



PALEOPATHOLOGY ASSOCIATION

SCIENTIFIC PROGRAM

43rd Annual North American Meeting
ATLANTA
April, 2016

PALEOPATHOLOGY ASSOCIATION
43rd Annual North American Meeting
ATLANTA
April 12-13, 2016

SCIENTIFIC PROGRAM

Monday, April 11

Pre-Meeting Excursion (1:00pm – 6.00pm) *Meet at Atrium Level*
Registration (6:00pm – 9:00pm) *Atrium Level*

Tuesday, April 12

Registration (7:45am – 5:00pm) *Atrium Level*

Student Action Committee Raffle (7:45am – 5:00pm)

Morning Session (8:30 – 11:30am):

Workshop I. *A 601*

8:30 – 11:00 **Animal Bones Tell Tales Too! Bone Lesions in Modern and Archaeological Specimens.**
Organized by Betsy Uhl & Betsy Reitz

Workshop II. *A 602*

8:30 – 11:00 **Using the Media to Your Advantage in Paleopathology.** Organized by Piers Mitchell,
with Margaret Clegg & Kristina Killgrove

Lunch (11:30am - 1:30pm)

Afternoon Session (1:30 – 5:00pm)

Podium Presentations *Imperial Ballroom A*

Part I (1:30 – 3:00pm) **Chair: Megan Brickley**

- 1:30 DIFFERENTIAL DIAGNOSIS OF PROPTOSIS. Della Collins Cook
1:45 ORAL MICROBIOMES & THE HYGIENE HYPOTHESIS. Molly Zuckerman, Jonathan Belanich & Heather Jordan +++++
2:00 CO-OCCURRENCE OF CLEFT PALATE AND OSTEOMALACIA IN A MEDIEVAL SKELETON FROM YORKSHIRE. Jo Buckberry
2:15 OSTEOIMMUNOLOGY: A NEW FRONTIER IN PALEOPATHOLOGY. Fabian Crespo, Chris Klaes, Mawadda Alnaeeli & Sharon DeWitte
2:30 NOT ALL HOLES ARE THE SAME. Bruno M Magalhães, Célia Lopes & Ana Luísa Santos ***
2:45 BIOLOGICAL OR MINERAL? EVALUATING A PURPORTED SCHISTOSOME EGG FROM SYRIA. Karl Reinhard, Luciana Sianto & Adauto Araújo

3:00 – 3:30 Break

Part II (3:30 – 4.45pm) Chair: Anne Austin

- 3:30 ORAL PATHOLOGICAL CONDITIONS AT BAKING POT, BELIZE. Amanda Harvey, Julie Hoggarth & Jaime Awe ***
- 3:45 EFFECTS OF BIOLOGICAL STRESS ON LONG BONE SHAPE DURING ONTOGENY. Sarah Stark. Simon Mays, Jo Sofaer & Sonia Zakrzewski ***
- 4:00 EVALUATING HUMAN REMAINS FOR SYPHILIS. Michelle Blyth & Frank Ruehli
- 4:15 PATTERNS OF OSTEOARTHRITIS: PETE KLUNK MOUNDS. Olof Olafardottir ***
- 4:30 POSSIBLE SCURVY IN PRISONERS FROM OLD QUEBEC CANADA: RE-EVALUATION OF EVIDENCE IN ADULT SKELETAL REMAINS. Megan Brickley, Annabelle Schattmann, Joelle Ingram & Jerome Cybulski

Student Action Committee Events (5:00 – 6:30pm) A 708

5:00 – 5:45 **Student Group Discussion Panel. Chair: Jessica Walker**
Reconciling Health and Stress

Panelists: Haagen Klaus (George Mason University), Laurie Reitsema (The University of Georgia, Athens), and Gwen Robbins Schug (Appalachian State University)

5:45 – 6:30 **Student Group Meeting. Chair: Amanda R. Harvey**

Association Business Meeting and Dinner (6:45 – 10:00pm) Imperial Ballroom B
Cash bar, followed by buffet

Wednesday, April 13

Registration (8:00 – noon)

Student Group Raffle (8:00am – 5:00pm)

Morning Session (8:00 – noon) A 601/A 602

SYMPOSIUM. The Bioarchaeology and Paleopathology of Feasts and Famines: Foregrounding the Interaction between Humans and Their Environment. Organized by Gillian Crane-Kramer and Kristina Killgrove.

Part I (8:00-9:20am) Chair: Gillian Crane-Kramer

- 8:00 INTRODUCTION. Gillian Crane-Kramer & Kristina Killgrove.
- 8:05 CAN DENTAL WEAR IN CHILDREN BE USED AS AN INDEX OF THE AMOUNT OF FOOD CONSUMED? Simon Mays
- 8:20 PATTERNS OF PHYSIOLOGICAL STRESS AMONG VICTIMS OF MEDIEVAL CRISIS MORTALITY. Samantha Yaussy & Sharon DeWitte ***
- 8:35 EXPLORING PAST DIET FROM THE ANALYSIS OF ANCIENT INTESTINAL PARASITES. Piers Mitchell

- 8:50 DIETARY RECONSTRUCTION AND DOMESTICATION: AN EXAMINATION OF SHEEP TEETH FROM THE NEOLITHIC SITE OF GRITILLE (TURKEY). Melissa Zolnierz
- 9:05 BETTER LIVING THROUGH CLIMATE CHANGE? IMPROVEMENTS IN HEALTH WITH PASTORALIST ADAPTATION TO LATE-HOLOCENE DRYING IN WESTERN CHINA. Elizabeth Berger & Hui Wang

9:20 – 10:35 Break & Poster Session I *Atrium Ballroom A*

Including POSTER SYMPOSIUM: Paleopathology in the Hamann-Todd Osteological Collection

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

Part II (10:35 – 12 noon) Chair: Kristina Killgrove

Symposium. Bioarchaeology and Paleopathology of Feasts and Famines (continued)

- 10:35 COLONIAL-INDIGENE INTERACTION IN ANCIENT NUBIA: AN INTEGRATIVE ANALYSIS OF DIET, HEALTH, AND THE MATERIAL RECORD. Sarah Schrader, Michele Buzon & Stuart Tyson Smith
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- 10:50 IDENTIFYING CHICHA: A PALEOPATHOLOGICAL INVESTIGATION OF MAIZE BEER CONSUMPTION. Sara Juengst & Celeste Marie Gagnon +++
- 11:05 SCURVY AT THE AGRICULTURAL TRANSITION IN THE ATACAMA DESERT, NORTHERN CHILE (3600-3200 BP): AN INVESTIGATION OF MATERNAL-FETAL TRANSFERENCE OF VITAMIN C DEFICIENCY IN PALEOPATHOLOGY. Anne Marie Sohler-Snoddy, Siân Halcrow, Hallie Buckley, Vivien Standen & Bernardo Arriaza ***
- 11:20 KEEPING UP WITH THE CAHOKIANS: INCREASED MAIZE ADOPTION MAY BE RELATED TO FEASTING. Charity Upson-Taboas ***
- 11:35 DISCUSSION. Gillian Crane-Kramer & Kristina Killgrove
- 11:50 **Paleopathology in the Hamann-Todd Osteological Collection POSTER SYMPOSIUM** DISCUSSION. Lyman Jellema

12:00 – 1:55 Lunch – Let’s Do Lunch: Sweet Georgia’s Juke Joint

The restaurant has a business casual dress code. “Sweet Georgia’s Juke Joint definition of business casual is dressing professionally, looking relaxed yet neat and pulled together. For ladies, business casual comprises of suits, collared shirts, knee-length skirts, tailored pants and/or dresses. For gentlemen, a combination of a collared shirt, which can range from a tennis/polo shirt or a button down, and dress pants or trousers, such as khakis, all tucked away and made neat with a belt or blazer, is idyllic. Jeans are permitted as long as they are in good condition and fit properly.

The following are not permitted: CUT OFF PANTS, JEAN SHORTS, TANK TOPS OR T-SHIRTS WITH INAPPROPRIATE LOGOS OR LANGUAGE, HATS, ATHLETIC ATTIRE, FLIP FLOPS, WORK BOOTS, and EXCESSIVE EXPOSURE OF SKIN OR UNDERGARMENTS.”

Student Group Silent Auction (2:00 – 5:00pm)

Afternoon Session I (2:00 – 5:00pm)

*** - Entrant for the Cockburn Student Prize

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+++ - Entrant for the Early Career Prize

Podium Presentations *A 601/A 602*

Part I (2:00 – 3:00) **Chair: Lesley Gregoricka**

- 2:00 THE COST OF WAR: LOOKING AT THE EFFECTS OF WARFARE ON NON-COMBATANTS. Petra Banks & Molly K Zuckerman ****
- 2:15 TRAUMA & VIOLENCE IN HISTORIC & MODERN SAMPLES. Larissa Collier
- 2:30 COMMUNITY DIFFERENCES? FRACTURE ANALYSIS IN MEDIEVAL POULTON, NORTON & GLOUCESTER. Carla L Burrell, Silvia Gonzalez, Lynn Smith, Michael M Emery, Joel D Irish & Matteo Borrini
- 2:45 SOCIAL STATUS OF THE DISEASED & DISABLED IN CULIMNE, POLAND. Magdalena Matczak & Tomasz Kozłowski +++

3:00 – 4:00 **Break & Poster Session II** *Atrium Ballroom A*

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

Part II (4:00 – 5:00pm) *A 601/A 602* **Chair: Jaime Ullinger**

Special Session: Local Bioarchaeology & Paleopathology

- 4:00 WELLNESS AND LIFESTYLE IN THE GEORGIA BIGHT, 1000 BC – AD 1700: REGIONAL CONTEXT, GLOBAL IMPLICATIONS. Clark Spencer Larsen
- 4:45 Closing Remarks and Announcements, Award of Cockburn Student Prize and Early Career Prize, Announcement of SG Raffle and Silent Auction Winners. Piers Mitchell

COLLECTIONS POSTER SYMPOSIUM: organised by Charity UPSON-TABOAS. Authors of these posters should be present at the first poster session (Wednesday, April 13, **9:20 – 10:35am**)

Discussant: **Lyman JELLEMA**

- A. Analyzing the Patterns of Health, Trauma, and Disease In 19th Century Chinese Salmon Cannery Workers in Kodiak Island, AK** Andreana Cunningham, David Hunt & Rhonda Coolidge

- B. The Dissected Destitute: Case Studies From The Hamann-Todd and Terry Anatomical Collections** Carlina De La Cova
- C. Health and the Huddled Masses: An Analysis of Immigrant and Euro-American Skeletal Health in 19th Century New York City** Kristen E Pearlstein
- D. An Expanded and Redefined Analysis of Diabetes in Two Known Historical Human Skeletal Collections** Charity F Upson-Taboas ***

POSTER PRESENTATIONS: Chaired by Emmalea Gomberg & Jennifer Willoughby

(Number refers to poster board number) An author of the poster should be present at the poster during their assigned poster session. Authors of **even** numbered posters should be present at the first poster session (Wednesday, April 13, **9:20 – 10:35am**), and those of **odd** numbers posters should be present at the second session (Wednesday, April 13, **3:00 – 4:00pm**).

1. **A 14TH C. BYZANTINE WARRIOR WITH *FRACTURA MANDIBULAE*.** P Anagnostis AGELARAKIS
2. **A DIFFERENTIAL DIAGNOSIS OF SPINAL PATHOLOGY OF THE GANGI MUMMIES.** Aniello CATAPANO, Jennifer CURRY, Ramon GONZALEZ, Gerald CONLOGUE, Mark VINER, Dario PIOMBINO-MASCALI & Ronald BECKETT
3. **DOWN BUT NOT OUT: A PROBABLE CASE OF CONDENITAL HIP DYSPLASIA IN A LATE PREHISTORIC NATIVE AMERICAN COMMUNITY.** Erica AUSEL
4. **THE IMPACT OF INDUSTRIALISATION ON LONDON HEALTH.** Jelena BEKVALAC, Gaynor WESTERN & Mark FARMER
5. **QUANTIFYING OBSERVER ERROR IN HISTOMORPHOMETRIC DATA COLLECTION: IMPLICATIONS FOR STUDYING BONE MASS IN PAST POPULATIONS.** Amy BERESHEIM & Klara KOMZA ***
6. **DETECTION OF TETRACYCLINE IN NEW KINGDOM NUBIAN REMAINS FROM TOMBOS.** Abigail BREIDENSTEIN, Michele BUZON & Maureen DEVLIN
7. **YOUR GUESS IS AS GOOD AS MINE: DIFFERENTIAL DIAGNOSIS OF ONE DISARTICULATED SKULL.** Alyson CAINE
8. **INVERTED SCHNEIDERIAN PAPILOMA: A REPORT OF A RARELY CONSIDERED SINONASAL NEOPLASM.** Gina M A CARROLL, Andrea WATERS-RIST & Sarah A INSKIP
9. **3D RECONSTRUCTION OF AN ACHONDROPLASTIC SKELETON FROM PREHISTORIC CENTRAL CALIFORNIA.** Natasha A CASTELLON-HINKLE, Dana E BECKER, Emily FIELDS, Thea M HANSON, Rebecca SJABBOUR & Gary D RICHARDS ***
10. **DIAGNOSTIC CRITERIA FOR ANATOMICAL CHANGES LEADING TO ACETABULAR DYSPLASIA.** Lenka CERVENKOVA, Zuzana SCHIEROVA & Jakub LIKOVSKY
11. **DIAGNOSING DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS (DISH) BEFORE VERTEBRAL ANKYLOSIS.** Laura CASTELLS NAVARRO & Jo BUCKBERRY ***
12. **PALEOPATHOLOGY AT JEBEL TOMAT, SUDAN.** Jason J CROSBY
13. **DEVELOPMENTAL DEFECTS OF THE TEETH AND AXIAL SKELETON IN A PREHISTORIC POPULATION FROM THE SOUTH COAST OF BRITISH COLUMBIA.** A Joanne CURTIN

14. **SPINAL HEALTH AT TELL EL-AMARNA** Heidi S DAVIS
15. **THE USE OF DUAL IMAGING STATIONS FOR INCREASED PRODUCTIVITY FOR LARGE SCALE RADIOGRAPHIC EXAMINATION OF MUMMIFIED REMAINS.** Annamaria DICESARE, Dario PIOMBINO-MASCALI, Ron BECKETT, Mark VINER, Gerald CONLOGUE, Aniello CATAPANO, Jennifer CURRY & Katherine J HARPER-BECKETT
16. **DIFFUSE ENDOSTEAL BONE FORMATION RESULTING FROM METASTATIC BREAST CANCER: A HISTOLOGICAL CASE STUDY.** Victoria M DOMINGUEZ, Timothy P GOCHA & Amanda M AGNEW
17. **DENTAL DISEASE OF THE TONGVA PEOPLE.** Sarah DRESSER & Alyson CAINE
18. **PHYSICAL IMPAIRMENT AND DISEASE ON TUDOR WARSHIP *MARY ROSE* VERSUS OSLO HOUSE OF CORRECTIONS.** Rose DREW & Gwyn MADDEN +++
19. **HIDING IN PLAIN VIEW: NONLETHAL VIOLENCE IN THE LAST 100 YEARS AT MESA VERDE (AD 1200-1300).** Elizabeth DUFFY & Debra MARTIN ***
20. **PERIOSTEAL LESIONS AS MARKER FOR SYSTEMIC INFLAMMATORY SHIFTS IN TUBERCULOSIS AND LEPROSY INFECTIONS: AN *IN VITRO* ANALYSIS.** Megan DUNCANSON, Chris KLAES, Sharon DEWITTE & Fabian CRESPO
21. ~~**PEAKS AND TROUGHS: LIFE HISTORY APPROACHES TO DIET, STRESS, AND CARE IN THE YOUNG INDIVIDUALS OF THE ST. MARY MAGDALEN LEPROSY HOSPITAL (WINCHESTER, UK).**~~ Kori FILIPEK-OGDEN, Charlotte ROBERTS, Janet MONTGOMERY, Rebecca GOWLAND, Julia BEAUMONT & Katie TUCKER ***
22. **HEALTH AND DIET IN A NON-ELITE SAMPLE FROM ANCIENT CORINTH.** Sandra GARVIE-LOK, Sherry C FOX & Steven J FRIESEN
23. **A NEW METHOD TO ASSESS BONE LOSS IN RADIOGRAPHS OF FRAGMENTARY SECOND METACARPALS.** Rebecca J GILMOUR, Megan BRICKLEY, Erik JURRIAANS & Tracy L PROWSE ***
24. **HEALTH OF THE TIPU MAYA: A REEVALUATION OF POROTIC HYPEROSTOSIS, CRIBRA ORBITALIA, AND SCURVY.** Emmalea GOMBERG
25. **DENTAL DISEASES OF EARLY FIRST MILLENNIUM BC MOUNTED PASTORALISTS IN THE KUNLUN MOUNTAINS, CHINA.** Julia GRESKY, Laura SCHWARZ, Tyede Helen SCHMIDT-SCHULTZ & Michael SCHULTZ
26. **INVESTIGATING THE RELATIONSHIP BETWEEN TUBERCULOSIS, LEPROSY, AND MIGRATION USING STABLE ISOTOPE ANALYSIS: A PILOT STUDY.** Amanda GROFF & Tosha DUPRAS
27. ~~**DIFFERENTIAL DIAGNOSIS OF DISEASE FROM THE RIMAC VALLEY, PERU.**~~ Jazlynn HALL & Melissa S MURPHY ***

28. **A DIFFERENTIAL DIAGNOSIS OF A FORMATIVE PERIOD MANDIBLE.** Amanda R HARVEY, Kirk SCHMITZ, Christopher VON NAGY, Eliseo PADILLA-GUTIÉRREZ, Paul SCHMIDT-SCHOENBERG & Mary POHL ***
29. **AN EURASIAN AMAZON ON HORSEBACK: IDENTIFICATION OF A FEMALE ARCHER VIA ARCHAEOLOGICAL AND PALEOPATHOLOGICAL APPROACHES.** Mauricio HERNANDEZ, Hong ZHU & Dong WEI +++
30. **DIFFERENTIAL DIAGNOSIS OF CALCIFIED LARYNGEAL CARTILAGE.** Tina JAKOB & Joe W WALSER III
31. **FETAL DEVELOPMENT IN A SET OF TWINS FROM TELL EL-HESI: A COMPARATIVE MORPHOMETRIC AND BIOCHEMICAL ANALYSIS.** Amel LANGSTON, Paige FERRERI, Brittney HIGHLAND, Jaime ULLINGER & Lesley GREGORICKA ***
32. **NON-MASTICATORY DENTAL WEAR IN THE MIDDLE WOODLAND COMPONENT OF PETE KLUNK MOUNDS.** Savannah LEACH & Amanda ROLLINS ***
33. **NEW BONE FORMATION ON THE VISCERAL SURFACES OF THE RIBS IN TWO ROMAN PERIOD SKELETAL SAMPLES.** Laura LOCKAU & Luca BONDIOLI ***
34. **DIFFERENTIAL DIAGNOSIS BY 3D PRINT.** Niels LYNNERUP, Alberte A LUNDQUIST & Chiara VILLA
35. **A CRACK IN THE LITTLE VINEGAR CUP: CASE OF *OS ACETABULI* WITHIN THE ROMAN PERIOD (2ND TO 3RD C. CE) POPULATION OF OYMAAĞAÇ, NORTHERN TURKEY.** Kathryn E MARKLEIN & Madelyn GREEN ***
36. **AN INVESTIGATION OF ELEMENTAL BIOGENIC UPTAKE: PORTABLE X-RAY FLUORESCENCE AS A METHOD OF OSTEOLOGICAL ANALYSIS.** Molly MARTELL & Sanchita BALACHANDRAN
37. **AN UNUSUAL EROSIIVE ARTHROPATHY FROM MEDIAEVAL ENGLAND.** Simon MAYS, Iain WATT & Louise LOE
38. **EXAMINING ROBUSTICITY DURING THE INDUSTRIAL REVOLUTION IN COPENHAGEN.** Amanda McCAFFREY
39. **CONGENITAL RADIO-ULNAR SYNOSTOSIS AT THE DEARMOND SITE (40RE12) IN EAST TENNESSEE.** Donna McCARTHY
40. **PREMATURE SUTURAL FUSION AND CRANIAL SHAPE CHANGE: EVIDENCE FROM THE PREHISTORIC RECORD.** Alexandra M McGOUGH, Laura E CIRILLO, Julie DING, Rebecca S JABBOUR & Gary D RICHARDS ***
41. **PALEOPATHOLOGIC-ANTHROPOLOGICAL INVESTIGATIONS IN THE KINGS' VALLEY TOMB KV40 (WESTERN THEBES, UPPER EGYPT).** Sabrina MEYER, Nakita FRATER, Roger SEILER, Susanne BICKEL & Frank RÜHLI

42. **LIFE IN THE CARIBBEAN: AN OVERVIEW OF SKELETAL PATHOLOGY FROM THE RED HOUSE ARCHAEOLOGICAL SITE, PORT OF SPAIN, TRINIDAD.** Patrisha L MEYERS, John J SCHULTZ, J Marla TOYNE & Basil REID ***
43. **THE (LACK OF) ASSOCIATION BETWEEN CRIBRA ORBITALIA AND POROTIC HYPEROSTOSIS: WHEN POROSITY IS NOT ENOUGH.** Hannah MILLER & Cynthia A WILCZAK
44. **PALAEOPATHOLOGICAL ANALYSIS OF THE SUBADULT POPULATION OF THE ALT-IMPERIAL ROMAN SITE OF TARRACO (TARRAGONA, SPAIN).** Joanna MOORE & Laura CASTELLS NAVARRO
45. ***CRYPTOSPORIDIUM PARVUM* AMONG COPROLITES FROM LA CUEVA DE LOS MUERTOS CHIQUITOS, RIO ZAPE VALLEY, DURANGO, MEXICO.** Johnica J MORROW & Karl J REINHARD ***
46. **OUCH! OSSEOUS INDICATORS OF TRAUMATIC SHOULDER STRESS IN PREHISTORIC TENNESSEE.** Deborah NEIDICH
47. **THE DECLINE IN ORAL HEALTH FROM MEDIEVAL TO MODERN TIMES IN BASQUES AND OTHER EUROPEAN POPULATIONS.** Amanda J O'NEILL & G Richard SCOTT ***
48. **TRAUMA AND DISEASE IN THE FORT ANCIENT WORLD: AN ANALYSIS OF THE HARDIN VILLAGE SITE, KENTUCKY.** Amber E OSTERHOLT
49. **IMPACT OF DENS IN DENTE ON TOOTH WEAR IN THE MIDDLE AND LATE ARCHAIC.** Rose L PERASH & Christopher W SCHMIDT ***
50. **A SKELETON WITH PROBABLE LEPROSY FROM A POST-MEDIEVAL CEMETERY IN RIGA, LATVIA.** Elina PETERSONE-GORDINA, Charlotte ROBERTS & Guntis GERHARDS ***
51. **PALEOPATHOLOGICAL ASSESSMENT OF A LATE ARCHAIC GROUP GRAVE.** Robin QUATAERT, Fatma Basim ZALZALA, Arysa GONZALEZ & Jessica GREGORY
52. **AN EXECUTED WITCH FROM LUNDENWIC?** Rebecca REDFERN, Madeleine MANT & Jo BUCKBERRY
53. **COPROLITE ANALYSIS: THE MISSING DATA SET FOR UNDERSTANDING ANCESTRAL PUEBLOAN POROTIC HYPEROSTOSIS.** Karl REINHARD
54. **ORAL PATHOLOGY AND DENTAL WEAR IN DISTINCT BURIAL COMPONENTS AT KOSTER MOUNDS.** Lita SACKS ***
55. **RETROSPECTIVE DIAGNOSIS OF HALLUS VALGUS IN 19th-20th CENTURY PORTUGUESE INDIVIDUALS.** Ana Luisa SANTOS & Vanessa CAMPANACHO
56. **AURICULAR EXOSTOSES IN ROMAN INDIVIDUALS FROM OSSONOBA (PORTUGAL): AN INTERSECTION BETWEEN THE CLINIC AND PALEOPATHOLOGY.** Ana Luisa SANTOS, Hélder FERNANDES, Ana GONÇALVES, João LAFFONT, Daniela JARDIM Carlos RIBEIRO & António DIOGO PAIVA

57. **INTRAPELVIC HOLLOW CALCIFIED MASS IN A MEDIEVAL ADULT FEMALE (PRÁDENA DEL RINCÓN, MADRID, SPAIN).** Ana Luisa SANTOS, J HERRERÍN LÓPEZ, Natasa SARKIC, Alvaro M. MONGE CALLEJA, Wilson D T ANTUNES & António Pedro ALVES DE MATOS
58. **MOVING BEYOND MIGRATION: USING BIOGEOCHEMICAL DATA FROM A BRONZE AGE SKELETON FOR DIFFERENTIAL DIAGNOSIS OF A PROGRESSIVE NEUROMUSCULAR DISORDER.** Alecia SCHRENK, Lesley A GREGORICKA, Debra L MARTIN & Daniel T POTTS
59. **ANALYSIS OF FRAILITY IN THE LOWER ILLINOIS VALLEY DURING THE TRANSITION TO AGRICULTURE THROUGH PERIOSTEAL NEW BONE FORMATION.** Megan SCHWALENBERG
60. **ORAL HEALTH AND DIET AT THE LATE POSTCLASSIC MAYA CAPITAL OF MAYAPAN.** Stanley SERAFIN & Carlos PERAZA LOPE
61. **TOXOCARA (ASCARIDIDAE) EGGS IN A FRANCISCAN FROM PORTUGAL (XVII-XVIII CENTURY): CASE REPORT.** Luciana SIANTO, Sérgio AM CHAVES, Nathalie ANTUNES-FERREIRA & Ana RM SILVA
62. **ROUNDWORM EGGS IN A MEDIEVAL SKELETON FROM ABRANTES CASTLE, PORTUGAL.** Luciana SIANTO, Vítor MATOS, Davide DELFINO, Filomena GASPAS & Gustavo PORTOCARRERO
63. **MACROSCOPIC AND RADIOLOGIC EVIDENCE OF PATHOLOGY OF SKELETONS FROM TELL EL-HESI.** Daniella TARQUINIO, Jaime ULLINGER, Gerald CONLOGUE & Ramon GONZALEZ ***
64. **DIPHYLLOBOTHRIUM PACIFICUM OVERDISPERSION IN ANDEAN ARCHAEOLOGY: BREAKING THE BARRIER BETWEEN PARASITOLOGY AND ARCHAEOPARASITOLOGY.** Isabel TEIXEIRA-SANTOS, William AVERY & Karl REINHARD ***
65. **VARIATION IN THE STYLOID PROCESS OF THE THIRD METACARPAL IN HUMANS: EXPRESSION, FREQUENCY, AND PATHOLOGY.** Josh THOMPSON
66. **SPONDYLOLYSIS IN POPULATIONS FROM ANCIENT NUBIA DURING THE MEROITIC TO CHRISTIAN PERIODS.** Samantha TIPPER-BOOTH, Charlotte ROBERTS & Penelope WILSON ***
67. **TRAUMATIC INJURY OR INFECTIOUS DISEASE? DIFFERENTIAL DIAGNOSIS OF A DEFORMED SUBADULT SCAPULA FROM A LATE INTERMEDIATE HIGHLAND TOMB FROM MARCAJIRCA, DEPARTMENT OF ANCASH, PERU.** Anne R TITELBAUM & Bebel IBARRA
68. **PRELIMINARY EVIDENCE FOR CHACHAPOYA DIET AND MOBILITY AT KUELAP FROM CARBON, NITROGEN, AND OXYGEN STABLE ISOTOPES.** J Marla TOYNE, Luis Alfredo NARVÁEZ VARGAS, Armando ANZELLINI & Vu TRAN
69. **INVESTIGATING SOCIAL VARIABILITY IN DENTAL DISEASE AT KUELAP IN PRE-COLUMBIAN CHACHAPOYAS, PERU.** Vu TRAN & J Marla TOYNE ***

70. **PATHOLOGICAL TRENDS IN SLAVIC MIGRANTS FROM THE JUCU DE SUS NECROPOLIS (TRANSYLVANIA, ROMANIA).** Katie TUCKER, Kori FILIPEK-OGDEN, Ioan STANCIU, Kathryn HUNT, Jordan SNYDER, Kayla CROWDER, Megan BEREZA, Megan OLIVERSON & Khrystyne TSCHINKEL
71. **THE EFFECT OF BURNING: HEAT-RELATED FRACTURES IN BURNED BONE.** Alexis VARVARES
72. **G6PD DEFICIENCY DETECTION METHOD IN ARCHAEOLOGICAL SAMPLES.** Claudia VIGANÓ, Gülfirde AKGÜL, Frank J RÜHLI & Abigail BOUWMAN
73. **CO-MORBIDITY OF CONGENITAL MENINGOCELE AND SYSTEMIC FUNGAL INFECTION: A CASE STUDY FROM LATE PREHISTORIC NORTH AMERICA.** Robyn WAKEFIELD-MURPHY ***
74. **AN INVESTIGATION OF SCHMORL'S NODES IN INSTITUTIONALIZED INDIVIDUALS.** Sara WALLACE
75. **THE VIABILITY OF USING 3D SCANNING IN THE STUDY OF DENTAL PATHOLOGIES AND ENAMEL DEFECTS IN BIOARCHAEOLOGY.** Teresa V WILSON +++
76. **BIOARCHAEOLOGICAL ANALYSIS OF CARE PROVISION IN A NINETEENTH CENTURY HOSPITAL IN CENTRAL KENTUCKY.** Heather WORNE +++
77. **A SUSPECTED DIAGNOSIS OF SKULL METASTASES ON THE HUMAN REMAINS FROM SHIYANZI, A CEMETERY OF HAN DYNASTY IN NORTH CHINA.** Qun ZHANG, Zhichao SUN, Ningning LIANG, Xiaofang GAO & Quanchao ZHANG



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Abstracts for the **PODIUM PRESENTATIONS** (in presenting order)

Della Collins COOK (Indiana University, USA)

DIFFERENTIAL DIAGNOSIS OF PROPTOSIS.

James Ford's 1936 excavations at Allen Place, Natchitoches Parrish, LA, produced 28 fragmentary skeletons. An elderly probable male is noteworthy for a neoplastic lesion of the roof of the right orbit exhibiting Codman's triangle. The orbital plate is thinned and shows several perforations. The soft tissue lesion traveled through the inferior orbital fissure to the base of the lateral pterygoid process. The size of the soft tissue mass suggests proptosis. There is endocranial new bone formation at vertex and on the posterior portion of the lesser wing of sphenoid. The remainder of the cranial base is poorly preserved. There is no evidence for disruption of mastication.

Differential diagnosis of soft tissue lesions in bones is always difficult. In this case, mucocele, cellulitis, Wegener's granulomatosis of eye, septic cavernous sinus thrombosis, orbital lymphoma, orbital fibrous tumor, neurofibroma, Schwannoma, glioma, and hemangioma must be considered. Codman's triangle suggests a rapidly progressing lesion. Proptosis has a high likelihood of effects on social identity.

Molly K ZUCKERMAN, Jonathan BELANICH & Heather JORDAN (Mississippi State University, USA)

ORAL MICROBIOMES AND THE HYGIENE HYPOTHESIS: WHAT CAN HUMAN DENTAL CALCULUS TELL US ABOUT THE HISTORY OF CHRONIC INFLAMMATORY DISORDERS AND THE HUMAN IMMUNE SYSTEM? +++

The hygiene hypothesis proposes that within high income developed nations, increasingly widespread lack of exposure during early life to many environmental microorganisms predisposes humans to chronic inflammatory disorders (CIDs), like autoimmune conditions, later in life. Specifically, the hypothesis proposes that reduced exposure to diverse macro- and microorganisms, including helminthes and commensal and pseudo-commensal microorganisms—with which humans have a long-standing, co-evolutionary dependence—induces immunodysregulation. Several have also recently implicated the gut microbiome, which exerts immunomodulatory effects, in this dynamic, but the oral microbiome has yet to be incorporated. Here, we propose that the oral microbiome likely represents a critical component of this co-evolutionary dynamic, especially as its composition is highly susceptible to environmental influences and affects oral and systemic host health. We aggregate and evaluate published findings on both 'ancient' and modern oral microbiomes, particularly those providing insights into the antiquity of commensal and pathogenic oral microorganisms in the oral cavity, and assess these against our own preliminary findings from characterization of the bacterial composition of preserved human dental calculus from a sub-sample of early 20th century skeletons. Isolation and rRNA sequencing through Illumina BaseSpace enabled positive identification at the genus- and species-level of multiple commensal and pathogenic bacteria and indicates that despite being roughly contemporary in the same institutional environment, each individual's microbial composition was significantly

different ($p < 0.00$). Using these data within a critical, comparative, evolutionary perspective, we can make direct, empirical insights into the co-evolutionary history and potential immunomodulatory effects of oral microbiomes throughout recent human evolutionary history.

Jo BUCKBERRY (University of Bradford, UK)

CO-OCCURRENCE OF CLEFT PALATE AND OSTEOMALACIA IN A MEDIEVAL SKELETON FROM YORKSHIRE.

A small number of skeletons excavated in 1983 from St Wilfrid's Church, Hickleton, South Yorkshire are curated by the Biological Anthropology Research Centre, University of Bradford. Hickleton 32, a young adult female, displays a bilateral, symmetrical perforation of the hard palate, previously diagnosed as a cleft palate. Unusually, the pre-maxilla is not affected. Reanalysis of this individual has identified subtle pseudofractures of both scapulae, several ribs, and probably the ischio-pubic ramus. The appearance of the lesions and their distribution are characteristic of osteomalacia, a condition rarely diagnosed in palaeopathology and especially in pre-industrial populations. The co-occurrence of the two conditions is unusual.

This paper will discuss this individual in their social and cultural context. It is possible that the noticeable cleft deformity may have marked this individual as 'disabled', potentially impacting on their life experience from childhood through to adulthood. Medieval invalids may have been restricted in their activities, spending a higher proportion of their life indoors. Did this young woman suffer a similar fate, with a restriction in activity leading to reduced exposure to sunlight, contributing to her Vitamin D deficiency? The interpretation of this burial sheds light on how social attitudes to pathology may have impacted on both the lifestyle and health status of individuals in the past. Additionally, it highlights the need to curate and re-evaluate human skeletal remains, even those we regularly use for teaching.

Fabian CRESPO (University of Louisville, USA), **Chris KLAES** (University of Louisville, USA), **Mawadda ALNAEELI** (University of Louisville, USA) & **Sharon DEWITTE** (University of South Carolina, USA)
OSTEOIMMUNOLOGY: A NEW FRONTIER IN PALEOPATHOLOGY.

The study of bone and immune system interactions (i.e. osteoimmunology) is an emerging and recently appreciated multi-disciplinary field. Osteoclast differentiation (osteoclastogenesis) is regulated by several complex pathways in health and disease, where receptor activator of nuclear factor- κ B ligand (RANKL) is known as a key indispensable factor. Interestingly, RANKL is highly expressed by activated immune T cells, thus conferring these immune cells the capacity to regulate osteoclast differentiation. To explore the underlying biological pathways linking osteoimmunology and paleopathology, we investigated the effect of shifting immune responses of human peripheral mononuclear blood cells (PBMCs) on osteoclastogenesis *in vitro*, upon activation with pathogens known to produce bone alterations (*Mycobacterium tuberculosis*, *M. leprae* or *Porphyromonas gingivalis*). Osteoclasts were generated from (i) CD14+ cell purified from healthy donor's PBMCs or (ii) Poietics™ osteoclasts, as

osteoclast precursors in the presence or absence of supernatants from PBMCs previously exposed to lysates of the indicated pathogens. Our preliminary data show that osteoclastogenesis is differentially affected by supernatants from activated cells exposed to single pathogen lysates, and by supernatants from cells sequentially exposed to two pathogen lysates (especially *P. gingivalis* and *M. tuberculosis*); suggesting that chronic infective scenarios as generated by tuberculosis or leprosy, and its potential interaction with persistent infections (i.e. *P. gingivalis*) can influence osteoclastogenesis and bone pathology. We propose the use of experimental osteoimmunology models as a new frontier in paleopathology for understanding the complex interplay of the immune and bone systems, and help contribute to more comprehensive paleopathological reconstructions.

Bruno M MAGALHÃES, Célia LOPES & Ana Luísa SANTOS (University of Coimbra, Portugal)

NOT ALL HOLES ARE THE SAME: SURGERY FOR RHINOSINUSITIS *VERSUS* MEDICAL TRAINING IN THE FIRST HALF OF THE 20TH CENTURY (COIMBRA, PORTUGAL). ***

Rhinosinusitis (RS) is characterized by the inflammation of the paranasal sinuses, with germs, bacteria and fungi playing an important role in its etiology. Symptomatology includes pain, nasal obstruction and fever, which can lead to impairment of quality of life. This work aims to investigate the medical approach to RS before antibiotics.

Skull 878 from the International Exchange Collection (n=1144), at the University of Coimbra, shows intense porosity at the superciliary arch, and an irregular hole (ca.8mm) above the right frontonasal suture, most probably caused by surgery. This 24 y.o. male died in 1933, at the Military Hospital, due to frontal sinusitis and meningitis. To interpret these evidences the Coimbra University Hospital (CUH) archives were researched. Between 1913-1940, 46 females and 59 males (aged 15 months-84 y.o., \bar{x} =35.33) underwent surgery to treat RS, mainly trepanation (94.3%). Patients were hospitalized from 4-370 days, and 84 left the CUH listed as cured, 18 as improved and one died. Searching for similar cases in the collection, skull 85 shows four quadrangular holes (ca.5mm/side) located above the right supraorbital notch, right and left maxillae, and left mastoid process. This individual was a 42 y.o. female, who died in 1927, also at the CUH, due to sarcoma in the abdomen. The number and location of the holes and the cut marks point to postmortem examination during surgery teaching, as she was buried 6 days after death. This work shows that paranasal disease was a serious problem treated with surgery and alerts for evidences of medical training.

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Karl REINHARD (University of Nebraska, USA), **Luciana SIANTO** (University of Coimbra, Portugal) & **Adauto ARAÚJO** (Oswaldo Cruz Foundation, Brazil)

BIOLOGICAL OR MINERAL? EVALUATING A PURPORTED SCHISTOSOME EGG FROM SYRIA.

Evilena Anastasiou and her colleagues presented evidence of schistosomiasis based on a single structure recovered from burial sediment in Syria. These authors interpreted the structure as a schistosome egg. Based on our combined experience, we make a case that this is not a parasite egg. Instead, we believe that they mistook a sand grain for an egg. We present methods that can be applied to avoid this type of confusion. We also summarize a case study showing the need to diagnose ancient parasites based on a combination of morphological analysis of many eggs combined with molecular biological confirmation.

Amanda R HARVEY (University of Nevada Reno, USA), **Julie HOGGARTH** (Baylor University) & **Jaime AWE** (Northern Arizona University, USA)

ORAL PATHOLOGICAL CONDITIONS AT BAKING POT, BELIZE. ***

Located in the upper Belize River Valley, Baking Pot was a regional civic-ceremonial center continuously occupied from the Late Preclassic (~400 cal BC) to the Terminal Classic periods (cal AD 800-900), with a later reoccupation during the Late Postclassic (cal AD 1280-1420). During the Late Classic (AD 600), the site reached its political height with named rulers, large-scale agriculture, and a population around 3,000 individuals with strict social roles. Oral health is the state in which dental diseases are controlled and shape a 'health-related quality of life'. This clinical, socio-environmental model of health includes environmental, social, and psycho-social influences (Allen, 2003). Using this concept, oral pathological conditions including calculus, caries, antemortem tooth loss (AMTL), and periodontal recession are scored using standard methods of evaluation to make inferences about the 'health-related quality of life'. A sample size of 16 adults represents all social classes and both sexes. Calculus affects 35.2% (121/343) of teeth, and is present on every tooth class in both jaws, with more accumulation on mandibular dentition. For caries, 87.5% (14/16) of individuals and 16.6% (57/343) of teeth are affected. AMTL in both jaws is scorable in seven individuals, with only three exhibiting instances of tooth loss. All AMTL is located on posterior, mandibular dentition. Periodontal recession was scorable in both jaws of six individuals; only two (33%) do not have recession on either jaw. Compared to other Lowland Maya sites, the oral health rates at Baking Pot are higher than most, yet almost equal to Kichpanha (Magennis, 1999).

Sarah STARK (University of Southampton, UK), **Simon MAYS** (Historic England, UK), **Jo SOFAER** (University of Southampton, UK) & **Sonia ZAKRZEWSKI** (University of Southampton, UK)

THE EFFECTS OF BIOLOGICAL STRESS ON LONG BONE SHAPE DURING ONTOGENY. ***

This paper evaluates juvenile development and nutritional stress in the long bones and their interaction in a biomechanical framework. This was neglected in the past due to the lack of accessible

techniques to analyze bone shape, techniques that have now become available with the rise of methods such as geometric morphometrics and Finite Element Analysis (FEA).

This paper tests if biological stress, as evidenced by bone markers, affects bone shape change during ontogeny. A dataset of femora (n=17), tibiae (n= 18), and humeri (n=21) from 28 juveniles and adolescents ranging from infancy to twelve years old, was collected from medieval Wharram Percy. This sample consisted of nutritionally stressed individuals with cribra orbitalia (n=24), rickets (n=2), and periostitis (n=5). Three-dimensional models were created for each element by structured-light-scanning and linear measurements of length and metaphyseal width. Procrustes (GPA) analyzed 10 type I and II landmarks and 100 semi-landmarks. FEA was used to analyze loading patterns between the nutritionally stressed sample and their cohort.

Morphometric and FEA analysis revealed there is significant ($p=0.03$) difference between age and nutritional stress. Shape development occurs in the proximal and distal metaphyses followed by curvature in the midshaft, potentially reflecting an increase in loading patterns. The stressed sample showed delays in this which suggest that nutritional stress interrupts both size and shape trajectories during ontogeny.

By introducing geometric morphometrics and FEA to osteology, and in specific developmental studies, size and shape can be teased apart and provide a more comprehensive understanding of bone growth and form.

Michelle BLYTH (Louisiana State University, USA) & **Frank RUEHLI** (University of Zurich, Switzerland)
EVALUATING HUMAN REMAINS FOR SYPHILIS.

The origin of syphilis has long been a subject of much debate for decades. Much of this debate centers on whether or not particular findings in human remains can be considered syphilitic in origin. Many criteria have been proposed, some highly stringent, and some quite lax. We believe that taking a medical diagnostic point of view could help to bring clarity to some of these debates.

Currently, most syphilis diagnoses in developed countries are made utilizing molecular methods. However, historical methods, practices in resource poor environments, and utilization of clinical suspicion to elucidate false negatives can help illuminate methods of diagnosis in human remains.

After a review of medical and paleopathological literature, we found five findings that can be considered pathognomonic for congenital or acquired syphilis. One of these, thymic cysts, are limited to mummified remains. We also found eight signs that when found with another sign, make the diagnosis of syphilis likely. The remaining signs can be used with a differential diagnosis process to determine the likelihood that they represent a syphilis infection. Two of these signs can only be found in mummified remains.

We would also like to stress that we believe that several of these signs are not routinely looked for in human remains, and that methodological scrutiny for all these findings may bring further clarity to the pre-Columbian prevalence of syphilis. As several of these signs are only found in mummified remains, the use of diagnostic imaging in searching for these signs may prove fruitful.

Olof OLAFARDOTTIR (Indiana University, USA)

THE PATTERNS OF OSTEOARTHRITIS IN MIDDLE AND LATE WOODLAND POPULATIONS: THE PETE KLUNK MOUNDS. ***

Osteoarthritis (OA) is the most frequent musculoskeletal disorder in contemporary populations. Despite extensive research in paleopathology, no standardization of methods for scoring osteoarthritis currently exist, making cross-study comparison difficult.

This study examines the patterns of osteoarthritis in the Middle Woodland (ca. 150 B.C – A.D 400) and Late Woodland (ca. A.D 300 – A.D 1000) components of Pete Klunk Mounds in the Lower Illinois River Valley. Presence of osteoarthritis at the major appendicular joints of 150 individuals was assessed with respect to age, sex, activity, and diet.

Prevalence of osteoarthritis was similar in both samples, with differences noted for the elbows and feet. Middle Woodland peoples had more osteoarthritis at the elbows, and Late Woodland peoples had more osteoarthritis in the feet. The most common joint affected was the knee, with high rates noted for the shoulders, elbows, and hips in both populations. The presence and severity of osteoarthritis was found to be correlated with age. Males were found to have higher rates of osteoarthritis, but the severity of osteoarthritis was not different between the sexes.

Results from this current study differ from that of Pickering (1984) looking at the same population. Different methodologies could account for most, if not all of the differences noted. In addition, Tainter's (1980) claims about higher-status individuals (buried in log-roofed tombs) having significantly less arthritis of the elbow compared to individuals buried elsewhere, was refuted. The lack of standardization for scoring the severity of osteoarthritis is a common problem in paleopathology that needs to be addressed.

Megan BRICKLEY (McMaster University, Canada), **Annabelle SCHATTMANN** (McMaster University, Canada), **Joelle INGRAM** (McMaster University, Canada) & **Jerome CYBULSKI** (Canadian Museum of History, Canada)

POSSIBLE SCURVY IN PRISONERS FROM OLD QUEBEC CANADA: RE-EVALUATION OF EVIDENCE IN ADULT SKELETAL REMAINS.

Although it is known that scurvy was present in many past communities, recognising the condition in adult skeletal remains poses significant problems. In 1986-7 as part of a Canadian Parks Service restoration project 50 skeletons were excavated from the walls of old Quebec. Investigations provided good evidence that these individuals were likely protestant prisoners who died during the French-English war of 1746-1747. It was determined that some individuals may have had scurvy when they died based on skeletal lesions and contextual information (Cybulski, 1988; Piedalue and Cybulski, 1997). Nine individuals considered the most likely candidates for having scurvy were selected for re-evaluation. The utility of recently published macroscopic diagnostic criteria for cranial porosity, hypertrophy and new bone formation were assessed. Findings were compared to evidence of post-cranial periosteal new bone formation. It is possible that all individuals had scurvy close to the time of death, but just two displayed clear (probable) evidence of scurvy and a further two possible evidence; there was insufficient evidence in the remaining cases. In this collection poor dental health had a definite impact on the ability to use changes to the alveolar bone as indicators of scurvy. Findings for new bone formation in the post-cranial skeleton were not inconsistent with scurvy, but interpretations were complicated by evidence for co-occurrence of other conditions and trauma. The results demonstrate scurvy was likely relatively common, but skeletal changes are not clear-cut and skeletal completeness and preservation have a big impact on the potential to suggest a diagnosis.

Cybulski JS. 1988. Skeletons in the walls of old Quebec. *Northeast Hist. Archaeol.* 17:61-84.

Piedalue G, & Cybulski JS. 1997. Buried prisoners in eighteenth century Quebec. In: Poirier DA, Bellantoni NF, editors. *In Remembrance: Archaeology and Death*. Westport: Bergin and Garvey. p. 121-129.

Abstracts submitted for Symposium “The Bioarchaeology and Paleopathology of Feasts and Famines: Foregrounding the Interaction between Humans and Their Environment.”
Organized Gillian Crane-Kramer and Kristina Killgrove.

Simon MAYS (Historic England, UK)

CAN DENTAL WEAR IN CHILDREN BE USED AS AN INDEX OF THE AMOUNT OF FOOD CONSUMED?

The aim of this study is to investigate whether, in children consuming abrasive diets, dental wear is a potential indicator of the amount of food eaten. Growth is strongly influenced by nutrition. If the amount of dental wear is a correlate of total food intake, one might hypothesise that those showing poor growth should have less dental wear, once the effects of age upon both variables are controlled for. This study aims to test this hypothesis using skeletal remains of young children (aged 8 months – 6 years) from Mediaeval Wharram Percy.

Macroscopic wear is measured on the deciduous incisors using crown heights. Femur length is used as an indicator of growth.

Results showed that, after controlling statistically for the effects of age, individuals with shorter femurs tended to show greater incisor crown heights, suggesting that more poorly nourished individuals had less wear on their incisors.

Although other interpretations are possible (and are discussed in the paper), this result is consistent with the idea that those with poorer growth took in less food. The subset of children showing less dental wear and deficient skeletal growth may have consumed less food because they were chronically sick or because they happened to grow up during times of crop failure – historical sources show famines were common in Mediaeval England.

Samantha Yaussy & Sharon DeWitte (University of South Carolina, USA)

PATTERNS OF PHYSIOLOGICAL STRESS AMONG VICTIMS OF MEDIEVAL CRISIS MORTALITY. ***

Famine can broadly be defined as a shortage of accessible foodstuffs that instigates widespread excess mortality due to starvation, infectious disease, and social disruption. Like other causes of catastrophic mortality, famine has the potential to be selective—it can primarily target biologically- and culturally-determined population subgroups that differ in their frailty, or risk of death compared to others. This study examines famine burials from medieval London and compares them to nonfamine (attritional) burials from the same time periods. The data analyzed come from St. Mary Spital cemetery (SRP98, c. 1120-1540), particularly burials from the 12th – 16th centuries A.D. Using data previously collected by Museum of London Archaeology researchers, this study evaluates the associations between adult age, sex, and three skeletal indicators of stress (cribra orbitalia, linear enamel hypoplasia, and periosteal new bone formation) with hierarchical log-linear analysis. Results indicate significant associations

between famine burials and linear enamel hypoplasia and between attritional burials and periosteal new bone formation, independent of age or sex. The linear enamel hypoplasia results suggest that early exposure physiological stressors could impact overall frailty, and thus morbidity and mortality later in life. In contrast, the periosteal new bone formation results suggest that individuals were more likely to survive physiological stressors under normal, nonfamine conditions, allowing for lesions to develop and heal.

Grant: NSF (BCS-1261682, REG supplement)

Piers D MITCHELL (University of Cambridge, UK)

EXPLORING PAST DIET FROM THE ANALYSIS OF ANCIENT INTESTINAL PARASITES.

Intestinal parasites are infectious diseases with complex life cycles that are frequently dependent upon elements of human diet. The past distribution of parasite species can help us understand foods eaten in the past, fertilization of food crops, techniques used to prepare foods, and the hand hygiene of those cooking meals.

Parasitic worms can be spread more easily when certain agricultural practices are used to improve crop yields. When human feces are used as manure to fertilize food plants, crop yields increase but roundworm, whipworm and dysentery becomes more common. This may explain why Roman sanitation technology introduced into Western Europe failed to reduce these parasites. When water irrigation channels are used, plants can be grown in areas of unreliable rainfall but farmers can become infected with schistosomiasis. *Schistosoma haematobium* presence in Syria in the Chalcolithic period appears to support this hypothesis. Intestinal parasites consume nutrients before the host can access them, potentially leading to malnutrition in children with heavy parasite load, or in adults during food shortages. Textual evidence from the crusades suggests that 15-20% of nobles and clergy taking part in a long crusade died from malnutrition or infectious disease, and a higher proportion of poor foot soldiers would have done so. We will consider how parasite infection may have affected the likelihood of survival at times of famine during long military expeditions to the Holy Land. The geographic distribution of fish tapeworm in Europe seems to have varied temporally. So far the parasite has only been found in three European countries (France, Germany and Switzerland) in prehistory, but in six countries in the Roman and Medieval periods. We will consider how the distribution may have been affected by hunting wild fish, farming fish, the Roman fish sauce garum, preservation by smoking and pickling, and the Christian tradition of eating fish on fast days.

Melissa ZOLNIERZ (Missouri Southern State University, USA)

DIETARY RECONSTRUCTION AND DOMESTICATION: AN EXAMINATION OF SHEEP TEETH FROM THE NEOLITHIC SITE OF GRITILLE (TURKEY)

The Neolithic Revolution marked a dramatic change in subsistence. Researchers have proposed many different stimuli for domestication, such as a supply for feasting; however, unanswered questions remain concerning the mechanics of animal domestication. Traditional studies of faunal morphology and population profiles offer some clues, but such research has had limited success identifying stages intermediate between wild and domesticated forms, which makes it difficult to discern initial attempts at animal control, and to fully understand the domestication process. For instance, at the Neolithic site of Gritille (Turkey), changes in sheep morphology (size) indicates domestication over time but exactly when remains unanswered.

Dental mesowear and microwear analysis of Gritille zooarchaeological materials allowed for identification of diet changes related to husbandry (control of movement and penning animals), and to determine whether the process was gradual or abrupt. The Gritille Neolithic period was broken down into three parts. Each provided statistically significant dental wear signatures, indicating the evolution of human control (domestication) of animals at this site. For instance, animals from Phase B appeared closest to the wild diet, but still differed from it indicating the possibility of foddering. During the last Phase (A), the signatures of increased grit within the diet suggest the environment started to degrade however no pathological conditions were exhibited. Dietary stress may have become severe (famine), leading to the sites abandonment following this period. This methodology of reconstructing husbandry can lead to a better understanding of the causes and mechanics of animal domestication during the Neolithic Revolution.

BETTER LIVING THROUGH CLIMATE CHANGE? IMPROVEMENTS IN HEALTH WITH PASTORALIST ADAPTATION TO LATE-HOLOCENE DRYING IN WESTERN CHINA.

Elizabeth BERGER (University of North Carolina at Chapel Hill, USA) & **Hui WANG** (Gansu Provincial Institute of Cultural Relics and Archaeology, China)

Climate change in the second millennium BCE in Northwest China, and the corresponding spread of steppe and desert environments, corresponded to a shift in human subsistence away from mixed agro-pastoralism and towards more specialized pastoralism. The loss of conditions suitable to agriculture could have led to food insecurity and famine, as old subsistence practices became less productive. However, paleopathology data from the early and late Bronze Age (second and first millennia BCE) in the Hexi Corridor show that measures of health improved over the course of the transition. Periosteal reaction went from being mostly active at the time of death to mostly healing at the time of death, suggesting reduced frailty in the population; and the proportion of individuals with linear enamel hypoplasias decreased dramatically, indicating fewer growth disruptions. A decline in carious lesions and an increase in dental attrition are consistent with a dietary transition away from agricultural products and towards pastoral products, and changes in patterns of osteoarthritis also support the idea that subsistence activities changed. This runs counter to the currently dominant narrative of

climate “collapse” and hardship: rather than suffering from famine conditions, the late Bronze Age population of the Hexi Corridor was part of a resilient adaptive system, and exhibited improved population health despite facing a changed climate.

Sarah A SCHRADER (UC Santa Cruz, USA), **Michele R BUZON** (Purdue University, USA) & **Stuart TYSON SMITH** (UC Santa Barbara, USA)
COLONIAL-INDIGENE INTERACTION IN ANCIENT NUBIA: AN INTEGRATIVE ANALYSIS OF DIET, HEALTH, AND THE MATERIAL RECORD. +++

During the Middle Kingdom Period (2,050-1,650 BCE), the Egyptian Empire colonized Lower Nubia and constructed multiple fortresses along the Nile River, which controlled trade, monitored population movement, and defined a political border. Egyptian soldiers lived in these self-sufficient forts, while the indigenous C-Group Nubians lived nearby. After the decline of the Middle Kingdom, Second Intermediate Period (1,650-1,550 BCE) Egyptians – now expatriates – remained in the area. Furthermore, C-Group peoples as well as Nubians from farther south began to cohabit with Egyptians inside and outside the forts. This interesting scenario of colonialism and post-colonialism presents a distinct opportunity to examine changing social structure and agentive action through time.

We use an interdisciplinary approach to address the intersection of food (carbon and nitrogen isotope analysis), negative health indicators (e.g., cribra orbitalia, osteoperiostitis, linear enamel hypoplasia, stature), and material identities (ceramic assemblage) of these Egyptians and Nubians through time. Our analysis found that during the Middle Kingdom, the Egyptians and Nubians were eating different foods, and cookpots were the most common type of pottery found; however, during the Second Intermediate Period Nubian service vessels become more common. Negative health indicators were similar between the two time periods, despite written accounts of climatic variability and famine. We suggest that during the period of imperial rule, Nubians and Egyptians agentively chose differing foods to ideologically and socially separate themselves from one another. However, during the Second Intermediate Period, coexistence and cooperation encouraged feasting practices where service vessels would have been utilized.

Sara L JUENGST (Appalachian State University, USA) & **Celeste Marie GAGNON** (Wagner College, USA)
IDENTIFYING CHICHA: A PALEOPATHOLOGICAL INVESTIGATION OF MAIZE BEER CONSUMPTION.
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Andean feasts in the past and present regularly involve the consumption of fermented maize beer, called *chicha*. Archaeologically, this drink is often identified through phytolith and botanical remains, ceramic styles, and iconography. However, not everyone attending festivals had equal access to this resource; gender, age, social status, and ritual participation may have influenced who partook in sharing this beverage. Thus, we propose to investigate *chicha* consumption individually, as recorded as skeletal and dental pathology, in conjunction with isotopic signatures and traditional archaeological

means of identifying *chicha*. This paper will explore a potential, pathological “*chicha* signature”: the paleopathological lesions that regular consumption of this drink may have left on the bones of those who consumed it. We suggest that *chicha* consumption (or lack thereof) may be identifiable through the presence and distribution of dental lesions such as caries and abscesses, skeletal lesions such as cribra orbitalia and porotic hyperostosis, stable isotope signatures reflecting maize consumption, oxygen and strontium signatures, and phytolith and starch remains from dental calculus. We attempt to link patterns of paleopathology (dental and skeletal lesions) with the other *chicha* indicators (isotopic signatures and dental calculus) in order to build a model of *chicha* consumption, as reflected on the skeleton. Two case studies from the Andes (from the North coast of Peru 400 BC – AD 600 and the Titicaca Basin of Bolivia 800 BC – AD 200) will be presented to illustrate how this signature may reflect underlying social and economic hierarchies present in these different settings.

Anne Marie SOHLER-SNODDY (University of Otago, NZ), **Siân E HALCROW** (University of Otago, NZ), **Hallie R BUCKLEY** (University of Otago, NZ), **Vivien STANDEN** (Universidad de Tarapacá, Chile) & **Bernardo ARRIAZA** (Universidad de Tarapacá, Chile)

SCURVY AT THE AGRICULTURAL TRANSITION IN THE ATACAMA DESERT, NORTHERN CHILE (3600-3200 BP): AN INVESTIGATION OF MATERNAL-FETAL TRANSFERENCE OF VITAMIN C DEFICIENCY IN PALEOPATHOLOGY. ***

The Atacama in what is now Northern Chile is the most arid desert on earth and the ancient cultures of this region are remarkable examples of biosocial adaptation to environmental extremes. Beginning around 3500 BP a shift in subsistence strategy occurred here, with gradual movement from a maritime hunter-gather economy towards a maize-based agropastoral economy. In modern populations maternal health is known to be adversely affected by the low dietary variety and poor micronutritional status that characterize agricultural societies, and it is possible that the adoption of agriculture in ancient Chile led to similar micronutrient “famines”. Here we present a paleopathological case-series of individuals from Quiani 7 (~3600 - 3200 BP, N = 12), a coastal site which was occupied from the late pre-agricultural through the early post-agricultural periods. This extraordinarily well-preserved skeletal cohort contains an unusually high number of infants and perinates (34 prenatal weeks – 6 months; n = 4) with evidence of a chronic hemorrhagic disorder and defective collagen bone-matrix formation that closely resembles the lesion type and patterning of juvenile scurvy. One of these perinates (T17a, 34-38 prenatal weeks) is associated with a young adult female (T17, 20-34 years) who exhibits lesions strongly suggestive of the adult manifestations of scurvy. We discuss the possible implications of these findings in terms of the impact of the agricultural transition on maternal and infant health in the ancient Atacama, and suggest that greater consideration of perinates as sensitive indicators of population-level micronutritional status in the past is merited.

Charity F UPSON-TABOAS (Indiana University, USA)

KEEPING UP WITH THE CAHOKIANS: INCREASED MAIZE ADOPTION MAY BE RELATED TO FEASTING.

The commonly accepted scenario of the gradual introduction of maize into the American Bottom and Western Illinois has recently been challenged, suggesting that maize was adopted suddenly, rather than gradually. This research examines human bone collagen isotope values and reported maize-related pathologies from four regions – the Central Illinois River Valley, the Sny Bottom, the Lower Illinois River Valley, and the American Bottom. As maize was adopted, carbon isotope values are expected to increase, as are pathologies related to maize consumption, such as porotic hyperostosis, cribra orbitalia, dental caries, and pellagra. The time period and archaeological site are strong predictors for carbon isotopes where the Middle Woodland values were greater than the Late Woodland values, which were greater than the Terminal Woodland period, but there was no significant variation between the Terminal Woodland and Mississippian time periods. Preliminary pathology data confirm an increase in all pathologies at most of the sites over time, with spikes in the Terminal Woodland period. With this data, it is apparent that maize was not noticeably used before the Late Woodland time period, and especially not until after the Terminal Woodland time period. This supports the sudden adoption of maize rather than gradual adoption. This sudden adoption of maize may be associated with a cultural change in ritual feasting, spurred by socio-political events at Cahokia. However, the dietary picture is complex, and needs more work.

Abstracts for the PODIUM PRESENTATIONS (in presenting order, contd.)

Petra **BANKS** & Molly K **ZUCKERMAN** (Mississippi State University, USA)

THE COSTS OF WAR: USING THE “DIRTY WAR INDEX” TO IDENTIFY THE BIOSOCIAL COSTS OF WARFARE FOR CIVILIANS. ***

In the past and present, the biosocial effects of armed conflict are increasingly well documented for combatants but comparatively poorly understood for non-combatant civilians. Data for contemporary conflicts indicate that civilians suffer elevated morbidity and mortality above peacetime, but it is difficult to empirically reconstruct whether effects were similar for pre-modern populations. Here, we propose applying public health tools, specifically the ‘Dirty War Index’ (DWI), to bioarchaeological data for empirically assessing the effects of armed conflict on civilians, particularly children under five. The DWI is a recently introduced quantitative tool for identifying rates of undesirable or prohibited outcomes during conflict, with a ‘clean’ conflict generating low values (0) and a ‘dirty’ one high (100). To demonstrate the DWI’s utility for past conflicts, its novel insights, and the theoretical and methodological issues involved, we generate DWIs using established data for two well-documented conflicts: the Mountain Meadows, Crow Creek, and Sacred Ridge massacres. Among other findings, Mountain Meadows yields high DWIs for casualties left unburied (100) and captives executed (81.75), but low values for elderly (2.5) and child (7.5) deaths, indicating that only certain outcomes violated culturally specific moral standards. In comparison, Crow Creek yields the same DWI for non-burial, a high DWI (76.3) for mutilation, but low values (<27) for child and civilian deaths, indicating an arguably ‘cleaner’ conflict following culturally specific moral standards. The DWI enables empirical comparison of effects of conflict on civilians following culturally specific outcomes, enabling objective evaluations of pain and suffering.

Larissa **COLLIER** (University of Central Arkansas, USA)

A QUALITATIVE AND QUANTITATIVE ASSESSMENT OF TRAUMA AND VIOLENCE IN A HISTORIC AND MODERN SAMPLE.

The increase in recent conflict events worldwide has brought violence into the daily consciousness and driven the current global conversation as to why violence is perpetrated on such varying levels. This project examines the relationship between skeletal trauma and evidence for violence by developing a model that contextualizes potential changes in the frequency of trauma over time and maps them against archaeological, historical, and current events. Utilizing skeletal data from St. Mary Spital and modern data from crime statistics in the United States can aid in creating a more quantitative model to assess the relationship between trauma and violence. This data has narrow or exact time intervals and written accounts of cultural violence, locally and regionally. In the historic data, the frequency of violence-related trauma between periods was not significantly different except for Period 16 and 17, where the overall frequency of violence related trauma was significantly increased. The pattern of violence also changed between males and females within each period. The data will be framed in the context of wider regional stress events that could impact a population on a community level and lead to unequal distribution of resources and/or social unrest. This paper will focus on intra-group conflict

but include a discussion on how aspects of political and religious violence, conflict, and warfare can impact daily and/or domestic intra-group violence. The results of the analysis will, potentially, provide a model that could begin to analyze violence in prehistoric, historic, and modern cultures.

Carla L BURRELL (Liverpool John Moores University, UK), **Silvia GONZALEZ** (Liverpool John Moores University, UK), **Lynn SMITH** (Norton Priory Museum and Gardens, UK), **Michael M EMERY** (The Poulton Research Project, UK), **Joel D IRISH** (Liverpool John Moores University, UK) & **Matteo BORRINI** (Liverpool John Moores University, UK)

COMMUNITY DIFFERENCES? FRACTURE ANALYSIS IN THE MEDIEVAL POULTON, NORTON PRIORY AND GLOUCESTER COLLECTIONS.

Analysis of trauma patterns can provide valuable information about medieval life. Fractures are the most frequent type of trauma inflicted on the human skeleton and are more commonly observed within archaeological collections. Their presence allows us to review and compare living conditions and assess fracture risks within and amongst populations. This study reviews 1,152 individuals from three British medieval population groups – each displaying different occupations, social segregations and living conditions: rural Poulton (n=726) and Norton Priory (n=130), and urban Gloucester (n=296). In this study, fracture types and patterns were quantified, including severity and location within the skeleton. The association of types and prevalence was analyzed relative to sex and age at death. Fractures occur at a rate of 10.5% for Poulton, 13.8% for Norton Priory and 21.3% for Gloucester. Most fractures appear to have occurred through accidental trauma and nearly all had healed. However, further complications such as osteomyelitis, associated periostitis and malunion are evident and highest in frequency at Gloucester. As expected, fracture prevalence increased with age for all samples with a higher prevalence in males than females. Interestingly, there is a higher occurrence of fractures on the left side of the body. These analyses permit various interpretations about medieval life among these populations, which will be discussed in detail.

Magdalena Domicela MATCZAK & Tomasz KOZŁOWSKI (Nicolaus Copernicus University, Poland)
THE SOCIAL STATUS OF THE DISEASED AND THE DISABLED IN EARLY MEDIEVAL CULIMNE IN POLAND.

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We investigate the social status of the diseased and disabled in early medieval Poland. We consider two hypotheses. The first hypothesizes that the diseased and disabled might have had a higher social rank than the healthy because material goods might have contributed to their survival and lengthened the progression of their ailments, whereas people from a lower social layer with similar diseases might have died at earlier stages of their diseases. The second hypothesis considers whether the diseased and disabled were neglected and devalued because of their ailments, thus causing them to be categorized in a lower social layer. We examine 661 skeletons from early medieval cemetery in *Culmine*, Poland. Our research is based on qualitative and quantitative (statistical) analyses.

Based on modern clinical and paleopathological studies, we identified, which kind of pathological lesions of skeletons from *Culmine* could have been associated with diseases and disabilities. As a disability we define specific physical conditions, inferred from pathological lesions associated with disease, and likely to have disadvantaged the individual's functioning in a way that had an impact on, and was significant in, their everyday lives. Our research shows that 208 skeletons have pathological changes that might indicate different types of diseases and 40 skeletons have pathological changes that might indicate disabilities.

The χ^2 tests and correspondence analysis indicate that the diseased and disabled belonged to all social classes. The people of medieval Poland might have been used to the different appearance and behavior of the diseased and disabled and might not have devalued them. Multiple correspondence and nonlinear canonical correlation analyses and χ^2 tests indicate that the prevalence of diseases and disabilities depended on age and sex. We argue that diseases and disabilities might have been the result of the social roles associated with age and sex. Adults, and especially adult males, were more often diseased and disabled. The reason for this is that males lived longer than females, and their daily work was more physically demanding than the work of females. We discuss these results in comparison with other studies.

Abstracts submitted for the COLLECTIONS POSTER SYMPOSIUM: organized by Charity UPSON-TABOAS. Discussant: Lyman JELLEMA

ANALYZING THE PATTERNS OF HEALTH, TRAUMA, AND DISEASE IN 19TH CENTURY CHINESE SALMON CANNERY WORKERS IN KODIAK ISLAND, AK.

Andreana CUNNINGHAM (University of Miami, USA), **David HUNT** (Smithsonian Institution, USA) & **Rhonda COOLIDGE** (Smithsonian Institution, USA) ***

A skeletal series of Chinese immigrant salmon cannery workers were excavated in 1931 in Kodiak Island, AK, under the direction of Ales Hrdlička. During the bioarchaeological investigation of this series, numerous skeletal anomalies, as well as traumatic and infectious conditions, were identified. There was a noticeably high incidence of neural arch defect (35%) with expression ranging from one to two segments to completely open neural canal in the sacrum, often with associating lumbar spondylolysis and spondylothesis. Arthritic changes to the joints were a common observation, indicating the strenuous workload these individuals had at the cannery and in western coastal US where they worked other seasons of the year. The average age of this series is between 30-40 years, reflective of the Chinese immigrant wave in the latter part of the 19th century. Traumatic injuries included severe arthritic deterioration of the hip, healed fractures of the ribs and phalanges, healed cranial contusions, and a gunshot defect to the cranium. Infectious disease was observed in several of the individuals including - tuberculosis, syphilis, systemic periostitis, and some cases of severe periodontal disease. The findings from this study indicate that these Chinese immigrants had higher than expected congenital anomalies, indicators of less than adequate living conditions that exposed them to infectious diseases as well as a range of traumatic experiences, whether accidental or violent. All the findings reflect the challenges of immigrant living by these Chinese-Americans in the turn of the 19th-20th century.

THE DISSECTED DESTITUTE: CASE STUDIES FROM THE HAMANN-TODD AND TERRY ANATOMICAL COLLECTIONS.

Carlina DE LA COVA (University of South Carolina, USA)

This poster will examine the intersectional relationships between migration, social status, ancestry, dissection, and paleopathology in individuals from the Hamann-Todd and Terry anatomical collections. Case studies will illustrate the biological impact social marginalization had on individuals within these skeletal series. These will include African Americans that comprised the Great Migration, the institutionalized, and the impoverished, who relied on health care from public and charity hospitals in Cleveland, Ohio, and St. Louis, Missouri. A discussion about the link between dissection legislation, destitution, migration, and institutionalization will also be provided to argue how the individuals in these anatomical collections truly comprise and embody the dissected destitute.

HEALTH AND THE HUDDLED MASSES: AN ANALYSIS OF IMMIGRANT AND EURO-AMERICAN SKELETAL HEALTH IN 19TH CENTURY NEW YORK CITY.

Kristen E PEARLSTEIN (Smithsonian Institution, USA)

The purpose of this study is to evaluate the skeletal health of European immigrants and Euro-Americans from late 19th and early 20th century New York City in order to understand the biological impact of socio-cultural inequality and marginalization during this time period. This project analyzes 1508 partial human skeletons from the George S. Huntington Anatomical Skeletal Collection, housed at the National Museum of Natural History (Smithsonian Institution) in Washington, D.C. Specifically, this research compares skeletal health indicators from German (n = 260), Irish (n = 380), and Italian (n = 173) individuals with health indicators from impoverished U.S.-born (n = 695) individuals in order to determine if social and economic disparities between these groups differentially impacted their skeletal health. This project builds on existing biocultural scholarship by situating skeletal health and aspects of immigrant social marginalization through mortuary context, historical data, and narratives of social prejudice. Inclusion of the immigrant experience in previous skeletal studies is minimal. Rather than assimilating immigrants as one ethnic category, this study explores how heterogeneous nationality groups were treated and perceived, and how the intersection of social and physical processes is embodied and expressed in their skeletal remains. The comparison of skeletal health between immigrants and Euro-Americans is carried out using frequency analyses for fractures, periostitis, and eburnation. Results indicate that higher frequencies of the recorded health indicators are present in the Irish and U.S.-born samples compared to the German and Italian samples. Reasons for this disparity may relate to occupational mobility and social support, among other economic and cultural factors.

AN EXPANDED AND REDEFINED ANALYSIS OF DIABETES IN TWO KNOWN HISTORICAL HUMAN SKELETAL COLLECTIONS.

Charity F UPSON-TABOAS (Indiana University, USA)

The goal of this research is to further the understanding of the effects of diabetes on skeletal material. I examined known diabetics and age/sex/race matched controls in the Hamann-Todd (n=11, n=12, respectively) and the Robert J. Terry (n=18 for each) Human Osteological Collections for musculoskeletal disorders (MSDs) known to be associated with diabetes mellitus. The controls were individuals whose cause of death could not be directly tied to a diabetes-related confounding death. I recorded the presence and absence of each MSD and the presence was scaled for severity. The MSDs recorded were hyperostosis frontalis interna, periodontal disease, adhesive capsulitis, limited joint mobility, flexor tenosynovitis, carpal tunnel syndrome, diffuse idiopathic skeletal hyperostosis, peripheral neuroarthropathy, gout, lower extremity amputation, osteoarthritis, osteoporosis, osteomyelitis, exostosis, and fractures. There was no statistical difference between the weight, height, race, or sex of the diabetics and controls in either collection, nor between the collections, allowing for the combination of the collections for analysis of the MSDs. Preliminary results suggest there is a statistical difference between the occurrence of certain MSDs, with diffuse idiopathic skeletal hyperostosis, peripheral neuroarthropathy, lower extremity amputation, exostosis, and fractures occurring more often or more severely in diabetics than in controls. This research confirms my

previous research with the Hamann-Todd Collection that a single MSD cannot be used to diagnose diabetes mellitus in skeletal material. Future research may be able to use the MSDs occurring more often in known diabetics to infer the possible presence of diabetes in archaeological skeletal material.

Abstracts submitted for the POSTER SESSIONS:

P Anagnostis AGELARAKIS (Adelphi University, USA)

A 14TH C. BYZANTINE WARRIOR WITH *FRACTURA MANDIBULAE*.

This poster addresses paleopathological manifestations of a warrior provides glimpses of the human condition during the tumultuous last 100 years of the Byzantine Empire, as experienced at the provincial fort of *Polystylon* in Western Thrace-Greece.

During the mid-1380s, at the sacking of the *Polystylon* fort, the Byzantine warrior was decapitated by the Ottoman conquerors. His head, also bashed with a ghastly fracture at the upper facial third, had been laid to rest in a box-shaped grave of a 4.5/5.5 year old individual. Earth and few large ceramic fragments had safely retained through the passage of time the remains of the two individuals, excavated in 1991 by the Hellenic Antiquities Authority.

Along with the horrific trauma impacts sustained at the cranial *facies anterioris* and *basilaris*, the Byzantine warrior revealed a rare case of healed mandibular parasymphyseal, comminuted, fracture involving the dentoalveolar and basal regions of the mandible. Through differential diagnosis it was established that the mandibular fracture had been treated with a closed reduction with the technique of realignment and jaw fragments' immobilization by dental circumferential wiring/threading; suspected to have been further aided by bandages fastened on the vault of the head. It was thus possible to trace, in retrospect, through this case study the overall medical directions, advice, and precautions provided to physicians in the Hippocratic corpus for treating mandibular fractures, along with concerns and cautions on the *modus vivendi* of the patient during the recovery process, conditions which as in this case influenced the results of the healing process.

Aniello CATAPANO (Quinnipiac University, USA), **Jennifer CURRY** (Quinnipiac University, USA), **Ramon GONZALEZ** (Quinnipiac University, USA), **Gerald CONLOGUE** (Quinnipiac University, USA), **Mark VINER** (Cranfield University, USA), **Dario PIOMBINO-MASCALI** (Regione Siciliana, Italy) & **Ronald BECKETT** (Quinnipiac University, USA)

A DIFFERENTIAL DIAGNOSIS OF SPINAL PATHOLOGY OF THE GANGI MUMMIES.

In Gangi, Sicily, the Mother Church houses a crypt with 60 mummies that were previously priests. There are a total of 60 mummies in the crypt but only 36 of them were radiographically examined during this study. AP and lateral radiographs were taken of each mummy and examined for aging, paleopathology, body preparation, and preservation.

The examination was carried out within the framework of the Sicily Mummy Project. It was observed that there was spinal pathology in ten of the subjects. When originally examined, these spinal pathologies were thought to consist of four cases of Ankylosing Spondylitis (AK) and six cases Diffuse Idiopathic Skeletal Hyperostosis (DISH). However, when reviewed by a Radiologist, all but one of the cases turned out to be osteophyte formation. This is an assumption that is often made based on common knowledge among those examining such cases at the worksite. This occurs because AK, DISH, and osteophyte formation share some visual traits when observed in a radiograph.

As the capability of examining human remains in the field radiographically with portable equipment grows, it is important to be able to distinguish various spinal conditions from one another. This can be accomplished by being aware of the visual traits of various spinal pathologies as they manifest radiographically and how they differentiate from one another.

Erica **AUSEL** (Indiana University-Bloomington, USA)

DOWN BUT NOT OUT: A PROBABLE CASE OF CONDENTAL HIP DYSPLASIA IN A LATE PREHISTORIC NATIVE AMERICAN COMMUNITY.

The Angel site (12Vg1) was a fortified, late prehistoric Native American town (1050-1350 A.D.) located in southwestern Indiana. The site was extensively excavated during the early 20th century, resulting in the largest skeletal collection from the lower Ohio River valley. Presently, the first comprehensive paleopathological analysis of the Angel collection is being conducted by the author. Several unique, but previously unpublished, pathological case studies have been identified in this collection. Case studies broaden our knowledge of the various pathologies that afflicted prehistoric peoples and can provide insight into how individuals and communities viewed and dealt with disease. The case presented here describes a late adolescent male with severe emaciation of the lower right limb. Based on the criteria described by Mitchell and Redfern (2008), a diagnosis of developmental dysplasia of the right hip is proposed. Due to the degree of emaciation, it is probable that the right lower limb was of little-to-no use for a typical bipedal gait. However, the robusticity of the left lower limb suggests this individual was functionally mobile with long bone length demonstrating they had reached a height within the normal range of variation for males at Angel. Therefore, although physically impaired, it appears that this individual was not restricted in their mobility and was an active member of society. A discussion of complications related to congenital hip dysplasia, including those that may have led to the premature death of this individual, and differential diagnoses will be discussed.

Jelena BEKVALAC (Museum of London, UK), **Gaynor WESTERN** (Ossafreelance, UK) & **Mark FARMER** (Teesside University, UK)

THE IMPACT OF INDUSTRIALISATION ON LONDON HEALTH.

The period of the Industrial revolution is a pivotal time in the history of the UK and represents a fundamental shift in the nature of our lifestyles and the diseases we endure today. Using archaeological skeletal remains, a multidisciplinary three year project, funded by the City of London Archaeological Trust (Rosemary Green Grant), has started to investigate how health patterns have changed up to the present day in London and the role that industrialisation has played in determining the factors critical to the health of its population, past and present. The project will use the latest imaging techniques on a sample of eighteen skeletal assemblages from post-medieval and medieval sites across London and outside of London for comparison. Digital radiography will be carried out on 2,500 adults targeting strategically selected areas of the skeleton, crania, femora, vertebrae, pelves and 2nd metacarpal to allow maximum recording of data. Hyperostosis Frontalis Interna (HFI), osteoporosis, joint disease, trauma, Diffuse Idiopathic Skeletal Hyperostosis (DISH) and neoplastic

disease will be focused on using macroscopic and radiographic analysis. Using this data, we aim to investigate the origins of diseases that are highly prevalent today in our industrialised populations, tracing the rise of these diseases through time. Previous studies by the authors applying digital radiography have revealed new data for HFI and found that 10% of lesions overall were detected only by radiography. The preliminary analysis has similarly detected previously unobserved pathological lesions. Ultimately, we will present a synthetic overview of post medieval collections to aid understanding health in the past and potentially unlocking shifts seen materialising in modern populations.

Amy **BERESHEIM** & Klara **KOMZA** (University of Toronto)

QUANTIFYING OBSERVER ERROR IN HISTOMORPHOMETRIC DATA COLLECTION: IMPLICATIONS FOR STUDYING BONE MASS IN PAST POPULATIONS. ***

The accuracy and repeatability of histological measures of bone mass are of particular concern when studying metabolic bone turnover in human ribs. Cortical drift and high trabecular connectivity in younger individuals likely increase subjective decision-making when determining the bounds of the medullary space. Trabecularization of the cortex, as seen in post-menopausal bone loss, may also increase the difficulty of delimitating endosteal borders. This study aims to quantify the amount of intra- and inter-observer error associated with one digital histomorphometric data collection method.

One hundred sixty-two ($n=162$) photomontages of transverse rib cross-sections were independently evaluated by two observers using compatible imaging software programs to measure total area (Tt.Ar) and endosteal area (Es.Ar). Cortical area (Ct.Ar) and relative cortical area (Rt.Ct.Ar) were then derived from these values. Repeat measures ($n=17$) were collected by one of the authors (KK) approximately six months after the end of the initial trial to assess intra-observer variation. There were no statistically significant differences between pairs of observations in either the intra- or the inter-observer error component of this study. However, error rates were highest for the Es.Ar variable. While inter-observer agreement was very high, results demonstrated a directional bias with one observer consistently generating higher measured values.

This study underscores the importance of routine error reporting in histological research. The dynamic nature and structural complexity of the medullary space influences measurements of bone mass. Error rates must be taken into consideration when interpreting bone mass data.

Abigail BREIDENSTEIN (University of Michigan, USA), **Michele BUZON** (Purdue University, USA) & **Maureen DEVLIN** (University of Michigan, USA)

DETECTION OF TETRACYCLINE IN NEW KINGDOM NUBIAN REMAINS FROM TOMBOS.

The presence of tetracycline in Nubian populations, thought to be introduced through bread and beer products, was identified in the 1980s (Basset, *et al.*, 1980) and has been further investigated in recent

years (Margolis, 2015; Fabsits, 2008). The studies to date have demonstrated the presence of this broad-spectrum antibiotic in archaeological remains from Medieval sites. Here, we use previously established techniques to test for tetracycline deposition in a cohort of commingled Nubian adults from the site of Tombos, in modern-day Sudan, dating to the New Kingdom era (1400-1050 BCE). For this study, embedded samples of femoral midshafts (the location where we hypothesize the most bone remodeling occurs due to strain) were sectioned, mounted and polished, then examined under fluorescent light to identify the chemical within the bone tissue. We observed fluorescence consistent with tetracycline in multiple individuals. However, since the samples show evidence of diagenesis and tissue preservation is sub-optimal, the fluorescent signals could derive from post-mortem conditions, including microbial activity. We are currently working to independently verify the presence of tetracycline. If confirmed, identification of tetracycline-labeled bone at this site extends this phenomenon to an earlier time period than previously shown, with implications for health and disease as well as exploration of grain use, cultural differences, and environmental variation in Nubian populations dating as far back as the New Kingdom.

Alyson **CAINE** (Cogstone Resource Management, USA)

YOUR GUESS IS AS GOOD AS MINE: DIFFERENTIAL DIAGNOSIS OF ONE DISARTICULATED SKULL.

Differential diagnosis is key aspect of paleopathological analysis. However, commonly skeletal material is disarticulated and determining a distribution of features and therefore an etiology is inhibited. In the case of this project, mishandling and poor documentation of the NAGPRA affiliated skeletal collection, LAN-270, has led to the loss of information. This collection is comprised of discrete and disarticulated individuals encompassing a minimum of 54 individuals. Historically, the Gabrielino-Tongva burial site, LAN-270, has been infiltrated with individuals from the Veteran's Hospital, which is adjacent to the burial ground. The aim of this poster is to provide a differential diagnosis for one disarticulated skull. Contextual information of the skeletal collection, which is limited, along with macroscopic analysis were used to provide possible differential diagnoses for the pathological alterations observed in this individual.

This poster highlights the effect limited contextual information can have on differential diagnosis of disarticulated skeletal material. Contextual information as well as 3D images of the isolated partial skull will be provided to participants. Upon observing the 3D images of the skull, participants will be prompted to pick observable features such as new bone formation, trauma, and dental disease. Through an in-person survey, participants will determine the most likely differential diagnosis from the most likely etiologies: syphilis, leprosy, tuberculosis, cryptococcosis, and blastomycosis. This poll will highlight the ambiguity associated with determining differential diagnoses in disarticulated skeletal material, which is lacking contextual information.

Gina M A **CARROLL** (University of Calgary, Canada), Andrea **WATERS-RIST** (Leiden University, The Netherlands) & Sarah A **INSKIP** (Leiden University, The Netherlands)

INVERTED SCHNEIDERIAN PAPILOMA: A REPORT OF A RARELY CONSIDERED SINONASAL NEOPLASM.

During the routine assessment of skeletal material excavated from Middenbeemster, a post-medieval (~AD 1829-1866) Protestant cemetery in Northern Holland, an adult male with an unidentified resorptive-reparative, hyperostotic choanal lesion was discovered. The individual was analysed macroscopically and via computed tomography. Based on the radiographic and phenotypic characteristics of the lesion, it was determined that an inverted Schneiderian papilloma (ISP) was most likely the primary pathogenic mechanism. Originally 'discovered' in AD 1854, ISPs are classified as endophytic epithelial neoplasms histopathologically characterized by the inversion of the respiratory epithelium into the underlying stromal tissue (the Schneiderian membrane). While ISPs have generated an appreciable amount of interest within the medical community they are rarely, if ever, considered as part of the differential diagnosis for lesions within the sinonasal tract. This study presents the macroscopic and radiographic findings associated with the affected individual, and provides a brief description of the pathophysiology and aetiology of ISPs using both biomedical and bioarchaeological frameworks. A list of differential diagnoses is also provided. To the best of the authors' knowledge, this research is the first reported case of ISP within paleopathology; a feature which demonstrates the under-reported and under-considered nature of the lesion within the discipline. As such, this research also seeks to highlight the need to consider ISPs whenever slow-growing sinonasal neoplasms are suspected, as well as in cases which exhibit focal rhinitis.

Natasha A **CASTELLON-HINKLE** (UC Berkeley, USA), Dana E **BECKER** (UC Berkeley, USA), Emily **FIELDS** (UC Berkeley, USA), Thea M **HANSON** (UC Berkeley, USA), Rebecca S **JABBOUR** (Saint Mary's College of California, USA) & Gary D **RICHARDS** (University of the Pacific, USA)

3D RECONSTRUCTION OF AN ACHONDROPLASTIC SKELETON FROM PREHISTORIC CENTRAL CALIFORNIA. ***

In modern contexts the chondrodystrophies have an incidence rate of 1/25,000. In the global record, covering ~10,000 years, there are only 19 prehistoric cases. Although partially preserved skeletons complicate diagnoses, achondroplasia is the best-represented chondrodystrophy globally ($n=10$, plus $n=3$ possible). In North America the record comprises six achondroplastics ranging in time from 50 BCE to 1800 CE. We present a 3D reconstruction of the most complete prehistoric achondroplastic individual and provide differential diagnoses for other pathological processes impacting the skeleton. We also discuss a humerus with a tentative diagnosis of achondroplasia that may represent the oldest example of the condition in North America.

The female skeleton described derives from the Augustine Site (CA-Sac-127: Late Horizon 1500-1800 CE) while the male(?) humerus derives from the Tank Site (CA-LAN-1: >3000-1000 BCE). A third prehistoric (un-provenienced) achondroplastic cranium was employed for comparisons. Scanning of individuals was on a GE LightScribe VCT scanner (0.3-mm isotropic voxels). Isosurfaces, volume

renderings, reconstruction, and visualization of endocranial and internal bone surfaces was carried out in Amira (v. 5.5).

Comparisons with literature descriptions and reference to other chondrodystrophic individuals confirm the diagnosis of achondroplasia for the female. Reconstruction allowed visualization of spinal defects (kyphoscoliosis, gibbus) and joint malformations. Thoracolumbar collapse appears due to osteoporosis. Porotic parietals indicate porotic (symmetrical) hyperostosis while cranial lesions indicate a cavernous hemangioma. Alternatively, achondroplastic-specific arterial and diploic enlargement does not indicate pathology. Deeper insight into the impacts of pathological processes on individuals can be obtained via 3D analysis and reconstruction of skeletons.

Lenka **CERVENKOVA** (Charles University in Prague & University of South Bohemia, Czech Republic), Zuzana **SCHIEROVA** (Charles University in Prague, Czech Republic) & Jakub **LIKOVSKY** (Academy of Science of the Czech Republic, Czech Republic)

DIAGNOSTIC CRITERIA FOR ANATOMICAL CHANGES LEADING TO ACETABULAR DYSPLASIA.

Acetabular dysplasia represents the mildest end of the spectrum of developmental dysplasia of the hip (DDH). Acetabular dysplasia entails increased obliquity and loss of concavity of the acetabulum, but where the femoral head still articulates normally in the joint (Mitchell & Redfern 2008). Because it affects the hip joint, which is important for strength and stability of the entire skeleton, this apparently minor abnormality can have a profound affect upon much of the musculoskeletal system. The aim of the study is to describe anatomical changes of the acetabulum which can be a preceding stages of acetabular dysplasia affecting the hip joint. We also determine the prevalence of this conditions in our archeological skeletal sample. The material under study were the human skeletal remains derived from the Mikulčice settlement agglomeration (Central Europe), which represent one of the largest early medieval population sample in Europe, mostly from the 9th century. These preceding stages of acetabular dysplasia mainly involve changes to superolateral acetabular rim such as depressions and deformations of the shape of acetabular rim, which represent an unstable hip joint. The prevalence of structural changes preceding acetabular dysplasia was 5.8 %, while prevalence of acetabular dysplasia was 1.6 %. Because DDH, including its stages, is a complex musculoskeletal disorder affecting gait and other movements, it is important for paleopathology to study these conditions and estimate the clinical symptoms that an individual may have suffered during lifetime.

Mitchell PD & Redfern RC. 2008. Diagnostic criteria for developmental dislocation of the hip in human skeletal remains. *Int J Osteoarch* 18: 61-71.

Laura **CASTELLS NAVARRO** & Jo **BUCKBERRY** (University of Bradford, UK)

DIAGNOSING DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS (DISH) BEFORE VERTEBRAL ANKYLOSIS.

Diffuse idiopathic skeletal hyperostosis (DISH) is a spondylarthropathy commonly associated with males over 50 years of age (e.g. Julkunen et al 1971, Maat et al 1995). However this observation is likely to be biased by the diagnostic criteria used since to issue a positive diagnosis, 3 or 4 vertebrae must be ankylosed (e.g Resnick and Niwayama 1975, Rogers and Waldron 1995). Furthermore, it has been suggested that the development of this ossification is lengthy process, thus the onset of the disease could be between the second and the fourth decade of life (Mader 2008). To identify the early stages of DISH, 38 individuals (26 males and 12 females) with DISH between 52 and 89 years old from the WM Bass Donated Skeletal Collection were analysed.

Preliminary results show that, at either end of the ankylosed vertebrae, isolated outgrowths with vertical orientation, arising from the central portion of the vertebral body and unaccompanied by discarthrosis are present. These outgrowths could represent the earliest manifestations of the disease. The relationship between the spinal and the extraspinal manifestations (ESM) was also evaluated. Initial observations demonstrate a great variability in the presentation of ESM in advanced cases of DISH suggesting that the use of ESM as a DISH indicator should be brought into revision.

The identification of the early stages of the disease could help in the earlier diagnosis of DISH in clinical medicine and to improve our understanding of the relationship between DISH and the socioeconomical characteristics of a population.

Jason J CROSBY (Arizona State University, USA)

PALEOPATHOLOGY AT JEBEL TOMAT, SUDAN.

Paleopathological examination of large skeletal collections and new archaeological discoveries provide a continuous source of data for researchers interested in reconstructing the health of past peoples. Smaller assemblages from past excavations are often overlooked even though they may present valuable information, especially when analyzed in a modern bioarchaeological context. Using standard macroscopic data methods for paleopathological assessment, this study investigates the human remains from Jebel Tomat (n=3), an archaeological site dating to the Meroitic Period of ancient Nubia (350 BC - 350 AD).

The archaeology at Jebel Tomat captures an extensive rural settlement on the periphery of the Meroitic state, where the pottery tradition and scarcity of iron tools suggests continuity with earlier periods in the region (Edwards 2004, Phillipson 2005). The paleopathological analysis takes into account all three burials from the site, but primary focus is placed on the skeletal remains of a relatively well-preserved young adult male. The observed pathology in this individual (cribra orbitalia, osteoarthritis) is considered in the context of possible dietary and activity-based stresses and used in

comparison with published material from contemporaneous sites in the Meroitic state as well as its periphery.

The small number of burials at Jebel Tomat and their fragmentary condition limits the ability to generalize about the health and well-being of the larger transhumant populations that lived within the settlement. A paleopathological assessment of the skeletal materials, however, does provide much needed information from human remains in a region receiving an increasing amount of archaeological attention.

A Joanne CURTIN (University of West Florida, USA)

DEVELOPMENTAL DEFECTS OF THE TEETH AND AXIAL SKELETON IN A PREHISTORIC POPULATION FROM THE SOUTH COAST OF BRITISH COLUMBIA.

This poster presents a survey of congenital anomalies observed in a collection of secondary burials recovered from a series of five burial caves on Gabriola Island, British Columbia. More than 170,000 teeth, bones, and bone fragments were recovered from these five sites, representing a minimum of 147 individuals (116 adults, 5 adolescents, 8 children and 18 infants). Dental anomalies described and discussed include supernumerary teeth, dental agenesis, and germination/twinning; postcranial observations focus on anomalies in the vertebral column (segmentation failure, spondylolysis, and cleft neural arch). The Gabriola Island burials were disarticulated, commingled, and highly fragmented which makes direct comparisons with other South Coast skeletal samples problematic. Preliminary results, however, suggest that these anomalies occur with an unusually high frequency in the Gabriola Island sample. Possible reasons for this pattern are discussed.

Heidi S DAVIS (University of Arkansas, USA)

SPINAL HEALTH AT TELL EL-AMARNA.

The site of Tell el-Amarna represents the remains of a new Egyptian capital built by the Pharaoh Akhenaten during the 18th Egyptian dynasty and occupied for a brief period of approximately 17 years. This site has been the subject of much research, publication, and speculation, however, direct evidence from the general populous was not available until the recent identification of five cemeteries. These provided the first opportunity to investigate skeletal health and demographics of the non-elite population interred at Amarna during this period of radical socio-cultural change. The first cemetery excavated was the South Tombs Cemetery (STC), which yielded a total of 417 individuals. Excavations of a second cemetery, the North Tombs Cemetery (NTC), has just begun and in 2015, 115 individuals were recovered, with 77 individuals analyzed to date. This study assesses spinal health in the two samples, with a focus on rates in adolescents and young adults. Previous research on the STC sample found high rates of spinal trauma, but data from adolescents had not been analyzed. The first season of NTC data collection show the majority of the sample represents adolescent and young adult individuals, with a high frequency of spinal injury. This prompted the collection and analysis of

adolescent spinal injury from the STC for comparison. Spinal health, evaluated by the presence or absence of vertebral fracture, Schmorl's nodes, and osteophyte development, was examined along with spina bifida. The results indicate that the adolescents and young adults of both samples show high rates of spinal trauma.

Annamaria DICESARE (Quinnipiac University, USA), **Dario PIOMBINO-MASCALI** (Regione Siciliana, Italy), **Ron BECKETT** (Quinnipiac University, USA), **Mark VINER** (Cranfield University, UK), **Gerald CONLOGUE** (Quinnipiac University, USA), **Aniello CATAPANO** (Quinnipiac University, USA), **Jennifer CURRY** (Quinnipiac University, USA) & **Katherine J HARPER-BECKETT** (Quinnipiac University, USA)
THE USE OF DUAL IMAGING STATIONS FOR INCREASED PRODUCTIVITY FOR LARGE SCALE RADIOGRAPHIC EXAMINATION OF MUMMIFIED REMAINS.

In a clinical radiography setting, both anterior posterior (AP) and lateral radiographs are fundamental for proper radiographic examination of all anatomy. The same is true for objects aside from patients, such as mummified remains. Completing AP and lateral radiographs of these remains requires the manipulation of the x-ray equipment rather the inanimate subject. However, the use of a single imaging station necessitates a greater amount of time due to repositioning and readjustment of exposure factors to achieve acceptable AP and lateral radiographs. With a group of 60 mummies scheduled to be radiographically examined in a one week period, two imaging stations were employed, one for AP and another for lateral radiographs in order to optimize productivity. Each station utilized separate set-ups with differing Source-to-Image Receptor (SID) lengths and x-ray sources, as well as, different direct digital radiographic (DR) receptor plates. All radiographs were acquired within a three day period, as opposed to the original estimated one week period. During the project, times of acquisition for each radiograph were recorded onto preformatted charts, which were later further analyzed and utilized to demonstrate throughput at each station. It was determined that the quality and productivity of the entire project was improved with the use of the dual imaging stations.

Victoria M DOMINGUEZ, Timothy P GOCHA & Amanda M AGNEW (The Ohio State University, USA)
DIFFUSE ENDOSTEAL BONE FORMATION RESULTING FROM METASTATIC BREAST CANCER: A HISTOLOGICAL CASE STUDY.

Evidence of cancer's long history in humans exists in the archeological record, though it is restricted to cases in which cancer either originated in or metastasized to bone. Skeletal lesions from metastasized carcinomas, however, are varied in appearance and make differential diagnosis from skeletal material difficult. Modern clinical diagnostic tools are of limited use in paleopathology because of their reliance on non-mineralized material (e.g. blood work, decalcified biopsies). As a result, skeletal references for confirmed cases of metastasized carcinomas are rare. The current case study presents a histological analysis of the rib and femoral metastases resulting from a primary diagnosis of breast cancer in a 27 year-old female.

Multiple, undecalcified cross-sections from the femoral midshafts and various locations throughout the 6th ribs were examined under brightfield and polarized light microscopy. Overall, this individual presents with a mixed osteolytic and osteoblastic response, which is relatively uncommon in metastatic tumors of bone. The osteolytic response, observed only in the ribs, is primarily on the periosteal surface and extends moderately into the cortex. In contrast, the osteoblastic response primarily affected the endosteal border, resulting in a proliferation of woven-fibered bone highly disorganized in appearance. This indicates rapid deposition though some areas show evidence of incipient remodeling. This process is more marked in the rib, resulting in an almost complete infilling of the medullary area. Recognition of these patterns in a confirmed case of metastatic cancer may aid differential diagnosis in a paleopathological setting.

Sarah DRESSER (California State University Long Beach, USA) & **Alyson CAINE** (Cogstone Resource Management, USA)

DENTAL DISEASE OF THE TONGVA PEOPLE.

Dental disease is a common disease in prehistory. However, limited information is known of pathological conditions, including dental diseases, of the Southern California Native American Gabrielino-Tongva tribe. The aim of this research is to identify and disseminate patterns of dental disease in prehistoric Gabrielino-Tongva peoples through macroscopic analysis (Buikstra and Ubelaker 1994). The skeletal collection is comprised of discrete and disarticulated individuals. True and crude prevalence of antemortem tooth loss, periapical abscess, and carious lesions characterize the diet, cultural practices, and health of this population.

The prevalence of dental disease has been assessed from a minimum of 50 individuals. Crude prevalences of discrete individuals are: 21.1% for anterior antemortem tooth loss, 36.8% for posterior antemortem tooth loss; 5.3% for anterior periapical abscess, 10.5% for posterior periapical abscess; and 0% for carious lesions, both anteriorly and posteriorly. True prevalences of discrete individuals are: 14.7% for anterior antemortem tooth loss, 25.2% for posterior antemortem tooth loss; 1.3% for anterior periapical abscess, 2.8% for posterior periapical abscess; and 0% for carious lesions, both anteriorly and posteriorly. In the disarticulated individuals, crude prevalences are: 7.9% for anterior antemortem tooth loss, 34.2% for posterior antemortem tooth loss; 2.6% for anterior periapical abscess, 7.9% for posterior periapical abscess; and 5.3% for anterior carious lesions, and 13.2% for posterior carious lesions. True prevalences of disarticulated individuals are: 1.9% for anterior antemortem tooth loss, 11.9% for posterior antemortem tooth loss; 0.6% for anterior periapical abscess, 1.6% for posterior periapical abscess; and 0.6% for anterior carious lesions, and 1.3% for posterior carious lesions. The dental disease present in the dentition suggests a diet of coarsely processed grains or heavy attrition; this diet is consistent with those of similar Los Angeles basin Native American groups.

Rose DREW (University of Winchester, UK) & **Gwyn MADDEN** (Grand Valley State University, USA)
PHYSICAL IMPAIRMENT AND DISEASE ON TUDOR WARSHIP *MARY ROSE* VERSUS OSLO HOUSE OF CORRECTIONS.

Skeletal remains from a Norwegian workhouse – by definition a place for marginalised people – are compared with remains from the wreck of a Tudor warship. These populations offer divergent concepts of ‘work’ and community inclusion, comparing the mid-Sixteenth century, before industrialization and the rise of state capitalism, and the early Nineteenth century. The presumably all-male crew from *Mary Rose* died during a well-documented disaster; the Oslo House of Correction (HoC) sample is from a cemetery only for inmates, in use for a limited, documented period of time.

Eighty-two ‘Fairly Complete Skeletons’ (FCS) were examined from *Mary Rose*, and 86 fairly complete or identifiable individuals examined from HoC. Remains were studied via gross observation with hand and microscopic magnification using emerging and traditional assessments for disease. Healed traumatic injury is observed in both populations, though at higher crude prevalence in the *Mary Rose*; 58.5% (48 of 82 Fairly Complete Skeletons) have healed hip fractures, joint injuries, and indications of gait anomalies, but few have evidence consistent with infectious disease, either reported by Stirland, or observed in recent work (6/82: 7.3%). In contrast, 54.6% of the fairly complete (or discrete) individuals from the workhouse have evidence of tuberculosis or syphilis, with less than 19% of these same individuals presenting with dislocations, healed fractures or severe orthopaedic disorders. Despite skeletal evidence of widespread disabling injury, *Mary Rose* crew were employed and mostly healthy, whilst the HoC inhabitants were warehoused and exposed to infectious disease.

Elizabeth DUFFY & Debra MARTIN (University of Nevada-Las Vegas, USA)
HIDING IN PLAIN VIEW: NONLETHAL VIOLENCE IN THE LAST 100 YEARS AT MESA VERDE (AD 1200-1300). ***

During the 700 period Mesa Verde was occupied by the Pueblo (AD 550 to 1300), people spent the majority of that time living on the mesa tops. However, in the late AD 1000s people moved within the alcoves beneath overhanging cliffs and began building defensive structures and housing with up to 150 rooms, making these defensive sites difficult to access but visible to those in the canyons. By the late AD 1270s there were no people left in the Mesa Verde Region. Analysis of the skeletal assemblages from several of the larger alcove communities revealed the frequencies of healed cranial depression fractures. Of the total sample of 77 individuals, 38% of males and 47% of females exhibited nonlethal head wounds. In both females and males, individuals with nonlethal head wounds were primarily young or middle aged accounting for 88% of the total number of individuals with nonlethal head wounds. The location of wounds on females were largely on the front and back of the cranium whereas males were more variable with wounds occurring on the front, top, and back of the cranium. Head wounds located above the hat brim line and other facial fractures are indicative of hand to hand fighting for both males and females. This suggests males and females were involved in similar forms of violence and that they were increasingly attacked by outsiders culminating in mass migrations out of the area.

Megan DUNCANSON (University of Louisville, USA), **Chris KLAES** (University of Louisville, USA), **Sharon DEWITTE** (University of South Carolina, USA) & **Fabian CRESPO** (University of Louisville, USA)
PERIOSTEAL LESIONS AS MARKER FOR SYSTEMIC INFLAMMATORY SHIFTS IN TUBERCULOSIS AND LEPROSY INFECTIONS: AN *IN VITRO* ANALYSIS.

It is possible that during long lasting chronic infections such as tuberculosis (TB) and leprosy (LP) those individuals that generate a stronger immune response will produce a shift in the systemic levels of inflammatory mediators, heading to a potential hyper-inflammatory state or hyper-inflammatory phenotype (HIP) while fighting a chronic infection. Consequently, the systemic immunological shift could affect other persistent infections such as the one observed in periosteal lesions where the most common pathogen detected is *Staphylococcus aureus*. The objective of this study is to determine if *in vitro* immune cells exposure to *Mycobacterium tuberculosis* or *M. leprae* lysates impacts subsequent immune responses to persistent/local pathogen *S. aureus*. During a two-day experiment, we exposed human peripheral blood mononuclear cells (PBMCs) to either *M. tuberculosis* or *M. leprae* lysates on day one; sequentially on day two, we exposed the same culture to *S. aureus*. The expression of key proteins (TNF α and IFN γ) involved in the immune response was measured by ELISA. Preliminary results showed that early exposure (day 1) to LP lysate induces higher IFN γ expression when the same cells are exposed to *S. aureus*. Interestingly, early exposure to *S. aureus* altered IFN γ expression when cells subsequently were exposed to TB or LP lysates. These preliminary results show an immunological alteration when PBMCs are alternatively exposed to two different pathogens. These findings could be useful in osteological analyses when considering how TB or LP infection can have effect on other osteological lesions through the promotion of a HIP.

~~**Kori FILIPEK-OGDEN** (Durham University, UK), **Charlotte ROBERTS** (Durham University, UK), **Janet MONTGOMERY** (Durham University, UK), **Rebecca GOWLAND** (Durham University, UK), **Julia BEAUMONT** (Bradford University, UK) & **Katie TUCKER** (University of Winchester, UK)
PEAKS AND TROUGHS: LIFE HISTORY APPROACHES TO DIET, STRESS, AND CARE IN THE YOUNG INDIVIDUALS OF THE ST. MARY MAGDALEN LEPROSY HOSPITAL (WINCHESTER, UK). ***~~

~~Numerous documentary sources and social notions purport that medieval leprosy sufferers were exiled and quarantined to *leprosaria*. Reportedly, these *leprosaria* were not care facilities, but communes for the ‘unwanted,’ however more recent archaeological evidence has countered this long-standing belief by highlighting evidences that these facilities were providing care and treatment for its residents (Rawcliffe 2006; Roffey and Tucker 2012; Roffey 2013). Therefore, it must be considered whether individuals found buried at leprosy hospitals were there for care and treatment, and not exclusively assume that they were forcibly exiled to these ‘hospitals.’ This study employs a novel isotopic approach to examine the individual life histories of children, adolescents, and young adults displaying skeletal signs of lepromatous leprosy in Medieval England. Whole life dietary profiles (carbon and nitrogen stable isotopes) spanning birth to death from 10 targeted individuals were obtained at a sub-annual scale using collagen from high-resolution dentine sections of canines and second or third molars. The data from the analysis of dietary carbon and nitrogen, used in conjunction with skeletal and clinical evidence, offers a unique view into the physiological and nutritional stresses that may have~~

~~compromised leprosy immunity, and highlights the potential of dietary analyses to reveal care and treatment of sufferers including their lives subsequent to their entry into a *leprosarium*.~~

Sandra GARVIE-LOK (University of Alberta, Canada), **Sherry C FOX** (Arizona State University, USA) & **Steven J FRIESEN** (University of Texas at Austin, USA)
HEALTH AND DIET IN A NON-ELITE SAMPLE FROM ANCIENT CORINTH.

Ancient Corinth sat at the geographical gateway between the Peloponnese and Attica, protected by the fortress of Acrocorinth and served by two ports. Corinth was an important commercial center with a resident elite whose lives are documented in text and in stone. Here, we investigate quality of life in a broader range of the population. A paleopathological study of 94 individuals from Hellenistic and Roman period burials (3rd century BCE – 3rd century CE) was conducted to ascertain general health. Stable isotope analysis of 32 humans from an Early Roman component (1st-3rd centuries CE) allowed assessment of diet. Demographic data suggest relatively high infant and childhood mortality (30.9% under 12 years of age at death). LEH is present in 12 individuals. Pernicious anemia or folic acid deficiency is suggested by cribra orbitalia in 11 individuals. Mean statures (148.29 cm for females, 165.76 cm for males) are relatively low. The stable isotope values suggest a grain and oil based diet with modest animal protein, including significant amounts of fish. Fresh fish, dried fish, and fish sauce (*garum*) may have all been easily available at Corinth because of its role as a shipping and commercial center. This diet stands in contrast with most diets reconstructed for other Roman and early Byzantine era Greek sites, whose animal component appears to have been larger and more focused on dairy and meat. It combines with the skeletal stress indicators to suggest that Corinth's non-elite underwent periods of scarcity severe enough to significantly affect childhood health.

Rebecca J GILMOUR, Megan BRICKLEY, Erik JURRIAANS & Tracy L PROWSE (McMaster University, Canada)

A NEW METHOD TO ASSESS BONE LOSS IN RADIOGRAPHS OF FRAGMENTARY SECOND METACARPALS. ***

Second metacarpal (MC2) radiogrammetric methods are often used in palaeopathological studies to identify cortical bone loss, such as that associated with advancing age and osteoporosis. MC2 radiogrammetry is typically limited to complete elements and consequently excludes a number of individuals who, because of increased fragility related to bone loss, may be more susceptible to post mortem damage.

This paper presents a digital X-ray radiogrammetry approach, adapted from the clinical literature, which calculates the amount of MC2 diaphyseal cortical bone within a 19-millimeter square region of interest (ROI). Antero-posterior radiographs of MC2s from 1st-4th century Roman sites in the UK (Ancaster) (n=48) and Italy (Vagnari) (n=8) were used to test this method. Results show that a standardized ROI (19mm) can be reliably used to measure cortical area at the narrowest part of the

MC2 diaphysis. A strong correlation in cortical area is present between the standardized ROIs and those scaled to the bone's length ($r=0.955$, $p<0.000$). Compared to traditional cortical indices, ROIs appear to more clearly identify age-related deviations from peak bone mass.

The ROI method is an easily applied, reliable alternative to measuring and relatively assessing cortical bone in damaged archaeological remains. Including incomplete MC2s will better characterize the range of cortical bone present in archaeological collections. The findings indicate that the ROI method has potential to contribute widely to the palaeopathological observation of the prevalence and patterns in past bone loss.

Emmalea GOMBERG (University of Southern Mississippi, USA)

HEALTH OF THE TIPU MAYA: A REEVALUATION OF POROTIC HYPEROSTOSIS, CRIBRA ORBITALIA, AND SCURVY.

At the Maya site of Tipu in western Belize, approximately 600 individuals dating to AD 1541-1638 were recovered in the nave and cemetery of the visita mission. The series was analyzed in 1989 for evidence of porotic hyperostosis and cribra orbitalia, and high rates of both conditions were observed. However, new more conservative scoring standards as well as different etiologies for the conditions, including B12 and Vitamin C deficiencies, have since emerged. These would suggest different social and environmental stressors than just those associated with iron deficiency anemia. Therefore, a re-evaluation of associated lesions was undertaken.

All individuals with at least 50% of the crania were examined, providing a final sample size of nearly 300 individuals. The four major cranial vault bones, orbital roofs, and greater wings of the sphenoid were examined for porotic and sclerotic lesions.

Even with the revised scoring standards, levels of lesion activity were still high. Juveniles were the most frequently affected with 36% showing porosity traditionally associated with PH and nearly 90% with those associated with scurvy. Among adults, about 10% of males exhibited cribra orbitalia and two-thirds displayed porosities on the temporal and sphenoid. Females, however, at 48% were over twice as males likely to have PH.

These data suggest Tipuans may have been experiencing Vitamin C deficiency, which has not been previously considered in previous analyses. They also suggest that males were less likely to suffer from these health disparities than females or juveniles. Possible explanations for these findings are explored.

Julia GRESKY (German Archaeological Institute Berlin, Germany), **Laura SCHWARZ** (German Archaeological Institute Berlin, Germany), **Tyede Helen SCHMIDT-SCHULTZ** (University of Göttingen, Germany) & **Michael SCHULTZ** (University of Göttingen, Germany)

DENTAL DISEASES OF EARLY FIRST MILLENNIUM BC MOUNTED PASTORALISTS IN THE KUNLUN MOUNTAINS, CHINA.

The dental status of populations can be a good indicator for dietary habits, oral hygiene, and work related use of the teeth. As there is little known about the population of Liushui, Xinjiang, West China, dating to the early first millennium BC, an attempt was made to acquire information about their subsistence strategy and way of life by examination of their dental health. Paleopathological investigations with macroscopic and optical-microscopic techniques were carried out on about 1600 teeth from 81 adult individuals. Investigated features were ante-mortem tooth loss, caries, periodontal changes, periapical lesions, dental attrition, calculus, hypoplasia, chipping, and interproximal grooving.

The frequency of caries and apical processes was low, probably due to a diet poor in carbohydrates. In contrast, ante-mortem tooth loss was more common, with the main location in the upper incisors, lower second premolars and second molars. The high frequency of the lost upper incisors may coincide with the frequent occurrence of facial trauma. Dental attrition was most severe in the first molars and the lower incisors with the irregular patterns suggesting rather work procedures than dietary-based abrasion of the teeth. The patterns of dental health correspond to those supposed to be typical of hunter-gatherers rather than of agriculturists except the very rare frequency of interproximal grooving. Assuming it to be due to the removal of fibers from the interproximal spaces, it may be found more often in mainly meat consuming people. Possibly, it was not a widely accepted habit or other teeth-cleaning methods were used.

Amanda GROFF & Tosha DUPRAS (University of Central Florida, USA)

INVESTIGATING THE RELATIONSHIP BETWEEN TUBERCULOSIS, LEPROSY, AND MIGRATION USING STABLE ISOTOPE ANALYSIS: A PILOT STUDY.

Investigating the origin of individuals who are co-infected with tuberculosis and leprosy can provide useful insight into disease origin, and motivations for migration. A pilot study was conducted to address the origins of six infected or co-infected individuals excavated from the Kellis 2 Cemetery, Dakhleh Oasis, Egypt. Oxygen isotope ratios, in correlation with DNA tests for co-infection, were used to investigate origin (e.g. Nile Valley or the Dakhleh Oasis) of individuals with leprosy, and those who were co-infected with tuberculosis and leprosy. Individuals with $\delta^{18}\text{O}$ values that express a combination of Nile Valley and Dakhleh Oasis oxygen values are identified as 'travelers', or individuals who moved between the two locations. Results indicate that individuals suffering from a co-infection of tuberculosis and leprosy were either local to Dakhleh Oasis (n=2) or were local oasis travelers (n=2). Conversely, two individuals identified as originating in a foreign location were not co-infected, and only were infected with leprosy. Tentatively, it can be argued that it is likely the two foreigners arrived in Dakhleh Oasis shortly before their deaths, since they did not contract tuberculosis. This hypothesis lends to the idea that the ill were migrating to Dakhleh Oasis to access healing waters. Likewise, it can

also be suggested that perhaps tuberculosis was more endemic to the oases. Results of this pilot study also highlight the usefulness of combining two methods of testing.

Jazlynn HALL & Melissa S MURPHY (University of Wyoming, USA)

DIFFERENTIAL DIAGNOSIS OF DISEASE FROM THE RIMAC VALLEY, PERU.

Long-term investigation by the Rimac Valley Bioarchaeology Project (RVBP) has documented the skeletal remains of 973 individuals from eight cemeteries or complexes located in the Rimac Valley on the central coast of Peru. Dating from approximately 200 BC –A.D. 1540, the people from these communities experienced life prior to Inca rule, then Inca occupation of the region and the collapse of the Inca Empire after Spanish conquest and invasion. Previous research with some of the sample has documented the prevalence of traumatic injuries, degenerative joint disease, non-specific indicators of stress, as well as diet reconstruction from stable isotope analysis of bone and dental tissues. Yet the paleopathological study of specific diseases has yet to be undertaken. Therefore, this study is a differential diagnosis of the different pathological lesions and their patterning and distribution on the individuals from a subsample (N= 37) of the entire RVBP sample. The individuals in this subsample exhibited hypertrophic bone formation on multiple skeletal elements, abnormal bone loss on multiple skeletal elements, or a combination of the two. We employ macroscopic, demographic, radiographic, archaeological and modern clinical data in our analyses. Possible diseases include tuberculosis, brucellosis, metastatic carcinoma, treponematosi, and hypertrophic osteoarthropathy, among others. We then attempt to reconcile these results with our previous work on the skeletal health of communities from the central coast of Peru and contextualize these results within archaeological knowledge about life in this region.

Amanda R HARVEY (University of Nevada Reno, USA), **Kirk SCHMITZ** (University of Nevada Reno, USA),

Christopher VON NAGY (University of Nevada Reno & Florida State University, USA), **Eliseo PADILLA-**

GUTIÉRREZ (National Autonomous University of Mexico, Mexico), **Paul SCHMIDT-SCHOENBERG**

(National Autonomous University of Mexico, Mexico) & **Mary POHL** (Florida State University, USA)

A DIFFERENTIAL DIAGNOSIS OF A FORMATIVE PERIOD MANDIBLE.

During the 2014 field season of the Urban Origins Project, a human mandible fragment was discovered at Oxtotitlán cave in Guerrero, Mexico. The cave is part of a larger Middle to Late Formative Period site called Quiotepec-Oxtotitlán. Material culture analyses indicate intense activity during its occupation, and exhibit ties to local cultural complexes, as well as long distance trade. Found at the mouth of a rockshelter in the northern part of the cave complex, it is one of two fragments of human remains from the cave. No metal tools were used during excavation, and the poorly sorted matrix is a dry, fine silty loam with stones ranging from small cobbles to large boulders.

The extent of human manipulation of the fragment is multifaceted. Three factors, polishing, marks, and discoloration, are presented to the larger paleopathology community for differential diagnosis. The

polishing on the fragment could be from rubbing, abrasion, constant touch (similar to lab specimens), or natural taphonomic processes. The marks are near the mental foramen, and are similar to cut marks, root marks, bug burrowing, or even possibly rock abrasions. The discoloration is grey in nature, supplemented by white and black areas. It is either from direct heat, indirect heat, magnesium oxide in the soil, or from other taphonomic processes associated with the cave. With the goal of obtaining unbiased diagnoses, our conclusions will be discussed in person. Together, the paleopathology community will jointly aid in creating a better understanding of the mandible's significance within the larger site context.

Mauricio HERNANDEZ (UCLA, USA), **Hong ZHU** (Jilin University, China) & **Dong WEI** (Jilin University, China)

AN EURASIAN AMAZON ON HORSEBACK: IDENTIFICATION OF A FEMALE ARCHER VIA ARCHAEOLOGICAL AND PALEOPATHOLOGICAL APPROACHES. +++

In this poster, we evaluate the possible occupation of an adult female buried at the site of Heigouliang, located on the northern edge of the Tianshan mountain range in eastern Xinjiang province, China. The site, which consists of approximately 15 single and multiple-burial tombs, was briefly occupied during the early Western Han period (c.200 BCE) by Inner Asian pastoralist groups. The Xiongnu, a confederation of nomadic steppe tribes, eventually conquered the vast, arid steppes of Eastern Eurasia on horseback, unleashing multiple raids on Han dynasty outposts. Skeleton M4(C), a middle-aged female, represents the central burial in a tomb containing three additional skeletons. Although incomplete, her upper limbs display marked, asymmetric entheseal and degenerative joint changes. We carried out a complete assessment of musculoskeletal stress markers and joint scoring for osteoarthritis. The right humerus displays hyper-developed insertion sites of the *deltoideus* and *pectoralis major* muscles, indicating repeated contraction under strain. Moreover, all three articular surfaces forming the left elbow display moderate osteoarthritis with slight eburnation in the articulation of the radial head and distal humerus, indicating heavy, repeated joint loading. In addition, her femora display slight antero-posterior bowing, which is indicative of horseback riding. After comparing these patterns to various contemporary occupations that may result in similar osteological changes, we conclude this individual to have been a left-handed, mounted archer. Our findings shed light onto the sexual division of labor of nomadic steppe tribes and show that habitual activity may be reconstructed with the help of adequate archaeological and historical data.

Tina JAKOB (Durham University, UK) & **Joe W WALSER III** (University of Iceland & National Museum of Iceland, Iceland)

DIFFERENTIAL DIAGNOSIS OF CALCIFIED LARYNGEAL CARTILAGE.

Calcified cartilage of laryngeal structures (e.g., thyroid and cricoid cartilage) is occasionally recovered during the excavation of archaeological human remains. Such calcifications are usually not regarded as being caused by a pathological process, but are seen as an indication of older age. Male individuals are

more prone to complete calcification of the thyroid cartilage and the angulation and extent of calcification of the thyroid cartilage has been used to determine biological sex. The calcification of cricoid cartilage is less common, although it still tends to calcify with increasing age. In clinical studies, however, it has been verified that the degree of calcification of these cartilaginous tissues is not a reliable index of increasing age. Extensive calcification of the laryngeal cartilages, prior to the 3rd decade of life, clinically indicates metabolic or other pathological processes. In this presentation we explore potential pathological conditions that have been associated with cartilage calcifications of the larynx in clinical studies. A small sample (n=6) of a total of 43 post-medieval individuals buried in the Parochial church of San Miguel, Ambel, Aragon, Spain had calcified thyroid and/or cricoid cartilage. Only one of these individuals was female and all but one individual was older than 35+ years at the time of death. By including a variety of co-morbidities in form of soft tissue ossification a range of differential diagnoses have to be considered. These include iodine deficiency and hypothyroidism, elongated styloid process as well as certain seronegative spondyloarthropathies.

Amel LANGSTON (Quinnipiac University, USA), **Paige FERRERI** (Quinnipiac University, USA), **Brittney HIGHLAND** (University of South Alabama, USA), **Jaime ULLINGER** (Quinnipiac University, USA) & **Lesley GREGORICKA** (University of South Alabama, USA).

FETAL DEVELOPMENT IN A SET OF TWINS FROM TELL EL-HESI: A COMPARATIVE MORPHOMETRIC AND BIOCHEMICAL ANALYSIS. ***

The skeletons of two perinates were uncovered from the Ottoman-period (1400-1800 CE) cemetery of Tell el-Hesi, located in modern-day Israel. Excavation of the site took place between 1977-1983, during which time over 400 burials were uncovered. Only those burials identified as “abnormal” were kept, including the remains of two perinates suspected to be twins because they were found buried together with a single broken vessel covering their bodies. This project sought to (a) estimate age for these twins through bone measurement, and (b) analyze stable carbon and nitrogen isotope ratios from bone collagen to examine whether differences in nutrient acquisition may have existed between these two individuals.

Maximum width and length measurements were taken from the following intact bones by two researchers: the basilar portion of the occipital, zygomatic, pars petrous, greater and lesser wings of the sphenoid, post-sphenoid, first rib, clavicle, radius, humerus, ulna, and first metacarpal. Interobserver error was insignificant (Matched Pairs t-test; Twin A: $t=0.38$, $df=20$, $p=0.38$; Twin B: $t=0.093$, $df=32$, $p=0.93$). Analysis of these measurements indicated ages between 24 to 40 weeks for Twin A and 22 to 38 weeks for Twin B, supporting the premise that these two individuals were indeed twins who developed together in the womb. Stable isotope analysis supported this hypothesis, as both carbon (-14.7 and -14.8‰) and nitrogen values (9.2 and 9.4‰) were nearly identical and indicate that both individuals received comparable nutrition. In sum, a variety of bioarchaeological techniques suggest that these two perinates were likely twins.

Savannah LEACH (Indiana University, USA) & **Amanda ROLLINS** (Indiana University, USA)
**NON-MASTICATORY DENTAL WEAR IN THE MIDDLE WOODLAND COMPONENT OF PETE KLUNK
MOUNDS. *****

Dental attrition is the anticipated result of mastication throughout life and is impacted by several factors, including diet composition and food processing technology. However, diet is not the only factor involved in tooth abrasion and alterations. Teeth are often modified intentionally or may show wear patterns due to habitual tooth picking, dentistry practices, disease, or manipulating non-food items. Here we identify patterns of non-masticatory dental wear and associated pathology in the Middle Woodland component of the Pete Klunk Mounds from the Lower Illinois River Valley in west central Illinois. We examined 155 crania containing a total of 2,619 teeth, including 920 anterior teeth and 1,699 posterior teeth, using consistent lighting and a hand lens. Of the crania viewed, 30 individuals showed evidence for dental wear that was not only the consequence of regular, dietary mastication. These wear patterns included interproximal grooves (14 females, 6 males), excessive incisor wear (4 males, 4 females), and lingual polishing (2 females). This suggests a prevalence of non-masticatory dental wear for at least 19.3% of the population. A scanning electron micrograph was obtained for an interproximal groove on an individual from Mound 11, which supported the therapeutic relief hypothesis due to the presence of parallel striations and a dental caries at the cemento-enamel junction. Outside of this therapeutic picking, the rich Hopewell culture of the Middle Woodland time period and the evidence presented of unusual abrasion hints at the function of teeth in a non-dietary manner, such as in material manipulation and production.

Laura LOCKAU (McMaster University, Canada) & **Luca BONDIOLI** (Museo Nazionale Preistorico
Etnografico "L. Pigorini", Italy)
**NEW BONE FORMATION ON THE VISCERAL SURFACES OF THE RIBS IN TWO ROMAN PERIOD
SKELETAL SAMPLES. *****

Proliferative lesions on the visceral surfaces of the ribs can represent valuable evidence for chronic respiratory infections in past populations, following the demonstration in documented skeletal collections of a link between the two. This connection is likely mediated by inflammation of the ribs from chronic and long-standing infection of the adjacent pleura. While such lesions cannot be used to specifically diagnose tuberculosis in skeletal remains, they can more reliably be considered an indicator of chronic respiratory infections. This poster will examine new bone formation on the visceral surfaces of the ribs as an indicator of chronic respiratory infections in two Roman period skeletal samples, one from Ancaster (3rd-4th century AD) in the United Kingdom and one from Isola Sacra (1st-3rd century AD) located near Rome, Italy. At Ancaster, rib lesions exhibit greater prevalence values for both adults and juveniles. However, Ancaster individuals have a smaller average number of ribs affected, and exhibit lesions that are less extensive and show a greater degree of healing than at Isola Sacra. Variation in the age structure of affected individuals, as well as in the appearance and extent of lesions present, suggest important differences in disease expression that may relate to variation in biological or sociocultural factors between the two populations, and would likely have greatly impacted disease experience. These results indicate that qualitative aspects of paleopathological lesions may provide

important information regarding how individuals experienced disease in the past, representing a valuable complement to quantitative measures.

Niels LYNNERUP, Alberte A LUNDQUIST & Chiara VILLA (University of Copenhagen, Denmark)
DIFFERENTIAL DIAGNOSIS BY 3D PRINT.

We present the case of a skeleton excavated in a medieval parish churchyard in Denmark. The skeleton was of a young girl of approx. 17-18 years old with a stature of about 147 cm. The vertebrae C1 and C2 were fused, while there was non-fusion of the vertebral arches of C3-L4 (not all vertebrae were preserved). The sacrum was normal. The dentition showed no anomalies. The nasal aperture was very wide, with flat, wide nasal bones. The maxillary arch was broad, and the mandible lacked both mental foramina. The left temporo-mandibular joint was very small; indeed, the left ramus of the mandible was malformed, with a missing coronoid process and an atrophic ramus articular surface. The left zygomatic process was malformed, and there was agenesis of the left outer ear opening. CT-scanning showed that the inner ear was formed.

Diagnostically, this may point to several congenital malformations and syndromes. However, a closer differential diagnostic approach was difficult because the delicate facial bones, as well as bones of the skull, had become warped taphonomically. In order to overcome this difficulty, we CT-scanned all the bones of the skull and 3D printed them. These 3D printed copies were then joined together in order to correct the taphonomic damage, allowing us to better evaluate the comprehensive changes, indicative of several congenital branchial arch defect syndromes, such as oculo-auriculo-vertebral syndrome (Goldenhaar syndrome). We will present the skeleton, the use of CT in diagnostics, and the use of 3D print to arrive at tentative diagnoses.

Kathryn E MARKLEIN & Madelyn GREEN (The Ohio State University, USA)
A CRACK IN THE LITTLE VINEGAR CUP: CASE OF *OS ACETABULI* WITHIN THE ROMAN PERIOD (2ND TO 3RD C. CE) POPULATION OF OYMAAĞAÇ, NORTHERN TURKEY. ***

Os acetabuli, a developmental or traumatic condition, is reported at an incidence of two to three percent in living populations. However, within archaeological populations, few, if any, cases of this bony anomaly have been published. Among the Roman period (2nd to 3rd centuries CE) skeletal series at Oymaagac, Turkey, an adult male was observed to have an acetabular rim fragment on the medial-superior border of the left acetabulum, a fragment which exhibits the diagnostic features of *os acetabuli marginalis superior*. Based on the absence of hip dysplasia or trauma to the joint, as well as the morphology and orientation of the arthrotic surface of the *os acetabuli*, this case is considered an effect of incomplete fusion between the secondary ossification (*os acetabuli*) and primary ossification (pubis and ilium) centers during late adolescence. Despite neurological and orthopaedic consequences associated with *os acetabuli*, no skeletal atrophy or osteoarthritis is observed in the individual's lower limbs, which may indicate compromised mobility or neuropathy attributable to the acetabular non-

fusion. It is possible that this condition did manifest symptomatically, albeit not skeletally. This male lived nearly twenty years with this bone fragment, which, if symptomatic, suggests that there were resources for temporary treatment and pain relieve as well as support within familial and communal contexts.

Molly MARTELL (University of Florida, USA) & **Sanchita BALACHANDRAN** (Johns Hopkins University, USA)

AN INVESTIGATION OF ELEMENTAL BIOGENIC UPTAKE: PORTABLE X-RAY FLUORESCENCE AS A METHOD OF OSTEOLOGICAL ANALYSIS.

Portable X-ray fluorescence (pXRF) provides non-destructive analysis allowing researchers to identify the elemental composition of surface materials. In situations where destructive analysis is not possible (e.g., human bone), pXRF may be a valuable method for bio-anthropological research. This proof-of-principle study used pXRF to test for presence of a heavy metal (lead) in human bone from two populations expected to show different levels.

XRF analysis was performed on modern (N=9) and archaeological (N=18) human bone samples in order to compare elemental compositions and ascertain the capacities and limitations of pXRF analysis in human bone. The modern sample, provided by the Baltimore Chief Medical Examiner's Office, was the control group and not expected to show presence of lead. An archaeological sample from three Roman era burial urns was the experimental population. We predicted that Roman populations would show identifiable lead values due to prolific use of lead in water pipes and eating and drinking implements. Results showed that all of the samples from the Roman population had identifiable lead levels. Contrary to expectations, two of the nine modern individuals had trace lead levels, which may indicate accidental lead ingestion throughout life. The results of this study show that differences in the elemental composition of human bone can be found using pXRF analysis. Confounding effects, including sample contamination, diagenesis, and cremation must be considered. This experiment indicated that pXRF can be useful in identifying trace elements related to pathology in an archaeological context, both in the lab and in the field.

Simon MAYS (Historic England, UK), **Iain WATT** (University of Exeter & Oxford Archaeology, UK) & **Louise LOE** (Oxford Archaeology, UK)

AN UNUSUAL EROSIIVE ARTHROPATHY FROM MEDIAEVAL ENGLAND.

Classically, diagnosis in palaeopathology is made with reference to alterations produced by known diseases in modern or recent cases. This assumes that manifestations of the various diseases that afflict the skeleton have not altered greatly over the centuries. Occasionally, one encounters specimens that appear to challenge this assumption. This poster describes macroscopic and radiographic examination of a 13th-16th century AD adult male skeleton.

There are erosions affecting the synovial joints of the appendicular and axial skeleton. Few articulations are spared and there is severe destruction in the hands. Erosions are also present at some entheses. Alterations are lytic; there is no syndesmophyte formation or other enthesial or periarticular bony proliferation.

This is clearly an erosive arthritis, but a more precise diagnosis is difficult. The skeletal distribution - axial involvement coupled with a symmetrical polyarthritis of the appendicular skeleton - resembles that in seronegative spondyloarthritis developing in response to psoriasis or other conditions. However, the lesions' purely erosive character, and their concentration more at synovial articulations than at entheses, is more redolent of rheumatoid arthritis.

Clinical studies show that expressions of rheumatoid arthritis may change in populations over fairly short time spans, and manifestations of psoriatic arthropathy may vary markedly in different patients, so finding of palaeopathological cases of erosive arthropathy which do not fit well with modern clinical classifications may not be unexpected. This potential for variability within a population, and for potentially quite rapid secular change in expression, makes the identification of the erosive arthropathies in palaeopathology particularly challenging.

Amanda McCaffrey (SUNY Binghamton University, USA)

EXAMINING ROBUSTICITY DURING THE INDUSTRIAL REVOLUTION IN COPENHAGEN.

Attempting to understand the health changes associated with the Industrial Revolution is a growing trend in European bioarchaeology, with research being conducted on the origin of modern diseases, diet, and diseases of the time period. Previous research has focused on stature as a proxy for nutrition levels; however, there has been no research examining robusticity, an indicator of physical activity levels, during the Industrial Revolution. This is an important area of research as the type of labor changed during this period due to socioeconomic status. Differential robusticity, along with prevalence of disease, and stature, can reveal an embodiment of socioeconomic status. This may contribute to overall differences in well-being during the Industrial Revolution. While not possible for this project, future research should incorporate analysis of pathological conditions such as osteoarthritis, tuberculosis, and rickets/osteomalacia in addition to robusticity. This project utilizes three collections from Copenhagen in order to examine robusticity changes associated with the Industrial Revolution. Robusticity was calculated in these collections by creating a robusticity index for long bones following Bennike and Anderson (2007). This allows for a standard score that is not disproportionately skewed by sex when comparing between groups, pending there is similar sex distribution for each group. When total group indices were compared using ANOVA, there was no significant relationship between humeral robusticity, but there was a significant relationship between femoral robusticity ($n=206$, $p=.001$). These results indicate that changes in robusticity may have occurred disproportionately throughout the skeleton and could be associated with changes in labor type.

Donna McCARTHY (McClung Museum of Natural History and Culture, USA)

CONGENITAL RADIO-ULNAR SYNOSTOSIS AT THE DEARMOND SITE (40RE12) IN EAST TENNESSEE.

This paper introduces a case of prehistoric congenital radio-ulnar synostosis (CRUS) to contribute to our understanding of this rare developmental anomaly and its frequency in New World populations. The case presented here was recorded in a child approximately 8 years old from DeArmond (40Re12), a Mississippian-age site in east Tennessee.

Approximately 50% of the subadult skeleton was recovered at excavation, and examination revealed no other skeletal anomalies and no pathologies with the exception of linear enamel hypoplasias indicative of nutritional stress and very mild healed periosteal reaction on the tibial shafts.

Titelbaum and Verano (2013) reported 13 additional prehistoric cases of this developmental anomaly. Interestingly, more than half of the cases occur in the United States. Two of them occur in a single Mississippian site in Illinois dating to AD 1200-1300, a range coinciding with the early habitation at the DeArmond site in Tennessee. While the distance between these sites is large, the presence of this rare anomaly at both sites provides intriguing possibilities regarding population movements during this time period.

Alexandra M McGOUGH (UC Berkeley, USA), **Laura E CIRILLO** (California State University Chico, USA), **Julie DING** (UC Berkeley, USA), **Rebecca S JABBOUR** (Saint Mary's College of California, USA) & **Gary D RICHARDS** (University of the Pacific, USA)

PREMATURE SUTURAL FUSION AND CRANIAL SHAPE CHANGE: EVIDENCE FROM THE PREHISTORIC RECORD. ***

Premature sutural fusions are widely considered to result in neurocranial shape change. Variation in growth force redirection results in a range of defined shape categories. In one case, trigonocephaly, shape change occurs with or without premature fusion. This calls into question our understanding of suture biology and its role in shape change. Here we present a summation of efforts undertaken to delineate *sutura frontalis* fusion, frontofacial growth, the trigonocephaly phenotype, and the interplay between shape changes in the neurocranium and face.

Observational and metric data on *sutura frontalis* fusion derive from late-fetal to 3.0-year-old individuals ($n=128$). Three-dimensional coordinates were collected on crania aged 6-9.0 years ($n=37$). Crania ($n=9$) with premature fusion of the frontal, sagittal, or coronal sutures were examined. All crania derive from prehistoric contexts and are housed in the Phoebe Hearst Museum, UC Berkeley and Institute for Craniofacial Growth, UOP, San Francisco. CT-scan-based observations employed Amira (v. 5.5) while principal components analysis on Procrustes-aligned shape variables employed Morphologika.

Functional fusion of the *sutura frontalis* was found in ~55% of newborn-to-six-month-olds, with 87.5 % of one-year-olds showing fusion. The time of greatest frontal expansion occurs between 0-1.0 years.

These data demonstrate a disjunction between suture closure, neurocranial growth, and shape. Further, geometric morphometric assessment demonstrates major changes in the facial mask in trigonocephaly. These results expand the traditionally-understood trigonocephaly phenotype well beyond the obvious neurocranial modifications. The impact of conditions with an early fetal onset to reconstructions of incidence rates for congenital malformations in prehistory is also discussed.

Sabrina MEYER (University of Zurich, Switzerland), **Nakita FRATER** (University of Zurich, Switzerland), **Roger SEILER** (University of Zurich, Switzerland), **Susanne BICKEL** (University of Basel, Switzerland) & **Frank RÜHLI** (University of Zurich, Switzerland)

PALEOPATHOLOGIC-ANTHROPOLOGICAL INVESTIGATIONS IN THE KINGS' VALLEY TOMB KV40 (WESTERN THEBES, UPPER EGYPT).

In this study we present a paleopathological overview and a preliminary anthropological analysis of the human remains from tomb KV40 in the Valley of the Kings. Archeological findings point to an initial burial period in the 18th dynasty and a reuse of the tomb in the 21st dynasty. Tomb robberies in ancient times and a late 19th century AD fire led to the disintegration and scattering of the mummies and resulted in many human remains being severely burnt and fragmented.

So far, 80 different individuals have been identified and assessed anthropologically (i.e. age, sex, body height). All age ranges, from perinatal to late adulthood, are represented. Interestingly, approximately 30% of the individuals are juveniles, which is not a commonly found proportion in burials in the Valley of the Kings. The adult sample shows a 2:1 female:male sex ratio.

Mummified and pathologically altered remains were conventionally X-rayed with a portable x-ray generator EXAMION PX60HF. These radiological imaging data are not only of diagnostic importance for pathologies, but are also an additional resource for anthropological analyses if standard methodologies cannot be applied due to mummification.

Skeletal developmental abnormalities such as several cases of achondroplasia, degenerative joint disease (in the spine and long bones), a skullcap deformation, and other pathologies e.g. long-bone fractures, are of paleopathological interest in KV40. Furthermore, several stress markers (i.e. Harris lines, cribra orbitalia and porotic hyperostosis) indicate poor health in some individuals. Additional investigations will give us a deeper insight to ancient Upper Egyptian life conditions.

Patrisha L MEYERS (University of Central Florida, USA & The Florida Historical Society Archaeological Institute, USA), **John J SCHULTZ** (University of Central Florida, USA), **J Marla TOYNE** (University of Central Florida, USA) & **Basil REID** (Office of the Parliament of the Republic of Trinidad and Tobago, Trinidad)

**LIFE IN THE CARIBBEAN: AN OVERVIEW OF SKELETAL PATHOLOGY FROM THE RED HOUSE
ARCHAEOLOGICAL SITE, PORT OF SPAIN, TRINIDAD. *****

In 2011, renovations of the Red House, Trinidad and Tobago's Parliament building, revealed human remains buried under the building's lower levels. Excavations and radiocarbon dating indicate the remains are pre-Columbian in nature with dates ranging between approximately AD 125 and AD 1380. An osteological analysis of the skeletal material was conducted to determine the demographic profile and the pathological conditions exhibited by the collective skeletal "population." An MNI of 60 individuals was determined, including 47 adults and 13 juveniles (one infant, eight young children, three older children, and one adolescent). The skeletal completeness of these individuals ranges from just one bone to more than 90% complete. Where possible sex was determined and included 13 females and 16 males (including the one adolescent). A total of 35 individuals (58.3%) exhibit one or more pathological condition, which include four examples and two possible examples of artificial cranial modification representing both sexes. Furthermore, six individuals exhibit healed fractures including possible examples of direct trauma and one individual, an adolescent male (A-CEP7-1), exhibits a possible perimortem depressed cranial fracture. Additionally, three individuals exhibit activity related humeral bilateral asymmetry, recognized by expanded cortical thickness and enlarged muscle attachment sites. While not a representative population, an osteobiographical approach allows us to reconstruct expressions of health, diet, lifestyle and disease for these ancient peoples, the first skeletal population for this island. These osteological results are a significant contribution to the limited bioarchaeological research available for the Caribbean's pre-contact period.

Hannah MILLER & Cynthia A WILCZAK (San Francisco State University, USA)

THE (LACK OF) ASSOCIATION BETWEEN CRIBRA ORBITALIA AND POROTIC HYPEROSTOSIS: WHEN POROSITY IS NOT ENOUGH.

Cribra orbitalia (CO) and porotic hyperostosis (PHO) have been assumed to share similar etiologies, but evidence of an association between the two is weak. We investigated this problem using a sample of 335 non-adult crania (0.5-20 years) from the Atkinson Collection, University of the Pacific. Lesions that have been recorded as CO or PHO were scored: porosity only; porosity with vascular impression; and coalesced/hyperostotic porosity.

Orbital lesions and age were significantly associated ($p < 0.01$) with lesions generally decreasing in older non-adults. Coalesced/hyperostotic porosity was 5.2x more likely at 6.6-10.5 years than at 17.5 – 20 years. Cranial vault lesions show a more complicated age pattern. Coalesced/hyperostotic porosity did not occur after 6.5 years, but it accounted for most of the significance in the age pattern despite the small number of cases (6/297). Porosity showed some tendency to increase with age but was in very high frequencies (56-88%) in all age categories. Vault and orbital lesions by type show a significant relationship that is mainly accounted for by porosity with vascular impression of the orbit being

negatively associated with no lesions of the vault and positively associated with coalesced/hyperostotic vault porosity. Crania with porosity of the vault most frequently have no orbital lesions (32%, n = 62) and more rarely have coalesced/hyperostotic porosity (19%, n = 36). The disparity in age patterns for the cranial and orbital lesion and the analysis of associations by lesion type suggests the etiologies may differ, particularly in the case of vault porosity.

Joanna MOORE (Durham University, UK) & **Laura CASTELLS NAVARRO** (University of Bradford, UK)
PALAEOPATHOLOGICAL ANALYSIS OF THE SUBADULT POPULATION OF THE ALT-IMPERIAL ROMAN SITE OF TARRACO (TARRAGONA, SPAIN).

Tarraco was the political and administrative capital city of the Roman *Hispania Citerior Province*, possessing one of the most important harbours in the Mediterranean. The human remains analysed from this site were from several small, late 3rd to 4th century necropoli located outside the city walls, in an area that had previously been the harbour. A pilot study analysing 105 of the original 431 individuals was carried out. Of these, 67 were age assessed as adults and 38 as subadults. Analysis of the skeletal material from this site revealed a population under stress; while 10 adult individuals showed signs of healed rickets, a 'failure to thrive' was evident in the subadult population. Of the aforementioned population, the majority of the individuals (N=26; 68%) were under the age of 10yrs and 18% under the age of 1yr. 40% of subadults exhibited pathological changes associated with some metabolic stress. More specifically, evidence for scurvy and/or rickets was observed in 32% of the individuals; with 60% of all scorbutic and rachitic changes exhibited by young children ≤2yrs. This mortality profile is similar to what would be expected for a Roman population (Carroll, 2014:160), however the high prevalence of metabolic diseases suggests that the population was under a dietary constrain. Interestingly, historic writings identify this time period as the Crisis of the late 3rd century, archaeologically, this is seen by the sudden abandonment of the buildings outside the Roman walls usually related to the incursion of the barbarian tribes from Northern Europe (Remola, 2000).

Johnica J MORROW & **Karl J REINHARD** (The University of Nebraska-Lincoln, USA)
CRYPTOSPORIDIUM PARVUM AMONG COPROLITES FROM LA CUEVA DE LOS MUERTOS CHIQUITOS, RIO ZAPE VALLEY, DURANGO, MEXICO. ***

In the present study, 90 coprolites from La Cueva de los Muertos Chiquitos (CMC) were subjected to enzyme-linked immunosorbent assay (ELISA) tests for three diarrhea-inducing protozoan parasites, *Entamoeba histolytica*, *Giardia lamblia*, and *Cryptosporidium parvum*. Samples were rehydrated in 0.5% trisodium phosphate for 24 hours, disaggregated, screened through a 250 micron mesh screen, and centrifuged. Sediments comprising the sample pellets were used to fill the ELISA test wells. ELISA test results were negative for both *E. histolytica* and *G. lamblia* across all coprolites. A total of 66/90 (~73% prevalence) coprolites tested positive or likely positive for *C. parvum*. Herein, we report the first successful recovery of protozoan parasite antigens from coprolites deposited at an archaeological site and naturally desiccated. The high prevalence of *C. parvum* among CMC coprolites contributes to our

growing knowledge of the pathoecology among the Loma San Gabriel who utilized CMC approximately 1,300 years ago.

Deborah NEIDICH (University of Pittsburgh, USA)

OUCH! OSSEOUS INDICATORS OF TRAUMATIC SHOULDER STRESS IN PREHISTORIC TENNESSEE.

The presence of rotator cuff disease (RCD) has been established within a Shell Mound Archaic (~4500-1000 BCE) Tennessean context. Evidence of soft-tissue damage in the form of enthesopathies have been previously discussed (Neidich, 2014) within the region. However, the traumatic impact of stress of the shoulder girdle including the presence of healed traumas, and Hill-Sachs lesions, found in conjunction with degenerative joint disease (DJD) have yet to be investigated fully. This poster presents a wide perspective of traumatic upper limb stress within the prehistoric Tennessee River Valley.

Amanda J O'NEILL & G Richard SCOTT (University of Nevada Reno, USA)

THE DECLINE IN ORAL HEALTH FROM MEDIEVAL TO MODERN TIMES IN BASQUES AND OTHER EUROPEAN POPULATIONS. ***

This study examines the oral health of a medieval (12th-14th century) and post-medieval (16th-19th century) Basque population from Vitoria-Gasteiz, Spain. The medieval Basque sample exhibits a lower rate of dental caries (10%) than the post-medieval sample (18%). Antemortem tooth loss follows the same pattern with the medieval sample showing a significantly lower incidence (6.7%) of tooth loss than the post-medieval sample (28.5%). During the transition from medieval to post-medieval times, there was an increasingly higher consumption of carbohydrates and cariogenic foods, accounting for much of the decrease in oral health over time (Corbett and Moore, 1976; Hillson, 1996). Results from northern Spain are consistent with several other regions in Europe that show an increase in dental caries and antemortem tooth loss from medieval to modern times (e.g., Croatia, Spain, England). The lowest frequencies of dental caries and antemortem tooth loss are reported in northern Europe. Novak (2015) found a lower rate of dental caries in medieval Ireland (3.0%) compared to the Basque sample (10%). Medieval Icelanders and Greenlanders exhibit the lowest rates of dental caries (0%), suggesting a diet less reliant on carbohydrates (Scott et al., 1991). In Europe, temporal variation in oral health is related primarily to dietary changes, including the introduction of refined sugars to a broader segment of the population after A.D. 1500.

Amber E OSTERHOLT (University of Nevada Las Vegas, USA)

TRAUMA AND DISEASE IN THE FORT ANCIENT WORLD: AN ANALYSIS OF THE HARDIN VILLAGE SITE, KENTUCKY.

This study presents the results of a pilot project conducted on the remains from the Hardin Village Site in eastern Kentucky. Hardin Village was occupied from AD 1000 – 1600, and is temporally positioned during a period where violence and disease are rapidly developing in this region. The pilot study was conducted on 10% of the remains and an isolated skull (n=31) during August of 2015. Twenty-two adults and eight subadults were analyzed in this project, and individuals were randomly selected. Data sheets consistent with *Standards of Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker, 1994) were used to record demographic information. Trauma and pathology were recorded by type, location, severity, and degree of healing, and were documented by digital photography. Enthesial markers were scored using the methods presented in Mariotti et al. (2007). Of the adults analyzed, 50% had cranial depression fractures and 8/22 had other fractures. One individual also had cuts and puncture wounds. Thirteen individuals showed signs of infection, and there was one case each of rickets and ankylosing spondylolysis. Nearly every individual surveyed showed signs of nutritional anemia in the form of porotic hyperostosis and/or cribra orbitalia. No subadults showed signs of trauma, but did show indications of nutritional anemia and infection. While small in scale, this analysis shows that trauma and disease are clearly present at Hardin Village and a larger study is warranted to understand the impacts of disease and trauma on the population as a whole.

Rose L PERASH & Christopher W SCHMIDT (University of Indianapolis, USA)

IMPACT OF DENS IN DENTE ON TOOTH WEAR IN THE MIDDLE AND LATE ARCHAIC. ***

Dens in dente (dens invaginatus), or “tooth within a tooth”, is a pathological condition where an infolding of enamel and dentin becomes trapped within a developing tooth. It is widely distributed but its prevalence is low, usually between one and five percent. Modern dentistry considers dens in dente to be a pathological condition because it is thought to weaken the overall structure of the tooth. The object of the current study is to test if teeth with dens in dente wear faster than surrounding teeth. We examined individuals with dens in dente from the Middle and Late Archaic in southern Indiana, a population that has demonstrated a relatively high prevalence of dens in dente (~5%). Macrowear scores were determined using dental standards (Smith 1984, Scott 1979). Seven individuals presented eleven dens in dente-affected teeth, and there was no statistically significant difference between affected and unaffected teeth, (pairwise t-test, alpha = .05). Although preliminary, given the extraordinary rate of macrowear and elevated masticatory demand among these Archaic people, it appears that dens in dente does not compromise dental function.

Elina PETERSONE-GORDINA (Durham University, UK), **Charlotte ROBERTS** (Durham University, UK) & **Guntis GERHARDS** (University of Latvia, Latvia)

A SKELETON WITH PROBABLE LEPROSY FROM A POST-MEDIEVAL CEMETERY IN RIGA, LATVIA. ***

This presentation focuses on an adult skeleton with probable leprosy from the St Gertrude Church cemetery (SGCC) in Riga, Latvia (15th – 17th century AD). Although there is substantial historical evidence for leprosy in post-medieval Europe, so far the disease has not been found in archaeological human remains from Latvia, and no evidence has been published from the Baltic region.

Individual 488 was buried in one of the two mass graves found in the SGCC. The remains were almost complete, and very well preserved. Age and sex estimates were based on observations of the pelvis and skull, using standard methodology. Pathological changes were recorded on all preserved and observable skeletal elements.

According to morphological analysis, individual 488 was an adult male (30-35 years old). Pathological changes were present in the skull and on the long bones of legs. Firstly, remodelling changes affected the nasal aperture, and the inferior margin had become smooth and almost completely obliterated, secondly, deposits of lamellar bone were present on the tibiae and femora, and finally there was evidence of infection within the left greater trochanter.

The appearance and distribution of the pathological lesions suggested that this individual might have suffered from early stages of leprosy. The evidence is not only unique due to the rarity of the condition in the Baltic archaeological populations, but the fact that the affected individual was buried in a mass grave also offers an important insight into how people with leprosy were treated by the post-medieval population in the region.

Robin QUATAERT, Fatma Basim ZALZALA, Arysa GONZALEZ & Jessica GREGORY (University of Indianapolis, USA)

PALEOPATHOLOGICAL ASSESSMENT OF A LATE ARCHAIC GROUP GRAVE.

Millersburg is a mortuary site located near the Ohio River in southern Indiana, dated to 5300 to 4100 RCYBP and has diagnostic Late Archaic period projectile points; it produced 345 features, and a minimum of 36 individuals. Feature 141 is a group grave with an MNI of six (three adults, individuals A, B, and F, and three subadults, individuals C, D, and E) that appears to have been a single deposition. Late Archaic group graves are uncommon in Indiana; the possible circumstances which led to this group grave, including trauma or disease, are currently under investigation. Each individual in this feature was assessed for the presence of pathological conditions using osteological standards. Individual B, a young adult female, exhibits an extreme form of asymmetrical femoral torsion uncommon in prehistoric groups, in addition to cortical thickening of the tibiae and fibulas. These pathological conditions may be the result of cultural and/or biological origins. Although the remaining individuals display some pathological manifestations, the conditions present in this female were the most aberrant. It should be noted that individual F exhibits two healed cranial traumata and a

perimortem projectile point wound in the right scapula. Based on the research conducted thus far, neither trauma nor disease singularly explain the context of this group grave, and further analysis is required.

Rebecca REDFERN (Museum of London, UK), **Madeleine MANT** (McMaster University, Canada) & **Jo BUCKBERRY** (University of Bradford, UK)
AN EXECUTED WITCH FROM LUNDENWIC?

In 1995, an excavation on the Thames Foreshore in London (England) uncovered a unique water-logged burial of an adult female, whose body had been laid between two sheets of bark, resting on a bed of reeds covered by a thin textile, with moss laid on her pelvis and knees. The resting-place was marked by stake- and post-holes and was probably covered by a mound.

We employed standard osteological methods to record the remains, and examined each bone using a digital electron microscope to determine the presence of trauma and to establish whether the injuries were peri- or ante-mortem in origin. Our analysis found that the female had been beaten on her back some weeks before death, as multiple healing fractures were present to the scapulae, and the posterior aspects of the ribs and vertebral column. Her manner of death included further beatings to her back, evidenced by peri-mortem blunt force fractures to the same locations, and repeated blows to the head, including one large circular lesion to the left parietal bone.

Anglo-Saxon law codes describe capital punishment by drowning and stoning. In addition, criminals were denied burial in consecrated ground. The type and distribution of injuries seen on this individual, combined with their burial in a liminal location, are consistent with Anglo-Saxon execution by stoning, a punishment often meted out for adultery or witch-craft.

Karl REINHARD (University of Nebraska, USA)
COPROLITE ANALYSIS: THE MISSING DATA SET FOR UNDERSTANDING ANCESTRAL PUEBLOAN POROTIC HYPEROSTOSIS.

Coprolites reveal the specific infectious organisms and dietary components that can be implicated in provoking the nonspecific indicators of disease stress evidenced in bone. Therefore, coprolite analysis should have a direct connection with paleopathology. I present an example of how the application of coprolite data can support and modify a testable hypothesis. I selected the Ancestral Pueblo porotic hyperostosis hypothesis developed by Walker and his colleagues. They presented a complex hypothesis with multiple dependent variables that can be evaluated with coprolite data. The total data set of 1,400 coprolite analyses from the Ancestral Pueblo area support their general proposal that unsanitary living conditions were conducive to additional nutrient losses from gastrointestinal infections. Of the eight parasites known from Puebloan sites, five are associated with lower vitamin B₁₂ levels. The prevalence of gastrointestinal parasites in Puebloan coprolites ranges

from 0% to 29% depending on site type. Walker and his colleagues hypothesize Puebloan diet was deficient in vitamin B₁₂. The diversity of Puebloan diet has been published in several papers based on coprolite analysis. Although the plant diet may have been deficient in B₁₂, Puebloans ate significant amounts of meat in the form of small animals, especially rodents and lizards. Therefore, even at times when large game was overexploited and unavailable, these ancient groups were able to maintain some meat in the diet through hunting small animals. Therefore, the coprolite data can be used to refine and focus existing hypotheses regarding porotic hyperostosis.

Lita SACKS (Indiana University, USA)

ORAL PATHOLOGY AND DENTAL WEAR IN DISTINCT BURIAL COMPONENTS AT KOSTER MOUNDS.

Dental wear and carious lesions are often used as proxies to study the technological preparation of food and the amount of carbohydrates in the diet, respectively. Dental wear was particularly heavy among early hunter-gatherer groups in the prehistoric Midwest due to a diet heavy in uncooked nuts and the frequent introduction of grit into food. The degree of wear decreased steeply following the advent of ceramic technology, which allowed hard foods to be cooked into porridge without contamination with abrasive material. Carious lesions, on the other hand, increased in frequency through time as the diet became more reliant on cooked starches (most notably maize), which accumulate along fissures in the teeth and promote cariogenic bacterial action.

This study applies regional temporal trends in degree of dental wear and frequency of caries to a site of murky chronology. Although Koster Mounds is often considered a Late Woodland (500-1000 CE) mortuary complex, the presence of distinctly Late Archaic (3000-1000 BCE) structures suggests a longer use as a burial center. A previous study of dental wear at Koster Mounds yielded inconclusive results as to its true period of use. This study expands on the previous one by increasing sample size and including a full analysis of dental pathology, including carious lesions, abscesses, and ante-mortem tooth loss. The results characterize the technology, diet, and general health of the Koster Mounds burials within the greater context of the prehistoric Midwest to ultimately reject or support the possibility of Archaic interments at the site.

Ana Luisa SANTOS (University of Coimbra, Portugal) & **Vanessa CAMPANACHO** (University of Sheffield, UK & University of Coimbra, Portugal)

RETROSPECTIVE DIAGNOSIS OF HALLUS VALGUS IN 19th-20th CENTURY PORTUGUESE INDIVIDUALS.

Hallux valgus (HV) is characterized by a progressive subluxation of the first metatarsophalangeal joint leading to a lateral deviation of the hallux. HV generally affects adult individuals, although is seldom reported in archaeological skeletal remains. The present research tested the application of three angles – currently employed in Medicine – to diagnose HV in disarticulated skeletal specimens. The analysis was performed on 146 individuals (age at death: 18 to 96 years; n females = 68, n males = 78)

from the Identified Skeletal Collection of the University of Coimbra. No medical records of HV presently exist for the Coimbra collection, and, therefore, a retrospective diagnosis was performed following the clinical criteria adapted by Mays (2005). The retrospective diagnosis allowed comparing measurements between individuals with and without HV. Subsequently, the first metatarsal and proximal phalange were digitally photographed in the dorsal view. Measurements of the distal metatarsal articular angle (DMAA), and proximal (PPAA) and distal angles (DPAA) of the proximal phalanx were performed with Adobe Photoshop CS2© version 9.0.

Establishment of the upper limit of normality and the lower limit of possible HV cases were carried out with a cut-point value from angles' mean. The values obtained were in conformity with medical references, except for DPAA. Twelve individuals (8.2%) exhibited bilateral HV and 25 unilateral HV cases (17.1%: 18 left feet, 7 right feet). Furthermore, a low correlation between HV and age at death was found. The present study suggests only DMAA and PPAA may assist in HV diagnosis in archaeological skeletal remains.

Mays, S.A. 2005. Paleopathological study of hallux valgus. *American Journal of Physical Anthropology*, 126: 139-149.

Ana Luisa SANTOS (University of Coimbra, Portugal), **Hélder FERNANDES** (University of Coimbra, Portugal), **Ana GONÇALVES** (ARKHAIOS Évora, Portugal), **João LAFFONT** (Centro Hospitalar e Universitário de Coimbra, Portugal), **Daniela JARDIM** (Centro Hospitalar e Universitário de Coimbra, Portugal), **Carlos RIBEIRO** (Centro Hospitalar e Universitário de Coimbra, Portugal) & **António DIOGO PAIVA** (Centro Hospitalar e Universitário de Coimbra, Portugal)

AURICULAR EXOSTOSES IN ROMAN INDIVIDUALS FROM OSSONoba (PORTUGAL): AN INTERSECTION BETWEEN THE CLINIC AND PALEOPATHOLOGY.

According to the paleopathological and clinic literature, auricular exostoses are defined as external auditory canal hyperplastic bone growths. They are more frequent among adults as a result of repetitive irritation of the external auditory canal, usually by cold water or recurrent external ear otitis, that stimulate reactive bone growth in a multilayered compact bone deposition pattern, with progressive reduction of the external auditory canal patency. The aim of this work is to discuss this condition in two individuals from the Roman necropolis of *Ossonoba* (modern Faro, Algarve, Portugal), where 82 individuals were exhumed with votive goods dating from the 1st-3rd centuries AD. Macroscopic observation revealed two adult males (2.4%) with auricular exostoses, documented through microscopic otoscopy, ear endoscopy and temporal bone CT scan. Auricular exostoses usually remain asymptomatic until complications arise, such as external ear otitis or conductive hearing loss, usually due to wax accumulation and retention of water. Besides exposure to cold water, atmospheric conditions of low temperature and wind chill have also been correlated with the presence of auditory exostoses. Such etiopathogeny and predominantly acquired origin has permitted us to utilize the presence of auricular exostoses as a marker of occupational activity. *Ossonoba*, located in a delta near to the Atlantic, was an important center of Lusitania province with a strong maritime connection with Mediterranean Sea populations. This study revealed the possible response of the ears of these

individuals to environmental stress, due to exposures to cold water and/or wind, and/or in the *frigidarium* cold bath, documented in the region in Roman times.

Ana Luisa SANTOS (University of Coimbra, Portugal), **J HERRERÍN LÓPEZ** (Universidad Autónoma de Madrid, Spain), **Natasa SARKIC** (Universidad Autónoma de Madrid, Spain), **Alvaro M. MONGE CALLEJA** (University of Coimbra, Portugal), **Wilson D T ANTUNES** (Unidade Militar Laboratorial de Defesa Biológica e Química, Exército, Portugal) & **António Pedro ALVES DE MATOS** (University Campus of Quinta da Granja, Monte de Caparica, Portugal)

INTRAPELVIC HOLLOW CALCIFIED MASS IN A MEDIEVAL ADULT FEMALE (PRÁDENA DEL RINCÓN, MADRID, SPAIN).

During the restoration of the Church of Santo Domingo de Silos (Prádena del Ricón, Madrid, Spain), a medieval cemetery with 90 graves was identified. Skeleton 83-6 (12th-13th cent. AD) belonged to an adult female (25-39 y.o., stature ca. 157-160cm) with arthrosis in C4 and excrescences on talus/calcaneus joints. However, the purpose of this work is to examine an unidentified semi-spherical and perforate hollow mass, ca. 30mm in diameter, found near the right ilium. To determine its composition, the mass was examined using a Scanning Electron Microscope (Hitachi TM3000) and subjected to Energy dispersive X-Ray (EDX) Spectroscopy (Bruker Quantax 70 for TM3000). This procedure revealed a heterogeneous inner surface with both smooth and irregular areas. A larger spherical and several smaller crescent-shaped perforations were noticed. X-Ray microanalysis revealed the presence of the elements C, K, P, Ca, Al, Si, Fe, and Mg, consistent with mineralization. Maps of the elements showed that Ca and P co-localized in most of the areas analysed, suggesting that they might be combined in a calcium phosphate mineral matrix that would most likely have been formed *in vivo*. Other minerals probably originated in the environment, although Fe could be in part related to the presence of blood. Etiologies for the onset of calcifications and cysts vary. In this individual, chemical composition and location point to an ovarian mineralized mass or hydatid cyst; the latter is not uncommon in agricultural populations with livestock production. Hopefully, ongoing microtomography examination will help in the differential diagnosis. This study increases our paleopathological knowledge about this kind of biological structure.

MOVING BEYOND MIGRATION: USING BIOGEOCHEMICAL DATA FROM A BRONZE AGE SKELETON FOR DIFFERENTIAL DIAGNOSIS OF A PROGRESSIVE NEUROMUSCULAR DISORDER.

Alecia SCHRENK (University of Nevada Las Vegas, USA), **Lesley A GREGORICKA** (University of South Alabama, USA), **Debra L MARTIN** (University of Nevada Las Vegas, USA) & **Daniel T POTTS** (New York University, USA)

Stable isotope analysis has been particularly useful in the exploration of lived experiences in past cultures. To date, however, no studies have used biogeochemical data to assist with differential diagnosis, and from this, to improve reconstructions of life courses. Here, strontium, oxygen, and carbon isotope values from the teeth of a young (18-20 year old) female with paraplegia from Bronze

Age Tell Abraq (UAE) were used to re-examine a previously indeterminate diagnosis of a progressive neuromuscular disorder. First ($^{87}\text{Sr}/^{86}\text{Sr}=0.70865$; $\delta^{18}\text{O}=1.6\text{‰}$; $\delta^{13}\text{C}=-13.2\text{‰}$) and third ($^{87}\text{Sr}/^{86}\text{Sr} = 0.70862$; $\delta^{18}\text{O}=1.6\text{‰}$; $\delta^{13}\text{C}=-13.0\text{‰}$) molar isotope values were considerably different from local individuals interred in the communal tomb, indicating that her childhood residence differed from those who grew up at Tell Abraq. These data also suggested that she migrated there after 15 years of age but before her death at 18-20 years old. Given this information, a previously conducted differential diagnosis unable to differentiate between cerebral palsy and poliomyelitis was reevaluated. Her newly-identified residential mobility made it unlikely that she suffered from cerebral palsy, which would have made long distance travel problematic; instead, she likely contracted poliomyelitis in her late teens upon moving to this more densely populated settlement. Due to large quantities of nonlocal goods recovered from the tomb, we also explore exogamous marriage practices and trade relations that may have placed this young woman at increased risk for developing a progressive neuromuscular disease. These results illustrate how isotopes can be used to give unique insight into paleopathological investigations as well as past lived experiences.

Megan SCHWALENBERG (North Carolina State University, USA)

ANALYSIS OF FRAILITY IN THE LOWER ILLINOIS VALLEY DURING THE TRANSITION TO AGRICULTURE THROUGH PERIOSTEAL NEW BONE FORMATION.

This study investigates the health of the people of the Lower Illinois Valley during the transition to agriculture by analyzing mortality patterns and observing any interaction between age-at-death and stage of periosteal new bone formation. Periosteal new bone formation is one of many skeletal non-specific indicators of stress used by bioarchaeologists to assess health patterns. While often utilized in paleopathological studies, little work has been done on differentiation between the stages of periosteal new bone formation - active, mixed, and healed - and any association with differential mortality and frailty. Previous studies on Black Death individuals have suggested that active lesions are associated with individuals with high frailty while healed lesions are associated with individuals of lower frailty. A total of 348 adult individuals from three Middle Woodland period (50 BCE – 400 CE) sites and three Late Woodland period (400 – 900 CE) sites were analyzed. Age-at-death was estimated using transition analysis and the presence and stage of periosteal new bone formation on the tibiae was noted. These data were analyzed using Kaplan-Meier survival analysis and preliminary results suggest a similar pattern as seen in previous research of healed lesions being associated with individuals of lower frailty. Assessing lesions and mortality in this way could provide a clearer understanding of mortality patterns during the transition to agriculture in general, as well as specifically within the Lower Illinois Valley.

Stanley SERAFIN (Central Queensland University, Australia) & **Carlos PERAZA LOPE** (Instituto Nacional de Antropología e Historia, Mexico)

ORAL HEALTH AND DIET AT THE LATE POSTCLASSIC MAYA CAPITAL OF MAYAPAN.

Analysis of oral health was conducted on 1,343 teeth and 1,362 sockets representing at least 60 adults from Mayapan, the largest Maya city of the Late Postclassic period (ca. A.D. 1200-1450). Pathologies scored include caries, calculus, antemortem tooth loss (AMTL), periodontal disease and periapical abscesses. These data were utilized to reconstruct diet and test the hypothesis that social disparities in diet had diminished by this time. Caries, AMTL, and abscess frequencies are lower than for most inland Maya samples suggesting that cariogenic foods, such as maize, did not make up as large a proportion of the diet. The only differences found according to sex are larger calculus deposits and a greater proportion of carious lesions in occlusal surfaces in males, while caries in females more commonly affected the cervical region. These results suggest both sexes had similar diets but meal frequency or food preparation techniques may have differed. With regard to status, differences in caries and abscess frequencies approach statistical significance, with lower status individuals exhibiting higher frequencies of both. The lower status group also exhibits significantly more calculus. This suggests slightly more maize consumption by the lower status group. In sum, status differences were present though less pronounced than in numerous Classic period sites. The similarity in male and female diet contrasts more sharply with the Classic; parallel findings in large urban centers of central Mexico have been interpreted as reflecting greater market access, which may also have been the case at Mayapan.

Luciana SIANTO (University of Coimbra, Portugal & Oswaldo Cruz Foundation, Brazil), **Sérgio AM CHAVES** (Oswaldo Cruz Foundation, Brazil), **Nathalie ANTUNES-FERREIRA** (University of Coimbra, Portugal) & **Ana RM SILVA** (Loures Municipality, Portugal)

TOXOCARA (ASCARIDIDAE) EGGS IN A FRANCISCAN FROM PORTUGAL (XVII-XVIII CENTURY): CASE REPORT.

The former Convent of the Holy Spirit, Franciscan Province of Holy Mary of Arrábida in Lisbon district, was excavated in 2005. From the Cloister of the building was recovered a skeleton of an adult male, probably old-aged. Dental calculus and loss of teeth before death was observed along with vertebral ankylosis and severe osteoarthritis in cervical vertebrae. In the anterior part of the sacrum a darker organic agglomeration in the region that would have been the final portion of the rectum was collected. Samples were rehydrated with Lycopodium tablets in a Na₃PO₄ 5% solution for 72 hours followed by swirl technique. Organic material was concentrated at 2500 rpm. At least 20 slides of each sample was examined in light/polarized microscope. Control sample from outside the pelvis revealed no biological remains. Sample collected inside the pelvic girdle was positive for pollen grains and other plant remains and *Toxocara* probably *T. cati* (2,766 eggs/gram sediment). The occurrence of adults of *Toxocara* in humans is rare, affecting children in contact with feces of infected dogs and cats. In this study the presence of eggs may be associated with ingestion of contaminated food or geophagy but an adult worm eliminating eggs is also a hypothesis. Soil contamination after the burial was discarded because it is a primary burial, possibly in wooden coffin, and the thick layer of soil on top closed with a

concrete slab prevented contamination by fecal matter of carnivores. This is the first report of *Toxocara* eggs associated with human burial.

Luciana SIANTO (University of Coimbra, Portugal & Oswaldo Cruz Foundation, Brazil), **Vítor MATOS** (University of Coimbra, Portugal), **Davide DELFINO** (Abrantes Municipality, Portugal), **Filomena GASPAS** (Abrantes Municipality, Portugal) & **Gustavo PORTOCARRERO** (Abrantes Municipality, Portugal)

ROUNDWORM EGGS IN A MEDIEVAL SKELETON FROM ABRANTES CASTLE, PORTUGAL.

The Castle of Abrantes is located in the city of same name and was built in the XII century by the Templars as part of the Tagus River defense line against Moorish attacks. The Church Santa Maria do Castelo is located inside the fortification and it was one of the intervention areas during archaeological excavations in 2015. Two skeletons were located outside the church dating from the 15th and 16th century. Samples of sediment were taken from the pelvic girdle and cranium. In lab samples with *Lycopodium* tablets were rehydrated in 5% Na₃PO₄ solution, processed with swirl technique and centrifuged at 2500 rpm. At least 20 slides of each sample was scrutinized in light and polarized microscope at 100 and 400 magnifications. Control samples were all negative for parasites. *Ascaris lumbricoides* eggs were found in burial 1, an adult male, in a concentration of 50.21 eggs/gram. This parasite is commonly found in archaeological material from Europe, especially those dating from medieval period. Draws attention the concentration of eggs which is similar to current studies in Portugal which are much lower than others in Europe. Explanations may be in taphonomic process or cultural habits such as alimentation and medical treatments.

Daniella TARQUINIO, Jaime ULLINGER, Gerald CONLOGUE & Ramon GONZALEZ (Quinnipiac University, USA)

MACROSCOPIC AND RADIOLOGIC EVIDENCE OF PATHOLOGY OF SKELETONS FROM TELL EL-HESI. ***

Excavations from 1977 to 1983 at Tell el-Hesi (an archaeological site located in modern-day Israel) uncovered an Ottoman-period (ca. 1400-1800CE) cemetery with over 400 burials. Most of the individuals were reburied after excavation, but the archaeological team curated approximately 50 partial skeletons for further investigation. A medical doctor working with the project, Dr. Kenneth Eakins, provided osteological analysis. This project assessed his observations and analysis with new techniques. Out of the partial skeletons available, eight individuals were chosen for further examination based on macroscopic examination of possible pathology identified by the original 1993 publication. The presence of active and woven bone was observed macroscopically along with X-rays and CT scans. Four of the eight skeletons were determined to have evidence of disease present, such as possible eosinophilic granuloma, whereas the others had markings and damage due to taphonomy and/or animal manipulation. This research highlights the importance of repeated study of pathological indicators, especially as new technology becomes available.

Isabel TEIXEIRA-SANTOS, William AVERY & Karl REINHARD (University of Nebraska, USA)
DIPHYLLOBOTHRIUM PACIFICUM OVERDISPERSION IN ANDEAN ARCHAEOLOGY: BREAKING THE BARRIER BETWEEN PARASITOLOGY AND ARCHAEOPARASITOLOGY. ***

Parasitological data from archaeological contexts are detached from modern studies. This attitude results from a perception that ancient material is not epidemiologically comparable to surveys of modern populations. A key epidemiological axiom in parasitology is that a minority of hosts carry the majority of parasites. Statistically, this is the negative binomial of overdispersion. We propose that identifying overdispersion in ancient material will demonstrate that ancient and modern parasite data have the same epidemiological value. Peruvian and Chilean mummies provide a great source of population base parasitological information. This is especially true of the fish tapeworm, *Diphyllobothrium pacificum*. Our analysis of Chinchorro mummies and Chiribaya mummies from Chile and Peru demonstrated overdispersion. About 70% of the worm eggs were recovered from 10% of the hosts. We augmented these data by an analysis of eggs from coprolites and burials. Taphonomic changes in burials eliminated some data points, but generally overdispersion is demonstrable. The fact that this distribution is evident in a multiple host life cycle parasite is significant. There is a statistically significant difference in prevalence between of Chinchorro and Chiribaya contexts. Infection intensity also differs. These data show that ancient data are comparable to modern data. Therefore, we are moving towards a point when archaeological parasitology will have the same epidemiological value as current studies.

Josh THOMPSON (North Carolina State University, USA)
VARIATION IN THE STYLOID PROCESS OF THE THIRD METACARPAL IN HUMANS: EXPRESSION, FREQUENCY, AND PATHOLOGY.

The styloid process of the third metacarpal (MC3) is a skeletal feature found only in humans among extant primates and has only been recorded in relatively recent human ancestral species. From an evolutionary perspective, selection for this trait is thought to have been the result of impacting forces on the carpometacarpal joint from the manufacture and use of stone tools. In anatomically modern humans, this feature is prone to pathological variation, as this secondary center of ossification can be found fused to the MC3, MC2, capitate, trapezoid, or expressed as a separate ossicle known as the *os styloideum*. This defect can cause a painful condition referred in clinical literature as “carpal bossing”. This study explores the frequency of these defects and bilateral expression in African and European-American males from the Terry Anatomical Collection at the Smithsonian Institution. Both qualitative and quantitative data were collected from the carpals and metacarpals of 406 individuals. Preliminary results indicate that the most common variation found in styloid expression is bilocation, wherein the styloid process is expressed on MC3 and either the capitate, or an unfused *os styloideum* connected to the MC3 by means of a non-osseous coalition. Statistical analyses show no overall significant difference between the two ancestral groups, but Pearson correlation analysis indicates that biomechanical length of MC3 and styloid length are only weakly correlated, indicating that the length of the styloid process may be partially independent of the length of the MC3.

Samantha TIPPER-BOOTH (Durham University, UK)

SPONDYLOLYSIS IN POPULATIONS FROM ANCIENT NUBIA DURING THE MEROITIC TO CHRISTIAN PERIODS. ***

Spondylolysis is a fracture of the pars interarticularis of the neural arch of the vertebra, usually of L5. The literature suggests predisposing factors such as; inherited weakness, stress and strain may result in spondylolysis. Although there have been a number of population studies, more research is needed to be carried out in order to get a complete understanding of the prevalence of spondylolysis over time and space. A study of spondylolysis, has not yet been achieved for past Sudanese populations, even though it can potentially tell us much about the health, welfare, and occupational and environmental stresses faced in ancient Nubia. The aim of this study is to explore the prevalence of spondylolysis across ancient Nubia for the throughout the Meroitic to Christian periods.

Four hundred and sixty skeletal remains from Nubia have been examined, to date, from four collections of Nubian human remains. They range in geographic location from the 2nd to the 6th cataracts, and date from 300 BC to 1500 AD. Sex and age estimation was carried out using accepted standard techniques applied to the pelvis and cranium. Spondylolysis was recorded as present or absent on all preserved and observable vertebra.

Preliminary results indicate frequency rates similar to previous studies on African populations ranging from 3 to 9 %, with a higher prevalence in males than females and a higher percentage found in young adult individuals. The location of spondylolysis was most often found in the lumbar vertebra at the L5 level, and most commonly bilaterally.

Anne R TITELBAUM (University of Arizona, USA) & **Bebel IBARRA** (Tulane University, USA)

TRAUMATIC INJURY OR INFECTIOUS DISEASE? DIFFERENTIAL DIAGNOSIS OF A DEFORMED SUBADULT SCAPULA FROM A LATE INTERMEDIATE HIGHLAND TOMB FROM MARCAJIRCA, DEPARTMENT OF ANCASH, PERU.

A deformed subadult right scapula was observed during the analysis of a sample of comingled human skeletal remains recovered from four tombs at Marcajirca, a Late Intermediate Period (AD 1040-1640) highland site in Ancash, Peru. The deformation involves the glenoid cavity, scapular neck, and the coracoid process. Rather than demonstrate a typical pyriform articular surface, the glenoid cavity has assumed a narrow, concave, elongated form that encroaches into the neck of the scapula and extends onto the coracoid process. As a result, the scapular neck is greatly reduced. In addition, the attachment sites for the coracohumeral ligament and the long heads of biceps brachii and triceps brachii appear as fossae. Macroscopically, the overall appearance is erosive; there is no evidence of bone deposition and the articular surface demonstrates macroporosity. Radiographically, there is no indication of sclerosis. Although the associated humerus and clavicle were not found, a subadult fused T12-L1 vertebra with a nearly completely eroded T12 body was recovered from the same tomb. A differential diagnosis of the scapula is explored, with a consideration of the possibilities for scapular fracture, glenohumeral joint dislocation, infectious disease, and arthritis.

J Marla TOYNE (University of Central Florida, USA), **Luis Alfredo NARVÁEZ VARGAS** (Museo de Túcume, Peru), **Armando ANZELLINI** (University of Central Florida, USA) & **Vu TRAN** (University of Central Florida, USA)

PRELIMINARY EVIDENCE FOR CHACHAPOYA DIET AND MOBILITY AT KUELAP FROM CARBON, NITROGEN, AND OXYGEN STABLE ISOTOPES.

In this study, we interpret multiple stable isotopes from bone collagen and apatite of human skeletons from the Late Intermediate Period (AD 800-1470) and Late Horizon (Inca Conquest AD 1470-1535) Chachapoya site of Kuelap, Peru. In this high altitude subtropical environment, archaeological remains identify a range of plant and animal resources grown at distinct elevations, including high altitude C₃ tubers and lower temperate zone C₄ maize. The goal of this research is to provide evidence of dietary and mobility patterns for a sample from a site with significant mortuary variability. Results of isotope analyses of 35 individuals (15 females, 12 males, and 8 juveniles) with paired bone and tooth tissues suggest the diet of this late pre-Columbian population was fairly narrow, mixed (C₃/C₄), with limited terrestrial-based protein. Bone oxygen values show limited variation about the mean $-11.02\text{‰} \pm 0.6$ and are not significantly different from predicted local water values. There are no significant differences between males and females, or adults and juveniles in any of the data, nor among collective wall burials, individual pits, or an unburied group of individuals. Only a single female had a significant shift in C, N, and O isotope values to suggest that she likely changed residence to Kuelap after childhood. These isotopic data suggest that the diversity in mortuary practices at Kuelap reflects a more complex local social organization than expected and do not show change over time or foreign influence, including no evidence for any dramatic change after Inca domination of the region.

Vu TRAN & J Marla TOYNE (University of Central Florida, USA)

INVESTIGATING SOCIAL VARIABILITY IN DENTAL DISEASE AT KUELAP IN PRE-COLUMBIAN CHACHAPOYAS, PERU. ***

This study examines health differences using patterns in dental disease to explore evidence of social variability at Kuelap (AD 800-1535) in Chachapoyas, Peru. We examined dental remains of 100 adult individuals, which included 54 males and 46 females from five different types of mortuary contexts (collective wall burials and tombs, individual pits, an ossuary, and an unburied group). These individuals lacked grave goods, which are often used to interpret differences in social status or identity. Thus, dental pathology was analyzed to explore influences of diet, cultural behavior, and the external environment on human biology; each of which may be socially mitigated. Three pathological indicators (caries, antemortem tooth loss, and calculus) were scored using coding systems based on size and location of the lesion or plaque and degree of alveolar remodeling. There were no significant differences in any of the pathological conditions among individuals from diverse mortuary contexts, but there were significant differences between males and females. Overall, females had higher frequencies of dental disease, which may be the result of various influences that can be biological, dietary, and social. These results suggest a heterarchical social organization rather than a hierarchical system. This research presents the first analysis of dental pathology from Kuelap, provides valuable

insight for understanding ancient Chachapoya social complexity, and furthers knowledge on dental health patterns in the Andean region.

Katie TUCKER (University of Winchester, UK), **Kori FILIPEK-OGDEN** (Durham University, UK), **Ioan STANCIU** (Romanian Institute of Archaeology, Romania), **Kathryn HUNT** (Paleo-Oncology Research Organization, USA), **Jordan SNYDER** (Transylvania Bioarchaeology, UK), **Kayla CROWDER** (Durham University, UK), **Megan BEREZA** (Durham University, UK), **Megan OLIVERSON** (Durham University, UK) & **Khrystyne TSCHINKEL** (Tulane University, USA)

PATHOLOGICAL TRENDS IN SLAVIC MIGRANTS FROM THE JUCU DE SUS NECROPOLIS (TRANSYLVANIA, ROMANIA).

The Jucu de Sus Necropolis site near Cluj-Napoca, Romania, is a unique, diachronic cemetery complex associated with multiple internment periods; namely the Late Roman (3rd – 5th centuries AD), Migration (5th – 7th centuries AD), Early Medieval (8th – 10th centuries AD), and Medieval (11th – 12th centuries AD) periods. The wealth of information at this site allows for the exploration of changing patterns of health providing a long-term view of little-known pre-Medieval Transylvanian history. The at-risk cemetery complex is estimated to contain over 1000 inhumations and cremations, with only 1/10th recovered thus far. Systematic and detailed analyses of the skeletal remains reveal varying patterns of pathological conditions and demography of the multiple populations through time, including high prevalences of trauma, and nutritional deficiencies associated with individuals purported to be Slavic migrants. This poster will share a summary of the findings from the Jucu de Sus Necropolis site, discuss possible interpretations for the high amount of abnormal pathologies, and suggest potential avenues of future research.

Alexis VARVARES (Saint Louis University & University of Florida, USA)

THE EFFECT OF BURNING: HEAT-RELATED FRACTURES IN BURNED BONE.

Ancient human remains that are found with burn marks create a new level of difficulty. It is important to know the condition of the bones, whether they were in a fleshed or de-fleshed state. The burning process creates fracture patterns on bones that vary depending on whether the bones were fleshed or de-fleshed. The aim of this study is to determine the status of the bones prior to burning by identifying these patterns. By doing so, the results will help to find or to corroborate the possible cause or state of death of ancient humans. The cause of death is the disease or injury that is responsible for the sequence of events that lead to death. By identifying the cause of death of the ancient human remains, it is possible to answer questions about culture or the manner in which they lived or if they conducted some ritualistic burial. To conduct this study hog bones, long bones and rib bones, were burned in a bonfire at temperatures roughly between 600 – 700°C (1112 – 1292°F). Analysis was conducted micro and macroscopically to observe the direction of the fracture patterns that resulted from intense heat on the surface area, and the color of the bones. The results indicated that fracture patterns could be used to determine the status of the bone prior to burning. This, combined with the color of the bone can be

used in Paleopathology of ancient human remains to determine the status of the remains before being exposed to the burning process.

Claudia VIGANÓ, Gülfirde AKGÜL, Frank J RÜHLI & Abigail BOUWMAN (University of Zurich, Switzerland)

G6PD DEFICIENCY DETECTION METHOD IN ARCHAEOLOGICAL SAMPLES.

Today, glucose-6-phosphate dehydrogenase (G6PD) deficiency is the most common enzymopathy in humans, affecting approximately 400 million people worldwide. Among the 300 known variants, G6PD A- is one of the most common deficiency type found in Europe, with high prevalence in historically malaria endemic countries. The recovery of the mutations responsible of this deficiency in archaeological specimens, therefore, can help in the reconstruction of a population history in the presence of endemic malaria.

In this study a PCR method to detect the two point mutations responsible for G6PD A- in archaeological specimens was developed. Forty tooth samples from Sardinia and Corsica, two European islands with a long history of endemic malaria, and 40 from Switzerland, a country where a milder form of malaria was only seasonal epidemic, were analyzed. The samples cover a period from the Roman to the Modern Age in order to give an insight into how human genes have adapted to malaria over the last two thousand years.

Sequences of the G6PD fragments which contain the mutations responsible for G6PD A- were recovered in 15% of the samples, showing that this method is suitable for the study of archaeological materials and can, therefore, be used to indirectly trace the history of malaria within a population. Although, none of the sequences yielded any evidence for the investigated mutations, one individual from Sardinia presented a nowadays unknown mutation 358C→T in exon 5 indicating that there has possibly been a shift in the variants over time.

Robyn WAKEFIELD-MURPHY (University of Pittsburgh, USA)

CO-MORBIDITY OF CONGENITAL MENINGOCELE AND SYSTEMIC FUNGAL INFECTION: A CASE STUDY FROM LATE PREHISTORIC NORTH AMERICA. ***

Multiple pathological lesions were identified in the skeleton of a young adult female (FC#5741), aged 20 years, from the Late Prehistoric archaeological site Godwin Portman in southwestern Pennsylvania. The site dates to the period from 1250-1580AD and is associated with the Monongahela cultural tradition. This indigenous group was settled in upland nucleated villages and practiced intensive maize agriculture. In the present case study, anterior and posterior meningoceles were identified in the sacrum, and the individual was of short stature with small bones. Lytic lesions were widespread throughout the skeleton in multiple foci. The right humerus, ulnae, sternum, scapulae, left ilium, and right femora were affected by this process. The skull and vertebrae were unaffected. Due to the widespread nature of the lesions, their margins, and location, systemic fungal infection is indicated. Blastomycosis is common in the region and is the most likely condition; differential diagnoses will be explored.

Sara WALLACE (Ohio State University, USA)

AN INVESTIGATION OF SCHMORL'S NODES IN INSTITUTIONALIZED INDIVIDUALS.

Does the causative force that creates a Schmorl's node produce a predictable pattern of appearance and location on the vertebral body; and can the analysis of the presentation shed light on the origins of the pathology, allowing a clearer life history to be produced? This project aims to establish if there is an association between presentation of paleopathological outcomes and causative biomechanics potentially caused by temporal trends in care. Data for this project comes from 86 burials that are associated with the Oneida County Poorhouse. Basic demographic information was used from previous studies. Pathologies were measured via anthroposcopic analysis. A measurement/landmark and grid-based method for mapping the location of each node allows overlay and comparison of samples and allows classification of Schmorl's nodes and suggests possible links between known information to further elucidate the etiology of Schmorl's nodes. Basic statistics and significance tests were run for various categories. Males, likely to be subjected to labor therapy, present a higher prevalence and severity of pathology than females from the same institution. Correlation was found between vertebral volume and the presence of Schmorl's Nodes. Appearance of pathologies show strong similarities but location comparisons did not present in any significant patterns in this sample size. Further study of other institutionalized populations may yield further statistics to support these findings.

Teresa V WILSON (Louisiana State University, USA)

THE VIABILITY OF USING 3D SCANNING IN THE STUDY OF DENTAL PATHOLOGIES AND ENAMEL DEFECTS IN BIOARCHAEOLOGY. +++

The use of 3D scanning technologies in paleopathological studies is becoming widespread and affordable. 3D scanning allows for a nondestructive and accessible way to bring osteological collections into the classroom and the laboratory. When using inexpensive, consumer-grade scanning technologies, researchers can run into many logistical and quality problems, including excess noise and gaps in the scans. Teeth are difficult to scan due to the glossy texture of the dental tissues interfering with the reflective angles of the lasers employed by 3D scanners. This study looks at the viability of using consumer-grade 3D scanner technologies to record and analyze dental pathologies and enamel defects in bioarchaeological research. Five isolated teeth were selected from one modern population, 15 isolated teeth were selected from three historical populations, and five mandibles (teeth: n=20; mandibles: n=5) were chosen as examples of various dental pathologies and enamel defects. Each specimen was scanned using a NextEngine 3D Ultra HD scanner and processed using the NextEngine ScanStudio ProScan software. Each specimen was scanned using different resolution settings, lighting conditions, and scanning techniques. Each scan was compared for measurement accuracy and the precision in which the defect or lesion was captured. Ten teeth representing various resolution settings were printed using a 3D printer to assess the possible advantages of using printed models as opposed to 3D virtual models. The results of this research provide recommendations for scanning dentition in bioarchaeological research when precision and accuracy are needed to identify, measure, or compare dental pathologies and enamel defects.

Heather WORNE (University of Kentucky, USA)

BIOARCHAEOLOGICAL ANALYSIS OF CARE PROVISION IN A NINETEENTH CENTURY HOSPITAL IN CENTRAL KENTUCKY. +++

The current study presents a case of possible disability of an individual from an historic cemetery in Central Kentucky. Individuals interred in the cemetery were patients of a psychiatric hospital during the mid-19th century. This case study focuses on a juvenile male who appears to have suffered from a neurogenic disorder, displaying evidence of extreme atrophy of one arm and one leg, as well as skeletal changes to the spine and pelvis associated with injury or disuse. A differential diagnosis is presented followed by consideration of the care he likely received within the context of a 19th century institution. This analysis draws upon the recent theoretical and methodological framework developed for the “bioarchaeology of care” in order to investigate possible disability and care provision in bioarchaeological contexts. This approach investigates the relationship between biological and sociocultural dimensions of physical impairment. Utilizing the Index of Care, his disability is assessed to identify possible immediate and long-term impacts that his disorder may have had on his ability to perform daily activities within the social, cultural and physical context in which he lived, and whether care provision would have been necessary for his survival (<http://www.indexofcare.org>). This paper also addresses how life in an institutional may have affected the type of care he likely received for his disability and how that may differ from the care he might have received outside of the hospital setting.

**Qun ZHANG, Zhichao SUN, Ningning LIANG, Xiaofang GAO & Quanchao ZHANG (Jilin University, China)
A SUSPECTED DIAGNOSIS OF SKULL METASTASES ON THE HUMAN REMAINS FROM SHIYANZI, A
CEMETERY OF HAN DYNASTY IN NORTH CHINA.**

This poster reports a suspected diagnosis of skull metastases on the human remains recovered from Shiyanzi (2100 B.P.), a cemetery site of Han Dynasty in northern China. This specimen shows bone erosion on most part of the calvarium, but there is no similar lytic postcranial evidence of malignancy. Left parietal bone and frontal bone are missing because of the osteolytic lesion to varying degrees. On the margin, it shows a short zone of transition between the lesion and the normal bone with porous and rough surface. The irregular and inward to outward-like beveled margins shows a possible neoplasm from the inside out. There is no typical feature of any disease observed on it based on the macroscopic observation. With a similar case shown on the reference book, we can only make a suspected diagnosis of metastatic cancer.



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