspects of the mobility and behavior of the La Jollans have been determined through the use of paleopathological diagnoses, as well as through cross-sectional geometry. Differences in lower limb diaphyseal robusticity and shape indicate variation in mobility between groups; while variation in upper limb diaphyseal robusticity and shape indicate differences in general subsistence behavior and activities such as paddling or swimming. The La Jolla robusticity data implies that the population did use watercraft, and displayed low terrestrial mobility. This is supported by the paleopathological evidence; namely, that patterns of osteoarthritis in the upper limbs suggests fishing and paddling. In addition, diaphyseal shape data shows patterns of repetitive habitual activity in the humeri of the La Jollans, which is likely due to shellfish collecting and seed processing. This behavior is also supported by paleopathological indicators of health and nutrition.

**Rando, Carolyn, and Tony Waldron (University College, London)**

### **DIFFERENTIAL DIAGNOSIS OF A GIANT CALCIFIED ABDOMINAL MASS**

Skeleton 3786 was recovered as part of the excavations of Eastgate Square Cemetery by Archaeology South East during 2011, one of 1634 burials found dating to the period between the 12<sup>th</sup> and 19<sup>th</sup> centuries CE. This individual, female and of advanced age, was discovered with a large, bony-appearing mass within the abdominal cavity. Oval in shape (24.3 x 19.0 x 16.4 cm) and weighing 3.32 kilos, this mass presents with an appearance that is bone-like, the surface showing evidence of vascularity. CT scans of the mass revealed a highly dense object (of varying densities depending on relative position), with a central void and a notably denser encompassing 'shell'; the central void appears to have also been vascularised. After initial analysis, it was decided to bisect the mass so that histology on the various layers could be performed. These histological analyses revealed that the mass was primarily composed of calcium. Considering this, along with visual inspection of the interior cavity and the location of the mass likely being within the pelvic outlet in life - and as such, the origin of the mass being from the reproductive organs - the following diagnoses are proposed (amongst others): primary osteosarcoma of the uterus, ovarian fibroma, uterine leiomyoma, or a calcified enlarged uterus with areas of fibromatous growths. Diagnoses such as mature cystic teratoma or lithopedion can be discarded, as there is no evidence for these. This mass represents one of the largest neoplastic growths ever found in archaeological material.

**Reis, Silvia, Victor Guida, Adilson Dias Salles, and Claudia Rodrigues-Carvalho  
(National Museum, Federal University of Rio de Janeiro)**

### **TO GROW STRONG: HEALTH ANALYSIS OF THE CHILDREN FROM THE CABEÇUDA SHELLMOUND, SANTA CATARINA STATE, BRAZIL**

The collection of human remains of Cabeçuda Shellmound, at the Museu Nacional/UFRJ reflects different moments of bone collection or archaeological excavations since the beginning of the last century. The human series recovered by researcher Castro Faria is the largest one, with more than 200 individuals and comprises 18% of children (fetus to 10 years old) from the 1950 excavation campaign, and 15% of children from the 1951 excavation campaign. New excavations are in progress in the site since 2010, which leads to reassess the 1950' series in order to develop questions and possible comparisons. Therefore, it has the potential of shedding some light over the health conditions of this population. Childhood health is one of the topics elected for comparisons. Variables such as signs of systemic infection (periostitis, osteitis, osteomyelitis), and *cribra orbitalia* were analyzed among children remains. The presence of *cribra orbitalia* points to the possibility of nutrition stress as well as health vulnerability to endemic diseases. Low cases of systemic infections reinforce the idea that acute diseases were the main cause of death in childhood. In a comparative perspective, the different samples from Castro Faria's campaigns and the museum recent campaigns of 2010 to 2012 will enable a diachronic analysis as and discussion of health trends through time in a site build from more than 3.000 years.

**Scott, Amy B., and Robert D. Hoppa (University of Manitoba)**

### **WALKING THE LINE: A RE-EVALUATION OF HARRIS LINES AND THE IMPACT OF RADIOGRAPHIC POSITIONING ON THEIR IDENTIFICATION AND INTERPRETATION**

The use of Harris lines as an osteological indicator of stress has been well-established since their initial discovery in the early 20<sup>th</sup> century. As indicators of arrested growth identified through radiographic analysis, Harris lines have both helped and hindered osteological research. This research explores the methodological challenges of identifying Harris lines and proposes a new standard for the radiographic capturing of these paleopathological indicators. Using the Danish Black Friars (late 13<sup>th</sup> – early 17<sup>th</sup> centuries) sample, 55 individuals (33 adults; 22 subadults) were radiographically analyzed in both an anterior-posterior (A-P) view and medial-lateral (M-L) view for the left and right radii and tibiae. Based on current literature and methodological standards, it was hypothesized that the A-P view would provide the best resolution and visualization of Harris lines in both adults and subadults. Results however, show that the number of Harris lines visible in the M-L view for both the tibiae and radii in adults were significantly higher than the lines visible in the A-P view. Further, the subadults only showed higher M-L resolution in the right proximal tibia, and the left and right distal radii. Identifying this discrepancy between the visualization of Harris lines in different radiographic views is an important step in refining this method to improve consistency both within and between osteological analyses. By defining the limitations of radiographic assessments, rather than assuming intra- and inter-observer error are the primary challenge, it may be possible to improve our ability to effectively assess and interpret Harris lines in paleopathological studies.

**Shidner, Ashley E., and Kathleen Kuckens (University of Arkansas)**

### **NON-SPECIFIC STRESS INDICATORS AND GROWTH IN ANCIENT EGYPTIAN CHILDREN FROM TELL EL-AMARNA AND HIERAKONPOLIS**

During the reign of the Pharaoh Akhenaton major political, economic, and social shifts took place in Ancient Egypt. To understand how these changes affected the health of Ancient Egyptian children during the Amarna period, rates of skeletal stress markers and childhood growth ratios of the South Tomb Cemetery at Tell el-Amarna is examined in relation to the Predynastic HK43 cemetery at Hierakonpolis.

Sixty-eight individuals from the South Tomb Cemetery and nineteen individuals from the HK43 cemetery ranging in age from 4.5 months to 16.5 years were used in this analysis. The indicators of stress: cribra orbitalia, linear enamel hypoplasias, and porotic hyperostosis was analyzed using the parameters set by *Standards*. Growth was assessed by calculating ratio of achieved long bone lengths to the Maresh standard ( $\delta I$  mean values).

From the total number of observable individuals from the South Tomb cemetery aged 0-2 years, 70.4% show at least one indicator of stress, while 87.5% aged 3-7 and 8-16 years have at least one skeletal marker. In comparison, only 28.5% of the individuals ranging in age from 0-2 from HK43 have at least one indicator of stress, while 25% of the individuals aged 3-7 years and 87.5% of the individuals aged 8-16 have at least one skeletal marker. The South Tomb Cemetery consistently has a higher percentage of stress indicators than HK43, which is consistent with the lower  $\delta I$  mean values (89.7% of the South Tomb sample falls below the line of unity versus 78.9% at HK43).

**Shuler, Kristrina A. (Auburn University)**

**CO-OCCURRING VERTEBRAL ANOMALIES AND SUPERNUMERARY TEETH IN AN ADULT BURIAL FROM A COLONIAL SLAVE CEMETERY IN BARBADOS - A POSSIBLE CASE OF EHLERS-DANLOS SYNDROME?**

Bioarchaeological investigations from Newton Plantation (ca. 1660-1820), Barbados have provided unique insight into the health and origins of enslaved Africans. Recently, the skeleton of a 20-35 year old Barbadian-born male from Newton (N48) was briefly described with co-occurring defects of the second cervical vertebra and supernumerary teeth. In addition to an extra right third premolar and a right fourth molar, Shuler and Schroeder (In Press) identified a smooth-walled unilateral defect on the left foramen transversarium of C2 and widening in all cervical intervertebral foramina. This presentation expands on earlier description of the case to include an in-depth discussion of the co-occurring defects, considering whether they likely resulted independently or from a related etiology. Multiple supernumerary teeth tend to occur most often in syndromes, particularly when unilateral. Trauma, tortuosity, and aneurysms are considered as possible causes of the vertebral defects in this individual, but the smooth-walled appearance seems to suggest an aneurysm of the vertebral artery. Both anomalies have been reported in Ehlers–Danlos Syndrome (EDS) Type IV (Melamed et al., 1994; Waldron and Antoine, 2002), a disorder of the connective tissues carried on the COL3A1 gene, which is reported more frequently for West African and African descended populations. EDS is believed to be under diagnosed by clinicians (Castori, 2012) and is rarely considered archaeologically due to diagnostic limitations. We weigh the paleopathological evidence from the case against contemporary evidence of population genetics. Benefits and limitations of using clinical descriptions for diagnoses in the past are discussed.

**Sirianni, Joyce, Jennifer F. Byrnes, and Jennifer K. Odien (University at Buffalo)**

**OSTEOBLASTIC INTRACRANIAL MENINGIOMA EN PLAQUE: A CURIOUS CASE FROM THE ERIE COUNTY POORHOUSE CEMETERY**

The Erie County Poorhouse Cemetery was exhumed during a partial salvage excavation during construction on the South Campus of the University at Buffalo in the summer of 2012. This historic cemetery from Buffalo, NY was in use between the years of 1851-1909. The individuals interred here died on the poorhouse grounds during this time. This excavation yielded 369 individuals for analyses. During the course of skeletal analyses, a female skeleton presented with a suite of traits suggesting that meningioma en plaque may be a possible differential diagnosis. Due to the absence of scorable ageing criteria, this female was given a minimum age of 30 years.

This presentation brings an unusual differential diagnosis challenge to the attention of scholars that has previously not been described in the paleopathology literature. Meningiomas arise from the arachnoid cap cells forming the external membrane of the brain, and are not primarily bone tumors. Intracranial versions of these are not uncommon, and are well recognized within the paleopathology literature (Ortner, 2003). However, meningioma en plaque is a rare type of neoplasm within the clinical literature (Kim et al., 1987), and is nonexistent in the paleopathology literature. The key traits observed on the right frontal bone that lead to this possible diagnosis are endocranial ossified dural “tails”, hyperostosis and thickening of the inner table with hypervascularization of endocranial surface, outer

table sclerotic and compact remodeling with slightly depressed undulating surface texture, and small lytic destruction within outer table reaction.

**Smith, Nicole E. (University of Arkansas) \*\*\***

### **AN ANALYSIS OF POROTIC LESIONS IN MODERN EAST AFRICAN SKELETONS**

Cribriform cervical fossae of the humerus and femur (Allen's fossa) have long been described as morphological variants of the human skeleton. Although the etiology of these features remains under debate, recent research suggests both of these traits, identified as humeral cribra (HC) and femoral cribra (FC), along with cribra orbitalia (CO) form a "cribrous syndrome," indicating malnutrition or anemia in past populations (Miquel-Feucht et al 1999, Djuric et al 2008). To evaluate this etiological hypothesis, this study tests the association of these features to anemia in a modern skeletal collection of 98 individuals from East Africa with known cause of death, including 27 individuals who died of malaria or anemia. High frequencies of CO (53.5%), FC (38.5%), and HC (24.1%) were present. All three features appeared more frequently in anemic individuals, adding some support to the anemia hypothesis. HC and FC were strongly associated to each other ( $p=.000$ ); however, neither associated strongly with CO. Additionally, HC and FC were strongly associated with younger age at death ( $p=.000$  and  $p=.003$  respectively), which CO was not. These findings suggest different and more complex etiological factors contributing to the development of CO versus the postcranial features, contrary to the hypothesized "cribrous syndrome" association. The association of HC and FC with immature age, coupled with their position in areas of high growth rate metaphyses and their higher rates in anemic individuals, adds support to Djuric and coworkers' hypothesis that these postcranial features are developmental defects, with anemia likely a contributing factor.

**Speith, Nivien (Bournemouth University) +++**

### **EXPLORING LIVED IDENTITIES VIA BIOARCHAEOLOGICAL ANALYSIS: LOCAL BIOLOGIES AND SOCIAL IDENTITIES OF THE ALAMANNI**

Historically, the Alamanni, an early-medieval population in the centre of post-Migration Europe, have been characterised as warriors, peasants, and "wives", assigning customary patterns of élite versus non-élite within a common Merovingian and thus kingdom-like configuration of social stratification. The hypothesis of an *open-ranked* society, with social stratification marked by fluidity between social statuses, achieved by individual efforts within society, could never be fully substantiated archaeologically through the analysis of material culture alone.

This paper presents the bioarchaeological analysis of the population of Pleidelsheim, near Stuttgart, in southwest Germany (5<sup>th</sup> - 8<sup>th</sup> c. AD; 266 individuals), discussing a life-course approach combined with investigations of palaeopathological and activity-related markers. The prevalence of patterns of health and physical stress, exposure to risks of trauma, and differences in enthesal changes among different gender and age groups, combined with the analysis of biological indicators such as stature, and notable differences in mortuary evidence, reveal social mechanisms that embrace the concept of "local biologies" (Lock 1998). These point to a strong relationship between individuals and their socio-cultural and geographical environments. The results provide physical evidence for fluid

social inequality by revealing patterns of attaining and maintaining rank within Alamannic society for those buried with grave goods, while indicating a highly active and labour-intensive life for individuals in burials lacking accoutrements.

The data corroborate a previously only ostensibly supported *open-ranked* society and contradict universal interpretations of early-medieval “peasant-warriors” and invisible women, indicating differing active and social identities for males and females in this Alamannic population.

**Stuck, Jennifer (California State University), Sarah Wallace (Ohio State University), Jonathan Bethard (Boston University), Andre Gonciar (Archaeo Tek Canada), and Zsolt Nyaradi (Haaz Rezsó Museum) \*\*\***

### **THE MYSTERIOUS ELDER: A BIOARCHAEOLOGICAL ANALYSIS OF BURIAL 61 AT TELEKFALVA, HARGHITA ROMANIA**

The 2007 excavation of the Telekfalva site in Harghita, Romania divulged a distinctive assemblage consisting of sixty-nine individuals, sixty-seven of which were children. Of the two adults, only one could be connected to the collection of children. Contrasted with the multitude of sub-adults, the identity of this single adult must be considered. With a lack of useable documents, a multi-tiered approach to enriching this burial’s profile information commenced. Using analytical methods including Phenice (1969), Kales et. al (2012), and Boldsen et. al. (2002), this individual was determined to be female, between 50-60 years old and showed signs of multiple age-related degenerative conditions such as probable osteoporosis, degenerative joint disease, and edentuloulism. A thorough pathological analysis confirmed mature age and proposed the likelihood that she received help as her body deteriorated. Then, a social-cultural identity research project was undertaken. By comparing what was already determined about this individual to representative profiles of different social identities of women in medieval Eastern Europe, we now have a better idea who this woman was. She was buried in a Reformist church, so she was not a nun. She was not a noblewoman. Her grave was surrounded by infant burials, implying a connection to the infants. Therefore she was likely a midwife. Further translation or analysis of records may reveal new information. This site casts light on religious attitudes during the Reformation in the region, potential ceremonial lingerings from centuries before, and the value placed upon the community relationship with the dead sub-adults.

**Temple, Daniel H. (University of North Carolina, Wilmington)**

### **BIOARCHAEOLOGICAL EVIDENCE FOR LIFE HISTORY TRADE-OFFS IN RESPONSE TO EARLY LIFE STRESSORS USING INCREMENTAL MICROSTRUCTURES OF ENAMEL**

This study uses linear enamel hypoplasia to test hypotheses regarding the human response to early life stressors. The predictive adaptive response hypothesis argues that humans exposed to early life stressors more effectively mediate future stress events via physiological responses to early environmental cues. The plasticity/constraint hypothesis argues that early life stressors are possible to survive via plasticity in the allocation of energetic resources, but that this plasticity reduces the ability to invest in future maintenance and growth. If the first hypothesis is correct, then no relationship between age-at-first-defect formation, future stress episodes, and mortality will be found. If the second



hypothesis is correct, then there should be significant relationships between age-at-first-defect formation, number of LEH (positive), age-at-death (positive) and LEH periodicity (negative). High resolution impressions of incremental microstructures of enamel were collected from intact teeth dated to the Late/Final Jomon period (ca. 4000-2300 BP). Casts of these impressions were studied under an engineer's measuring microscope. LEH were identified based on depressions in the enamel surface and accentuated perikymata. Age-at-defect formation was estimated based on cuspal enamel formation time and counts of perikymata. All LEH were matched at developmental locales between teeth, and multiple regression analysis was used to evaluate the hypotheses. Significant relationships were found between age-at-first-defect formation, number of LEH (beta = 0.56), and age-at-death (beta = -0.43), and LEH periodicity (beta = -0.29). These results support models of early life history that suggest individuals who survive early stress events inhibit future energetic investments in maintenance and growth.

This work was funded by the Japan Society for the Promotion of Science(#07012) and National Science Foundation (BCS 1044950).

**Thomas, Ariane, and Jaime Ullinger (Quinnipiac University)**

### **LINEAR ENAMEL HYPOPLASIA FREQUENCY AND DURATION IN A PATHOLOGICAL COLLECTION FROM OTTOMAN PERIOD TELL EL-HESI**

Enamel hypoplasias are enamel defects manifesting as pits, furrows, or lines, which have been used to indicate biological stress events that occurred in an individual's early years of life. This type of dental pathology provides health and dietary information of modern and historic populations and can also serve as a resource to define duration of each stress event by examining the number of perikymata within each defect. This project focused on linear enamel hypoplasia (LEH) in the permanent teeth of thirteen individuals from Tell el-Hesi, an Ottoman-period osteological sample of pathological individuals, located in modern-day Israel. LEH defects were recorded on the labial and buccal surfaces of every tooth present in the mandible or maxilla of each individual. Resin models of the teeth were used to observe perikymata counts under a scanning electron microscope. Seven of the thirteen individuals (53.8%) exhibited at least one LEH defect, and of that sample six of the individuals had three or more teeth with LEHs present. Of the seven tooth types that showed evidence of LEHs, canines had the most at 32% (n=31). Duration of event varied by individual, and association with identified pathological conditions will be discussed.

Supported provided by the College of Arts and Sciences, Quinnipiac University.

**Thompson, Joshua, and Daniel H. Temple (University of North Carolina, Wilmington)**

### **EVALUATING THE SENSITIVITY OF SKELETAL GROWTH PARAMETERS TO ENVIRONMENTAL EFFECTS: A CASE STUDY FROM CIS-BAIKAL, EASTERN SIBERIA**

This study explores the relative sensitivity of skeletal growth parameters in two skeletal samples from the Cis-Baikal region of Eastern Siberia. The purpose of the study is to provide a more explicit understanding of how environmental effects, particularly systemic stress and mechanical loading, influence skeletal growth. Humeral length, radial length, femoral length, tibial length, cortical thickness, total bone thickness, medullary area, estimated body mass, and estimated stature are included as

parameters of skeletal growth. Forward selection was used to fit lines to the relationship for each skeletal growth parameter relative to dentally-derived age. The coefficient of variation calculated from the relationship of each growth parameter relative to age was compared between-elements, within-samples using the V\* test statistic. Coefficients of variation were greatest in femoral length, body mass, femoral cortical thickness, and femoral medullary area. A visual assessment of the data suggests that the greatest deviations from the lines fit to the data are found following infancy and during early adolescence for femoral length and body mass, and during adolescence for femoral cortical thickness and medullary width. The results suggest that growth in estimated body mass and femoral length may be most susceptible to environmental perturbations such as infectious disease and dietary insufficiency, while femoral cortical thickness and medullary width are also responsive to mechanical and systemic factors.

**Tilley, Lorna (Australian National University) +++**

### **ACCOMMODATING DIFFERENCE IN THE PREHISTORIC PAST: REVISITING THE CASE OF ROMITO 2 FROM A BIOARCHAEOLOGY OF CARE PERSPECTIVE**

The remains of Romito 2, a male of around 17 years, were recovered from a mortuary context in southern Italy and date to ~11,000BP. Skeletal evidence indicates Romito 2 was born with a chondrodystrophic dwarfism (acromesomelic dysplasia), resulting in upper and lower limb abnormalities limiting potential participation in economic (and possibly social) activities normal for one of his cohort. Cranial anomalies and early childhood developmental delays would also have distinguished him from his peers. In 1987 Frayer et al. first described Romito 2, suggesting that his survival to age at death suggested community tolerance and support. In 1991 Dettwyler vigorously critiqued this conclusion, and in an interview ten years later (Bower 2002) Frayer retracted the original claim of care. This presentation argues that Frayer et al. (1987, 1988) were right in the first place, and that Romito 2's survival reflects community caregiving in the form of 'accommodation of difference'. Romito 2 and his lifeways are revisited from a bioarchaeology of care (Tilley 2012) perspective, using the Index of Care - a recently developed instrument designed to assist bioarchaeological research into health-related care provision. The presentation has two goals: firstly, to demonstrate that there is a valid basis for inferring receipt of care by Romito 2 and that this finding contributes to the understanding of practice in the Italian Epi-Gravettian; and secondly, to illustrate how application of the Index of Care can add value to a bioarchaeology of care analysis.

**Titelbaum, Anne R. (University of Arizona), Bebel Ibarra (Tulane University), and Stephan Naji (PACEA, Bordeaux) +++**

### **MADELUNG'S DEFORMITY AND POSSIBLE DYSCHONDROSTEOSIS: TWO CASES FROM ONE TOMB AT THE LATE INTERMEDIATE PERIOD SITE OF MARCAJIRCA, DEPARTMENT OF ANCASH, PERU**

Madelung's deformity of the wrist is an uncommon growth disturbance affecting the ulnar side of the distal radial epiphysis. Usually bilateral, characteristics include an ulnar tilt of the epiphysis creating a v-shaped articulation for the carpus, a dorsal and radial curvature of the radial shaft, an overall

shortening of the radius, and a posteriorly dislocated distal ulna. Predominantly seen in females, the disorder can occur in both sexes, but is usually more severely expressed in females. While Madelung's deformity can be isolated in its occurrence, co-occurrence with shortened tibiae relative to the femora may suggest dyschondrosteosis (Léri-Weill syndrome), a type of dwarfism characterized by mesomelic shortening.

*Chullpa 26*, one of 35 Late Intermediate Period (ca. AD 1250) comingled tombs at the highland site of Marcajirca, Peru yielded four radii and two ulnae that demonstrate morphologies consistent with Madelung's deformity. The six bones represent the bilateral congenital occurrence of the defect in two adults. The severity of the defect differs between the two pairs, and considering size and robusticity, it is likely that the differences reflect female and male expression of the condition. This deformity was not observed among the other examined adult radii ( $n=197$ ) and ulnae ( $n=186$ ) that were excavated from this and five other tombs (adult MNI=103). Three comparatively short tibiae were also recovered from *Chullpa 26*, which may suggest that these are cases of dyschondrosteosis. In addition to being rarely reported in paleopathology, these cases offer insight into the use of Late Intermediate Period *chullpas* in Ancash.

**Tschinkel, Khrystyne, and Rebecca Gowland (Durham University)**

### **A CONTEXT-LED APPROACH TO DIAGNOSING OSTEOMALACIA IN SKELETAL POPULATIONS: PROBLEMS AND PROSPECTS**

A high prevalence of vitamin D deficiency is thought to have been present in urban populations during England's period of industrialization, based on historical documents and skeletal evidence. However, only severe cases tend to be identified in the skeletal record, particularly for osteomalacia, the adult manifestation of this condition. Consequently, prevalence rates for osteomalacia tend to be low in the palaeopathological record. Severe osteomalacia results in skeletal features including osteopenia in the vertebrae as well as buckling in the pelvis and scapulae (Brickley and Ives 2008). Pseudofractures are the main radiological feature of osteomalacia, although rarely reported. Individuals in initial stages of the disease lack the severe skeletal features necessary for definitive diagnosis; thus osteomalacia is underrepresented in past populations. This paper provides a population-based study of osteomalacia through the analysis of 143 adult individuals from a post-medieval urban site from North Shields, England. A high proportion of individuals exhibited the characteristic skeletal changes associated with rickets and residual-rickets. Assessment of osteomalacia from this site relied on skeletal features such as rib shape, torsion, bending in the lower extremities, and a high fracture rate. In the North Shields collection 13.51% of children and 18.18% of adults were diagnosed with visible characteristics of vitamin D deficiency as well as additional individuals with no visible changes. This research aims to characterize the inconspicuous changes commonly associated with osteomalacia, which may be useful for differential diagnoses and identification of vitamin D deficiency within a population-based study instead of one centered on individual diagnoses.

**Uhl, Elizabeth W. (University of Georgia), Michelle L. Osborn (University of Georgia), and Jeffrey P. Blick (Georgia College and State University)**

### **SPONDYLOSIS IN PRE-COLUMBIAN NEW WORLD AND MODERN DOGS: A COMPARATIVE STUDY**

One hundred and twenty-six pre-Columbian (680-1430 AD) dog skeletons excavated from Weyanoke Old Town, a Native American village site in what is now Virginia, were assessed for signs of spondylosis, a degenerative disease of the spine characterized by proliferation of osteophytes along the ventral aspect of the intervertebral joints. Spondylosis is common in modern dogs and has also been reported in several different wild canid species. The dogs in this study were medium sized, averaging 42 cm tall and weighing 12-13 kgs. Lesions of spondylosis were found in 18 dogs and were scored based upon severity. The affected dogs were identified as mature to older individuals based on the presence of ossified costal cartilage, dental wear and fused growth plates. The incidence of spondylosis in the Pre-Columbian dogs was 14%, which is comparable to the 18% overall incidence reported in modern dogs. However, in contrast to those in modern dogs, the lesions in the pre-Columbian dogs were more localized and less severe. In the Pre-Columbian dogs, spondylosis lesions were confined to the lumbar vertebrae (L1-L7), while in modern dogs lesions were also common in the cervical (C5-C7) and thoracic (T4-T9) vertebrae. Spondylosis in dogs has been correlated with age, but other factors, including biomechanics, weight, and breed also affect its development. The results of this study indicate that while Pre-Columbian and modern dogs have a similar incidence of spondylosis, differences in the distribution and severity of lesions suggest there are differences in pathogenesis.

**Ullinger, Jaime (Quinnipiac University), and Kristen Hartnett (Forensic Anthropology Unit, New York City Office of Chief Medical Examiner) +++**

### **IDENTIFICATION OF TORTICOLLIS IN AN ENSLAVED MAN FROM 18<sup>TH</sup>-CENTURY CONNECTICUT AND ITS SIGNIFICANCE FOR PUBLIC BIOARCHAEOLOGY**

Mr. Fortune was a man enslaved by a bone surgeon in 18<sup>th</sup> century Waterbury, Connecticut. After his death, the doctor turned Mr. Fortune into a teaching skeleton. Abused in life, he was afforded no greater treatment in death. Mr. Fortune was buried in September 2013, but before his entombment, his skeleton was analyzed one last time. Several bony anomalies, including a cervical shift in the vertebrae, a fissure in the basilar portion of the occipital, a cervical rib, and asymmetrical eye orbits, occipital condyles, clavicles, and arms led to a differential diagnosis of torticollis. The implication of this diagnosis goes beyond a paleopathological case study. Facial reconstruction was completed during the osteological study conducted 15 years ago and included in a display of Mr. Fortune's life at the Mattatuck Museum in Waterbury. Knowledge of this condition will affect the way that he should be displayed, and the way in which the public understands Mr. Fortune's life and identity. This highlights the use of biological anthropology in public archaeology and outreach.

**Vang, Natasha (Middle Tennessee State University) \*\*\***

## **AN ARCHAEOLOGICAL CASE OF THE BEATEN COPPER SKULL: A DIFFERENTIAL DIAGNOSIS**

Endocranial convolutions are a normal occurrence in individuals during developmental periods with rapid brain expansion that tend to dissipate with age, and are often limited to the parietal and occipital bones. Current medical literature identifies the copper beaten skull as the presence of diffuse and prominent endocranial convolutions resembling the appearance of a copper surface that has been worked. In clinical cases, endocranial convolutions associated with the beaten copper skull are present on most or all of the cranial vault bones. It is associated with increased intracranial pressure caused by hydrocephalus and craniosynostosis.

A case of the beaten copper skull is identified in a 3 to 5 year old child from the Tipu site in Belize. The endocranial surfaces of most of the vault bones show prominent endocranial convolutions. Analysis of the cranium does not support the presence of hydrocephalus or premature suture closure. Additionally, what is unique regarding this case is the presence of periostitis localized within the endocranial convolutions. Examination of the zygomatics, the sphenoid, and the orbital roof suggests scurvy. Examination of the post-cranial bones and the ectocranial surface shows periostitis suggestive of a systemic infection. Despite the presence of scurvy and a possible systemic infection, the cause of the endocranial periostitis and the copper beaten skull is likely a localized brain infection capable of increasing intracranial pressure, such as meningitis or encephalitis.

**Waldron, Tony (University College of London Institute of Archaeology)**

## **WHERE HAVE ALL THE TUMOURS GONE?**

Where have all the tumours gone? The short answer is, nowhere, they are there but not in the numbers that are obviously anticipated by those who examine human remains. Some years ago I calculated that the prevalence of malignant disease – or at least, that which secondarily affects bone – was likely to be little different from that prevailing at the present day. A case study carried out using the rates derived from an historic population seemed to bear out this supposition. So why are so few tumours reported in the palaeopathological literature? There are two answers to this, one of which has to do with demography and the other, diagnosis. The incidence of malignant disease below the age of sixty is very low, although there are a few blips along the way. After the age of sixty the incidence increases logarithmically and by the age of eighty there will be few individuals who do not have a tumour somewhere even though it may be clinically silent and not be an actual or contributory cause of death. It seems very unlikely that there would have been large numbers of individuals in the past who survived to an age when their chances of acquiring malignant disease were high. And even if they did, diagnosing malignant disease in the skeleton is difficult and it is probable that cases are misdiagnosed; it is certainly probable that more cases would be detected if ‘elderly’ skeletons were routinely x-rayed; this is especially the case for males, where evidence of secondaries from prostatic cancer may not be apparent, or even suspected.

**Walter, Brittany S. (University of South Carolina) \*\*\***

### **DIAGNOSTIC DIFFERENCES OF METASTATIC CARCINOMA AND MULTIPLE MYELOMA IN A BIOARCHAEOLOGICAL CONTEXT**

The accurate diagnosis of skeletal pathologies can contribute information concerning malnutrition, disease prevalence, and overall health, enabling bioarchaeologists to reconstruct a more precise depiction of health patterns in past populations. In bioarchaeology, paleopathological analyses are limited to lesions left behind on bone, making the specific etiology of pathologies difficult to determine. Bone lesions resulting from cancer are exceptionally challenging to diagnose because of the numerous ways in which different types of cancer present on the skeleton. However, by considering the appearance of lesions and the prevalence of lesions on certain skeletal elements, along with contextual information of the individual, it is oftentimes possible to differentiate between types of cancer. This presentation will explore two of the most commonly occurring disorders that cause multiple osteolytic lesions- metastatic carcinoma and multiple myeloma. These conditions present similarly on bone and exhibit a morphological gradient that makes the differential diagnosis between the two particularly difficult. However, this presentation will demonstrate that differentiating between metastatic carcinoma and multiple myeloma is possible when age and sex of the individual are considered in conjunction with a thorough macroscopic and microscopic analysis of the appearance and distribution of lesions on the skeleton.

**Warren, Diane M. (University of Oklahoma)**

### **SKELETAL AND DENTAL PATHOLOGY IN A COMPARATIVE COLLECTION OF WOLVES AND COYOTES**

Animal paleopathology can provide important information about human-animal interactions in the past. However, it is difficult to differentiate skeletal traumas and other pathologies that resulted from interactions with humans from those that did not. Cases in point are the fractured vertebral spinous processes and vertebral body marginal osteophytes often observed in domestic dogs in archaeological assemblages. These pathologies have been interpreted as the result of interactions with humans, for example, burden bearing and/or trauma due to abuse. However, these pathologies are reported in modern dogs and wild canids, and other causes cannot be ruled out. Here, I present skeletal pathology data from a comparative collection of 28 adult coyotes (*Canis latrans*) and 7 adult wolves (*C. lupus* and *C. rufus*) from a natural history museum. The animals were collected from the wild and had minimal contact with humans before death. The aim of this study is to investigate the occurrence of pathology in these animals, particularly pathologies that have been interpreted as the result of human-animal interactions. Results: Among the skeletal pathologies were one wolf with vertebral spinous process fractures, and one wolf and three coyotes with significant marginal osteophytes (i.e., extending 2 mm or more beyond the vertebral body). These observations add to the body of data on human-animal interaction as a factor in canid skeletal pathology. Other notable pathologies in the museum collection include a coyote with heavy, unusual wear on the incisor and canine teeth consistent with obsessive grooming, for example due to skin parasites.

**Wheeler, Sandra, Tosha Dupras, and Lana Williams (University of Central Florida) +++**

### **BROKEN BODY: A CASE OF MULTIPLE SKELETAL FRACTURES IN A JUVENILE FROM ANCIENT EGYPT**

In bioarchaeological investigations, the holistic analysis of patterns of traumatic injury can be used to strengthen inferences distinguishing accidental from intentional injury. Among the remains recovered from Kellis 2, a Romano-Christian cemetery (ca. 100-400 A.D.) in the Dakhleh Oasis, Egypt, a juvenile aged between 10 and 12 years exhibited multiple skeletal fractures, which are unique to this population, both in adults and juveniles, and in the pattern and extent of fractures. The juvenile exhibits a depression fracture on the left parietal, compression fractures on several vertebrae, shearing fractures with plastic deformation of all sacral elements, greenstick fractures on most ribs with complete fractures on the upper ribs, and a complete fracture of the left pubis and ischium, as well as an intertrochanteric fracture on the right femur, complete tibial fractures, complete and greenstick fibular fractures, and a compression fracture with plastic deformation of the right talus. The only fracture with evidence of healing is the well-healed parietal fracture, indicating all other fractures occurred as a single, catastrophic, non-survivable event. A differential diagnosis of the extent and pattern of skeletal fractures suggests an accidental high-velocity impact from landing feet-first (i.e., a fall or jump from a great height) as a likely explanation. Cases such as this provide a basis for identifying possible behaviors and activity patterns within a population that may lead to catastrophic injury, but also provide insight into the local environment and daily experiences of individuals in ways that other means of investigation cannot.

**Willoughby, Jennifer L. (University College London)**

### **METHODOLOGICAL CONSIDERATIONS FOR ANALYZING NEOPLASTIC DISEASE IN JUVENILE ARCHAEOLOGICAL REMAINS**

Despite literary and archaeological evidence that children and adolescents were affected by neoplastic disease in the ancient world, the dearth of surviving examples has resulted in relatively few case studies. Among the existing case studies there has been wide variation in the application of diagnostic methods. A meta-analysis of the diagnostic methods used by bioarchaeologists in previous studies will be presented, in order to compare methodological trends and discuss the associated strengths and limitations, as well as to provide a framework for future discussion and investigation.

In clinical literature, it is evident that juveniles are affected differently by cancer than adults, as children and adolescents are more susceptible certain forms of neoplastic disease. This biological vulnerability must be taken into account when examining cases in the archaeological record. It is important to recognize the differences in prevalence of specific neoplastic diseases between different age groups, and how the presentation and causes of these diseases may vary with age. References to clinical literature and interdisciplinary research are vital in order to create more accurate diagnoses of neoplastic disease, and to understand how juveniles in antiquity were affected.

This paper will discuss methodological trends and contextualize them in an effort to identify the best approach for the study of juvenile neoplastic disease in the past. It will address the special considerations necessary for the study of neoplastic disease in the juvenile subset within an archaeological population, and will also make a case for the standardization of diagnostic methods.

**Woods, Katie N. (University of Nevada, Las Vegas) \*\*\***

### **IDENTIFICATION OF A NEOPLASM FROM COMMINGLED REMAINS**

The goal of this presentation is to discuss a distinctive neoplasm that was noted in several adult skeletal elements from a prehistoric commingled assemblage of unknown origin housed at the University of Nevada, Las Vegas. Overall morphology is indicative of a neoplasm and radiological analysis indicates that the growth does not have the spicule appearance of periostitis nor has the abnormality extended into the cortex. The neoplasm may be a sarcoma or a chondroma. Bone formation occurs as a layer over the bone and is located on the proximal shaft of a femur, on the tibial tuberosity of a tibia, in multiple locations on a scapula and on the anterior portion of an atlas. Presence in multiple locations may indicate a malignant tumor, or may be indicative of a multicentric neoplasm. Externally, the neoplasm resembles a cartilaginous exostosis, but lack of cortex involvement precludes this diagnosis. This also eliminates the possibility of hereditary multiple exostoses which would have fit with the multiple locations. Differentiation from the bony cortex is more common in neoplasms related to the periosteum. This neoplasm may be related to the inner layer of the periosteum and thus be periosteal in nature or may be associated with the outer layer and parosteal. Due to the rarity of these types of neoplasms and the distribution across elements, it can be assumed that these represent one individual in this commingled assemblage

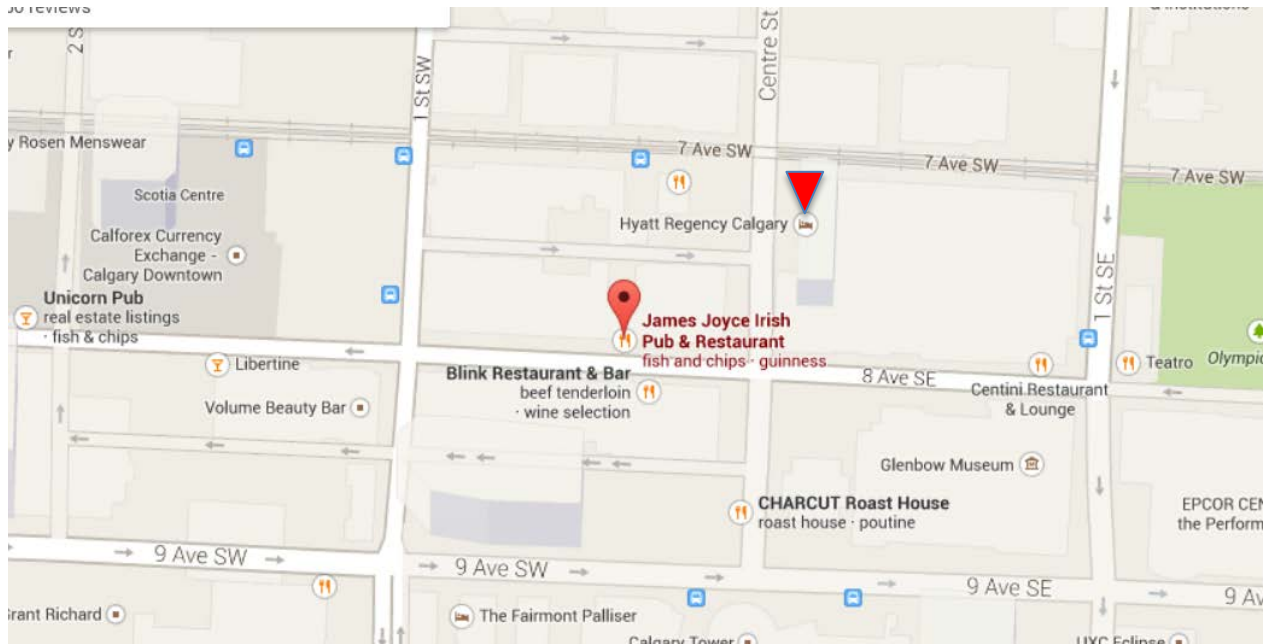
**Zarenko, Kristina M. (California State University) \*\*\***

### **HEALTH AND STRESS AT THE TURN OF THE CENTURY: A BIOARCHAEOLOGICAL ANALYSIS OF SKELETAL STRESS IN THE TERRY COLLECTION**

The period of time spanning between the late 19<sup>th</sup> and early 20<sup>th</sup> centuries is one of dynamic demographic movement and social change. The existence and abolishment of slavery, the American Civil War, and the Reconstruction era following the war created turmoil and change during the nineteenth century. The turn of the century brought the population movements of the Great Migration and the Great Depression. The aim of this presentation is to relate the effects of these social conditions to individuals that lived in their midst. Data on skeletal indicators of stress and dental health were collected from 112 individuals contained in the Terry Collection. Individuals were divided by sex and ancestry into four categories then randomly sampled to create the research population. Skeletal stress is interpreted through observations of cribra orbitalia, porotic hyperostosis, rickets, and periostitis. Dental health is interpreted through an analysis of caries, antemortem tooth loss, and enamel hypoplasia. Preliminary results for both pathology categories suggest a difference in association between their indicators and sex and ancestry. The frequency of teeth with carious lesions is higher in individuals with African ancestry over individuals with European ancestry. Chi-square tests indicate a relationship between the presence of enamel hypoplasias and ancestry in both males and females. Rickets and periostitis are evident at a higher frequency in males than females. These results suggest ancestry plays a larger role in determining indicators of dental health whereas sex plays a larger role in determining indicators of skeletal stress than other variables tested.



## Location of James Joyce Irish Pub and Eatery (Let's Do Lunch)



\*\*\* - Entrant for the Cockburn Student Prize

+++ - Entrant for the Early Career Prize