PALEOPATHOLOGY ASSOCIATION

SCIENTIFIC PROGRAM
Twenty-Seventh Annual Meeting

11 and 12 April, 2000

SAN ANTONIO, TEXAS
SECTION 1: WORKSHOPS

A. PALEOPATHOLOGY CASE REVIEWS

Organized by Donald J. Ortner, Department of Anthropology, National Museum of Natural History, Smithsonian Institution, and Bruce Ragsdale, Arizona State University. Conducted by Donald J. Ortner.

Unfortunately, Bruce Ragsdale was unable to attend the meetings of the Paleopathology Association this year, and his presence, expertise, and contributions were greatly missed. The content and format of the Ortner/Ragsdale annual workshop were slightly different than in past years. This year, each participant in the workshop was invited to bring one or two paleopathological cases (skeletal material, plus photographs and radiographs) for review by the other participants. Ten cases of skeletal pathology were reviewed, including five cases provided by Don Ortner, two by David Hunt (Department of Anthropology, NMNH, Smithsonian Institution), and one case each by Anne Titelbaum and Heather Backo (Department of Anthropology, Tulane University) and Alana Cordy-Collins (Department of Anthropology, University of San Diego).

Following the introduction of the cases by the organizer, the participants were invited to examine and evaluate each one. Ortner presented three cases of scurvy from the NMNH collections including one example that had evidence of both scurvy and anemia (NMNH 377454). Another case of scurvy (NMNH 3087600) demonstrated inflammatory lesions of the postcranial skeleton, particularly the scapulae. A classic case of osteosarcoma from the Terry Collection (NMNH 382085-360) provided a useful introduction to the skeletal manifestations of this disease. A troublesome case of spinal disease from the American Southwest (NMNH 329208) involves a severe destructive process of the cervical vertebrae with abnormal alignment and fusion. Opinions on the diagnosis varied but Ortner’s opinion was that it was probably an example of juvenile onset erosive arthropathy.

Hunt presented two cases from the Mammal collections of the NMNH. One of these (VZ 293165) was a case of fracture and non-union in an orangutan. There was debate about a possible infectious focus that led to a pathological fracture. The other case (VZ A49898) was the skeleton of a juvenile orangutan showing the classic features of scurvy. Backo described a large lytic lesion on the left ilium of a child aged 7 to 8 years from Northern Peru, dating to the Lambayeque Period. The lesion was located at the sacroiliac joint, and led to perforation of the ilium. Although there was some involvement of the articular surface of the sacrum, no other abnormality was noted in either the cranial or postcranial skeleton, except for extensive PH. Titelbaum’s case was also from northern Peru, an adult male with localized ankylosis of L3/L4. Congenital disease, DISH, ankylosing spondylitis, DJD, vertebral osteoarthritis, metabolic or endocrine disorders, and neoplastic growth were eliminated as differential diagnoses, leaving a diagnosis of ‘healed bacterial infection’ (favored by the physicians in the workshop) or ‘healed fracture’ (preferred by the anthropologically-trained paleopathologists present). Cordy-Collins described a young adult male from a Moche site in northern Peru who displayed a suite of rare anomalies - cortical thinning, reduced trabeculae, pathologic compression fractures, bilateral posterior parietal thinning, and odontoid aplasia - as well as unusually tall stature.
After the review period, the workshop participants reconvened and each case was presented by the contributing participant. This presentation included a description of the pathology and the presenter’s diagnostic options for the case. A lively discussion of the case by all the participants followed, in which diverse opinions about pathogenesis and diagnosis were expressed. This diversity of opinion highlights the need for careful description of each paleopathological case so that different observers can reach their own conclusions about pathogenesis and diagnosis.

B. SKELETAL TRAUMA

Organized by Charles Merbs, Arizona State University, with presentations by Charlotte Roberts, University of Durham, UK; Lenore Barbian, National Museum of Health and Medicine, Armed Forces Institute of Pathology; Phillip Walker, University of California, Santa Barbara; Robert Jurmain, San Jose State University; Eugénia Cunha, Universidade de Coimbra, Portugal; and Jerome Cybulski, Canadian Museum of Civilization.

The workshop began with a review of principles of skeletal trauma, particularly the processes of fracturing and healing of bone tissue. Locations of fractures in the skeleton and rates of healing were considered, along with occasional complications such as nonunion with pseudoarthrosis development, and compound fracturing resulting in infection. Using forensic cases involving child abuse, evidence of surprisingly rapid response to skeletal trauma was discussed. Several documented cases were presented that involved severe trauma resulting in subtle skeletal lesions that would be difficult to interpret without the soft tissue evidence. Skeletal trauma in nonhuman primates was also considered, including several examples clearly resulting from interindividual aggression. Skeletal trauma, particularly due to interpersonal violence, was also examined on a regional basis, with Portugal, British Columbia (Canada) and California (U.S.) being the foci of attention. Skeletal specimens of trauma showing amputation, poor union and nonunion, and infection were available for examination and discussion, courtesy of the National Museum of Health and Medicine and the efforts of Lenore Barbian, and to the San Diego Museum of Man and the efforts of Rose Tyson and her assistants Tori Heflin and Trisha Biers. A spirited discussion ensued which was prematurely terminated by lack of time.
SECTION 2: CONTRIBUTED PAPERS

DEVELOPMENTAL ANOMALIES FROM THE ABYDOS MIDDLE CEMETERY, EGYPT

Brenda J. Baker and Scott E. Burnett, Arizona State University

During the Fall 1999, 18 in situ skeletonized burials were excavated in the Middle Cemetery at Abydos, many of which exhibited skeletal anomalies. These burials are tentatively dated to the First Intermediate Period (c. 2181-2040 BC) or Middle Kingdom (2040-1786 BC). A subset of the abundant commingled bone (ranging from Old Kingdom to Ptolemaic) was examined, yielding further evidence of rare traits and possible congenital syndromes in this sample. Among the burials, two females have cervical ribs. One, a 17-20 year old, also has P2 hypodontia, absence of a lumbar vertebra, manubrium-first sternebra fusion, and bilateral non-osseous coalition of MT3-C3, suggesting the presence of a syndrome. Other defects in the burial sample include caudal shifting, spina bifida, and vertebral malsegmentation. Defects in the commingled remains include a partially bifurcated fibula, bipartite first cuneiforms, carpal and tarsal coalitions. The abundance of defects found underscores the need for further research on this oft-neglected topic.

TURNED ANKLES AND TROUBLED TIMES AT SAN JUAN CAPISTRANO MISSION, SAN ANTONIO, TEXAS: A BIOARCHAEOLOGICAL ANALYSIS OF SKELETAL TRAUMA

Joan E. Baker, Texas A&M University [Cockburn Student Award Runner-up]

Hundreds of Native Americans lived, worked, and died at the San Juan Capistrano Mission (located in what is now San Antonio, Texas) between A.D. 1731 and A.D. 1834. Two groups of burials were excavated from the mission grounds in the 1960s. Burials from Room 26 are primarily those of Native American individuals and date to the early mission period (approximately 1731 to 1756). Those from Room 17 represent a post-secularization group of individuals, probably of mixed ancestry, dating to the colonial period (approximately 1793 to 1862). Although both groups experienced high rates of skeletal trauma, the mission period individuals suffered a different range of injuries than the later group. This difference may be due in part to inter- and intragroup tensions between the Spanish and the many Native American groups living at the mission. Hard labor at unaccustomed tasks may also account for some of the trauma in the early mission period individuals.

THE INTERPRETATION OF TRAUMATIC LESIONS

Pia Bennike, University of Copenhagen, Denmark

It is generally known that in some cases traumatic lesions on skeletal remains may be difficult to interpret. It is not always evident whether the lesions are ante or post mortem ones or whether they were caused by (invasive) treatment or not, especially when the degree of preservation is low. In studies including bone trauma a number of published experiments have proven to be of great help to people working in the field of
palaeopathology and forensic anthropology. Several Danish cases of bone specimens with traumas traceable to known scenarios will be demonstrated and discussed. Together with a number of carefully excavated and registered samples they provide us with valuable knowledge and may help to understand and minimize misinterpretations.

**ENAMEL HYPOPLASIA AND STATURE: A TEST OF CORRELATION AND CAUSATION**

Carrie Anne Berryman and Kate Spradley, University of Arkansas, and Cory Sparks, University of Tennessee

Many of the primary indicators of health status utilized by physical anthropologists have been termed "nonspecific" indicators of stress. These markers of stress are the result of a variety of factors causing a metabolic disruption (malnutrition and/or disease), that may leave permanent or temporary indicators of stress in the skeletal system of an individual. The inability to determine specific causes for these markers results in much debate among bioarchaeologists attempting to determine the physical consequences of certain behavioral changes in human history, such as the transition to agriculture. This paper will explore the relationship between two indicators of stress, linear enamel hypoplasias and stature, in a variety of archaeological settings differing geographically and temporally. We hope that this research may enable anthropologists to more accurately interpret the stress event responsible for the markers found in the skeleton (chronic stress such as malnutrition versus acute stress).

**SUBADULT SCURVY: A PROBABLE CASE FROM EARLY BYZANTINE CRETE (GREECE)**

Chryssa Bourbou, Chania, Greece

Subadult scurvy is not well documented in archaeological human remains nor in the early medical literature. Several reasons may contribute to this gap in our knowledge. Not all children who suffered from scurvy died from the disease, or from other causes when they had scurvy; additionally scurvy may not leave clear bone changes in every case of the disease. The lack of evidence in Greece can be attributed to the temperate climate of the country that provided a diet of vitamin C-rich foods. However, the case presented here exhibits skeletal lesions that are most probably attributed to scurvy. As it is unusual for scurvy to develop under "normal" living conditions, an association with natural disasters, such as earthquakes, that have characterized the poorly understood early Byzantine era of Crete, is investigated.

**AN ALTERNATIVE EXPLANATION FOR THE DISTRIBUTION OF BONE LESIONS IN TREPONEMAL DISEASE**

Hallie R. Buckley & George Dias, University of Otago, New Zealand

This paper discusses the pathological mechanism for the distribution of skeletal lesions in treponemal disease. It is generally accepted that the limb bones of the extremities are most commonly affected in treponemal disease. The skeletal distribution of bone lesions in treponemal disease is generally explained because the commonly affected bones lie close to the skin and are more likely to be exposed to trauma with
subsequent subperiosteal new bone production. The literature which forms the foundation of this explanation is reviewed. An alternative explanation is proposed, based on the anatomical distribution of the regional lymph nodes. It is demonstrated that the distribution of the lymph nodes mirrors the distribution of the characteristic skeletal distribution of bone lesions in treponemal disease. The role of the lymphatic system in the immune response to disease is reviewed and the relationship of subcutaneous lymph nodes to the bones most affected in treponemal disease is demonstrated.

SCALPING IN THE SOUTHWEST U.S.: NEW CASES FROM PECOS PUEBLO AND SMOKEY BEAR RUIN, NEW MEXICO

Scott E. Burnett, Arizona State University [Cockburn Student Award Runner-up]

Evidence of scalping continues to be discovered yearly. Hundreds of cases are now known nationwide leading to regional syntheses for the Northern Plains and southeastern United States. The purpose of this paper is to review the burgeoning bioarchaeological evidence of scalping in the Southwest U.S. and describe recently discovered cases from two sites in New Mexico: Pecos Pueblo and Smokey Bear Ruin. A minimum of thirty-five scalping cases are now known in the Southwest U.S. The cases range in date from the Basketmaker II period to historic times with the majority dating from A.D. 900 to 1400. Male scalping victims outnumber female victims by a 2:1 margin in skeletons for which sex can be determined. Although over 80% of scalped individuals are classified as adults over twenty years of age, children aged four to six years old from Smokey Bear Ruin are among the victims.

PREHISTORIC PERUVIAN GIANTS?

Alana Cordy-Collins, University of San Diego

Recent excavations at a North Coast prehistoric Peruvian archaeological site have revealed three cases of apparent gigantism. A portion of the site's largest mud-brick pyramid served as a cemetery for citizens of the Moche elite during the 4th-5th centuries AD. There, in 1997, we encountered the tomb of a young adult male exhibiting unusual skeletal proportions and anomalies. In 1998 and 1999 we excavated two more such individuals. All were buried in the same stratigraphic layer of a single architectural feature, and were accompanied by similar grave goods and sacrificial offerings. Thus, the three individuals appear to have been interred as one event. So unusual is their suite of osteoanomalies that it suggests a close relatedness among the three. This paper discusses some of their conditions: cortical thinning, reduced trabeculae, pathologic compression fractures, bilateral posterior parietal thinning, odontoid aplasia, and others.

'HORSERIDER SYNDROME': THE INTERPRETATION OF SOME PORTUGUESE CASES

Eugénia Cunha, Universidade de Coimbra, Mary Lucas Powell, University of Kentucky, Carina Marques, and Francisca Cardoso, Universidade de Coimbra

A series of symmetrical enthesopathies located on the femur and pelvis has been described (Blondiaux 1994, Miller 1995, Palfi and Dutour 1996) as indicators of habitual horseriding. These lesions are
associated with insertion sites of muscles that adduct or abduct the legs, most frequently the gluteus maximum insertion on the proximal femur. Most of the cases here described are from Portuguese medieval sites, and several are from mortuary contexts which suggest that the individuals were knights. However, one case dated to the Mesolithic also shows these 'classic' signs, several millennia before historical documentation of equitation in Portugal. On the basis of the cases here presented we question the validity of the marked muscle insertion as an invariable sign of horseriding activity. We suggest that this pattern of enthesopathies may indeed often be causally associated with habitual horseriding, but that it is not invariably pathognomonic of this specific behavior.

**FASCIOLA HEPATICA EGGS IN A 4,500 YEAR OLD SOIL SAMPLE FROM THE PELVIC REGION OF A HUMAN SKELETON FROM GERMANY**

Katharina Dittmar and Wolf R. Teegen, University of Leipzig

From prehistoric Europe only a few helminth eggs have yet been recovered from mummies, coproliths and bog corpses. Analyses of medieval latrines have also provided evidence of intestinal infections. Regarding these findings, their presence in soil samples was hypothesized. During excavations of a tomb from the end of the neolithic Corded Ware Culture (2500 B.C.), soil samples were taken from the sacrum area of a human skeleton. The sample was rehydrated, treated by several parasitological techniques and microscopically examined. Eggs of the trematode *Fasciola hepatica* and of the nematode species *Capillaria* were observed. *Fasciola hepatica* is a common liver fluke of sheep and cattle. In the temperate climate zone it rarely affects humans. Due to careful sampling techniques a true infestation with this endoparasite seems more likely than a contamination. Regarding the *Capillaria* eggs, a contamination through rodents is highly probable. Further investigations are in progress.

**SUBADULT HEALTH IN PREHISTORIC THAILAND**

Kate M. Domett, University of Otago, New Zealand

The subadult portion of a community is especially sensitive to the natural and cultural environments. Subadults provide an indication of particular environmental conditions such as the adequacy of the diet, the extent of the pathogen load, and the social complexity of a community. This is investigated in skeletal samples from two regions within prehistoric Thailand. There are two skeletal samples from the southeast, Khok Phanom Di (early agricultural, 2000-1500 BC) and Nong Nor (Bronze Age, 1100-700 BC), and two from the northeast, Ban Lum Khao (Bronze Age, 1000-500 BC) and Ban Na Di (early Iron Age, 600-400 BC). Measures of subadult health, including subadult mortality, growth and growth disturbances, and adult stature, will be compared among the samples. A model will be presented as a new way of integrating this information to obtain a complete picture of subadult health at the population level.

**QUININE IN THE DESERT: THE ARIZONA MALARIA HISTORY PROJECT**

T. Michael Fink, Arizona Department of Health Services, Phoenix
During the 19th Century malaria was so common in the U.S. that it was dubbed the "American Disease." Many parts of the country, including the western frontier, had to adapt to the seasonal cycle of "intermittent fever." Although the disease is no longer endemic in the continental U.S., there is concern that it could become so again. This is due to the worldwide reemergence of malaria and the recent number of autochthonous cases in U.S. Despite an arid climate, Arizona was one of the frontier regions where malaria once well established. The Arizona Department of Health Services is currently studying the natural and anthropogenic factors that once sustained the disease at endemic levels. This includes sampling residual anopheline mosquito populations, DNA analysis of major vector species, and discerning the validity of historic accounts. The study illustrates how historic epidemiology can serve the interests of medical historians as well as epidemiologists.

UNUSUAL FOOT PATHOLOGY IN AN AMERICAN INDIAN SKELETON FROM ILLINOIS

Leslie Harlacker, Indiana University  [Winner of the Cockburn Student Award]

The partial skeleton of an adult individual showing severe abnormalities of three metatarsal bones was recovered from the historical site of Starved Rock in La Salle County, Illinois. The deformity is found in the left first, third, and fourth metatarsals, which are shortened and have flattened, porous heads. All the preserved left foot bones are smaller than the corresponding elements from the right side; they also differ significantly from a reference population from the Schild site in Illinois. The paucity of skeletal material for this individual makes a positive diagnosis difficult; however, the deformity appears to indicate a case of pauciarticular juvenile chronic arthritis. Several other conditions that might also account for the deformity are considered, including pseudohypoparathyroidism, trauma, clubfoot, and congenital syndromes. Though fragmentary, the available evidence points most strongly to a diagnosis of juvenile chronic arthritis with secondary osteoarthritic pathology.

DEGENERATIVE ARTHRITIS OF TEMPORAMANDIBULAR JOINT IN THE SKELETAL SAMPLE FROM ANCIENT POMPEII, 79 A.D.

Renata J. Henneberg and Maciej Henneberg, University of Adelaide, Australia

The skeletal remains of the inhabitants of ancient Pompeii excavated from various locations at the archaeological site have been examined. Degenerative changes on mandibular condyles and in glenoid fossae of skulls were assessed according to the method described by Richards and Brown (1981). Changes in temporomandibular joints were observed in 38 out of 108 adult mandibles (35.2%) and in glenoid fossae of 48 out of 201 skulls (23.9%). Males and females were equally affected. Frequency of degenerative changes increased with age. Only 13.5% affected were 20-30 years old individuals and 46.8% affected were 50 years old or older adults. Tooth wear and tooth loss in relation to the degenerative arthritic changes in the joint are also discussed.
ARCHAEOPARASITOLOGICAL STUDIES CONCERNING THE CHIRIBAYA CULTURE OF SOUTHERN PERU

Dan Holiday, Quinnipiac College and Sonia Guillén, Centro Mallqui, Peru

The Chiribaya people were first reported by the archaeologist Humberto Ghersi in 1956. The center of their cultural zone was within the Osmore river valley located in the southern Peruvian departamento of Moquegua. From May to July 1991 an analysis of 31 human coprolite samples was conducted in the Centro Mallqui’s Bioanthropology Foundation of Peru laboratory in El Algarrobal, Peru. This research demonstrated infection with tapeworms (Diphyllobothrium sp.) and the presence of nematode larvae. This is the first report of helminthological studies from coprolites of this cultural zone in Peru. Results of this study will be presented along with a description of future research goals which include comparing past and present helminthological infection patterns in the region.

Mycobacterium tuberculosis complex DNA from an extinct bison dated 17,000 BP

Larry Martin, University of Kansas, Bruce M. Rothschild, Northeastern Ohio Universities College of Medicine, Galit Lev, Gila Khila, Hillem Bercovier, Charles Greenblatt, Hebrew University, Jerusalem, Helen D. Donoghue and Mark Spigelman, Royal Free Hospital and University College London

Tuberculosis has been shown to exist on both sides of the Atlantic prior to European contact with North America (Salo et al 1994, Rothschild and Martin 1993, Verano and Ubelaker, 1992, and Widmer and Perzigian 1981). Recognition of tuberculosis-compatible pathology in bones of North American Pleistocene bovids suggested an early occurrence on that continent. This has been confirmed using DNA analysis from an affected bison dated to 17,000 years ago. The presence of similar pathology in fossil bighorn sheep and extinct musk ox suggests that the Mycobacterium tuberculosis complex of organisms was widespread in bovids that immigrated to North America over the Bering Straits during the late Pleistocene, suggesting a holoarctic distribution. The DNA analysis using TB specific primers (IS 6110) was done both in London and Jerusalem. The Jerusalem laboratory produced some interesting results using spoligotyping techniques, the problems and significance of which will be discussed. Recovery of mycolic acids from the bone specimen by A. Gernaey (U Newcastle) confirms infection of the bison by a pathogen in the Mycobacterium tuberculosis complex; although that test cannot distinguish between M. tuberculosis and M. bovis, it does support the DNA analysis.

DISH IN MEDIEVAL TIMES AND TODAY

Simon Mays, English Heritage

The prevalence of DISH (diffuse idiopathic skeletal hyperostosis) in two Mediaeval skeletal series is compared. One comprises burials of low social class from a rural site, the other comprises middle class benefactors interred at a friary site. Attention is paid to methodological aspects of recording this condition and quantifying its presence in earlier populations. The prevalences found in these two archaeological
groups are also compared with that in Caucasian populations today. Findings are discussed in the light of current ideas as to risk factors which may influence the prevalence of this condition in populations.

DUAL ENERGY X-RAY ABSORPTIOMETRY (DXA) OF THE RADIUS IN ARCHAEOLOGICAL BONE: A BETTER ASSESSMENT OF BONE MINERAL DENSITY (BMD) THAN THE FEMUR?

Janis M. McEwan, University of Alberta

DXA seems useful for measuring BMD in archaeological bone, but little is known of the effects of burial. As osteoporosis usually occurs after 50 when age can only be estimated, but starts earliest in the distal radius, DXA measurements here should be a more sensitive representation of bone loss than the femur. However, this highly trabecular bone often shows signs of erosion distally. Thirteen radii from the British medieval population at Wharram Percy were studied using standard DXA methodology, and the BMD measurements correlated to age, macroscopic signs of erosion and X-rays. BMD showed a direct correlation between estimated age and modern values. Visible erosion did not affect quantification unless also visible on X-ray. Measurements at the mid and upper third most accurately reflected BMD as most damage appears at the ultra-distal site. Radial BMD may be a more sensitive predictor of bone loss in archaeological bone than femoral BMD.

CONGENITAL SPONDYLOLYSIS REVISITED

Charles F. Merbs, Arizona State University

The early literature on spondylolysis refers to two alternative etiologies--congenital versus traumatic, with the trauma etiology gradually gaining supremacy. Specifically, spondylolysis is now seen as a kind of stress or fatigue fracture, produced by repeated microtrauma related to erect posture and accentuated by activities that put unusual stress on the lower back. Although this etiology appears to fit cases found in the lower lumbar region, the area of the lumbar curve which is so intimately related to erect posture, it is difficult to apply to cases observed in other regions of the column. This study examines clinical, anatomical and osteological cases of spondylolysis that appear to be of congenital origin. Although rare overall, the condition appears to occur most frequently in the cervical region, especially C6. The defects appear to reflect errors of chondrification rather than ossification, with the pedicle being affected most frequently. Congenital spondylolysis frequently occurs in company with other developmental defects of the same vertebra, adjacent vertebrae, or other parts of the body.

GROSS PATHOLOGY AND MOLECULAR DIAGNOSIS OF CHAGAS’ DISEASE IN THE PREHISTORIC AMERICAS

Karl J. Reinhard, University of Nebraska, Adauto Araújo and Luiz Fernando Ferreira, Escola Nacional de Saúde Pública, FIOCRUZ

This paper summarizes the work completed by an international group of researchers from Brazil, Chile, and the USA concerning the prehistory of Chagas’ disease in the New World. A case study of a
Chihuahuan Desert mummy is presented that exhibits the gross pathology of megacolon typical of the disease. A second case study of molecular diagnosis of Chagas' disease from a Chilean mummy by a consortium of Brazilian researchers is also presented. The two studies show that gross pathology of Chagas' disease can be seen in mummies. In cases where no pathology is visible, molecular analysis of mummy tissues can recover trypanosome DNA.

CHILDHOOD IN EARLY BYZANTINE ANATOLIA - ETIOLOGY AND EPIDEMIOLOGY IN THE SUBADULT POPULATION FROM ARSLANTEPE (TURKEY)

Michael Schultz and Tyede H. Schmidt-Schultz, University of Göttingen, Germany

During the field season of 1999, the skeletons of 97 subadults excavated by Italian archaeologists at the site of Arslantepe in Eastern Central Anatolia were examined. The skeletons date to the Early Period of the Byzantine Empire (6th to 8th century AD). Pathological changes of long bones which could not be diagnosed by macroscopic examination only were x-rayed at Göttingen University. Furthermore, from selected specimens, samples were taken for light (plane and polarized light) and scanning-electron microscopy. The results are striking. There is only relatively little evidence of malnutrition (e.g. rickets about 2%). However, scurvy could be diagnosed in about 11%. The frequency of anemia is also relatively low (12.5%). As a rule, some infectious diseases, for instance otitis media (0%) and sinusitis frontalis (0%), were extremely rare, whereas meningitis (about 12%) and sinusitis maxillaris (about 16%) show a slightly higher frequency. Nevertheless, the health situation was apparently much better than in other medieval Anatolian populations. The causes of these low frequencies of diseases will be discussed.

TB IN HUNGARY IN THE 18TH-19TH CENTURIES

Mark Spigelman, Helen D. Donoghue, Helen Fletcher, John Holton, Royal Free Hospital and University College London School of Medicine, Mark Thomas, University College London, and Ildrico Pap, Hungarian Natural History Museum, Budapest

We have access to 265 naturally mummified individuals from the 18th and 19th centuries discovered during the reconstruction of the Dominican Church of Vac, Hungary, in 1994-1995. The crypts were continuously utilized for burial from 1731-1838 and were the traditional burial site for a number of middle class families. More than 400 samples including lung, abdomen, pelvis, muscle, ribs, hair, skin, nails, teeth and clothing from 173 of these individuals are currently being screened for the presence of Mycobacterium tuberculosis DNA at the Department of Bacteriology, Windeyer Institute of Medical Sciences, University College London (Table 1). Contemporary written records are available for each individual and include information such as gender, date of birth, date of death, family name, relatives and a brief description of cause of death. Reasons for the presence of significant TB infestation in a middle class rural population of a small township well before the Hungarian industrial revolution will be discussed.

The samples were screened by nested PCR for the presence of TB DNA. Mycobacterium tuberculosis complex-specific PCR was performed with outer primers that amplify a 123bp fragment of the insertion element IS6110 followed by amplification of a 92bp internal fragment. Further analyses include the typing of strains into genotypic groups 1, 2, and 3 on the basis of silent point mutations in codon 463 of KatG.
and codon 95 of GyrA, the screening of samples for the presence of the multi-drug-resistant isolate "strain W" by the amplification of a W-specific copy of IS6110 in the dnaA-dnaN region, and screening for point mutations associated with drug resistance in the rpoB, katG, inhA and 23S genes. We have been able to amplify TB DNA from 40% (69/173) of these bodies.

This research was funded by a grant from the Wellcome Trust, UK.

Table 1. Summary of background work on Hungarian specimens

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TRAUMA IN STARIGARD/OLDENBURG (NORTHERN GERMANY)

Wolf R. Teegen, University of Leipzig and Michael Schultz, University of Göttingen

The population from Starigard/Oldenburg (Northern Germany) dates back to the 10th century AD. One hundred tombs were excavated, containing 66 subadults and 34 adults. These individuals belonged to the highest social class of the western Slavic tribe, the Wagrii. The skeletal material was studied by macroscopic and radiological techniques. Fifteen out of 35 individuals (44.1%) showed traumatic effects. Nine out of 34 individuals (26.5%) showed trauma of the skull, including two cases with unknown origin (burial 24 and 124). Eight out of 34 individuals (23.5%) showed traumatic alterations of the postcranial skeleton (including two unclear cases; burial 12 and 33). Cranial and postcranial trauma were found only in the man from grave 19 and the woman from grave 24. Injuries caused by arrows were found in burials 4, 98 and 99, and trauma due to cuts was present in burials 5, 6, 19, 28, 77, 98 and 121. They were cause of death for the individuals 4, 5, 19, 28 and 99. Probable war injuries were present at least in 9 out of 34 individuals (26.5%). With respect to fatal and survived war injuries there is an interesting result. Their frequency decreases from late juvenile to senile individuals. It could be that the young warriors fought more often than older ones and had also a higher risk of dying in the war. If they survived, they had a chance to grow old. The 50-59 year old man from grave 121 had suffered from a sword blow to the left mandible, cutting also part of the jaw and temporal bone. Medical treatment was applied (trephination), probably removing bone fragments. He survived the attack and survived for some length of time, with a chronic inflammation of mandible and cranium and severe alterations of the temporomandibular joint.

CLASSIC MAYA DIET AND HEALTH AT PIEDRAS NEGRAS

Cassady J. Yoder and Andrew K. Scherer, Texas A&M University
Paleopathological studies of Maya skeletons have dramatically increased in the past twenty-five years. One of the outcomes of this research has been the documentation of significant regional variation in diet and health in the Maya lowlands. This paper will examine the skeletal remains from Piedras Negras, a site in the Usumacinta River region, an area that has been overlooked in previous studies. Recent excavations at Piedras Negras have produced a series of 77 burials representing approximately 100 individuals. We report the results of systematic analyses of the skeletal and dental pathologies, including periostitis, porotic hyperostosis, dental caries and enamel hypoplasias. These data provide the first glimpse of ancient Maya diet and health for this important region of the Classic Maya lowlands. These preliminary data also are compared to osteological data gathered from other sites in the Maya lowlands and contribute to the emerging picture of regional variability in diet and health.

BIOARCHAEOLOGY OF A MULTIPLE INTERMENT TOMB AT YESILEH, JORDAN

Melissa Zabecki, Wendy Willis, University of Arkansas, and Michelle Buzon, University of California, Santa Barbara

The analyses focused on the context and health of individuals interred in a tomb at the Early Byzantine site of Yesileh. There are primary interments inside a finished grave and groupings of disarticulated material outside the grave, suggesting that individuals were removed from the grave and replaced elsewhere in the tomb. The discovery of males, females, adults, and subadults indicates that the tomb was not used for a specific age or sex group. The paleopathology suggests a relatively healthy population due to the low occurrences of infectious lesions, trauma, and dental problems. Although one tomb cannot represent an entire population, this is the first tomb at Yesileh to be understood well enough to act as a comparison for interpreting other tombs. Funding and support were provided by the King Fahd Middle East Studies Program at the University of Arkansas.
SECTION 3: POSTER PRESENTATIONS

CUT MARKS AS CLUES: A STUDY OF THE TOOLS AND TECHNIQUES USED IN LAMBAYEQUE HUMAN SACRIFICE

Laurel S. Anderson and John W. Verano, Tulane University

This poster demonstrates the usefulness of both macroscopic and microscopic analyses in the study of cut marks on human skeletal remains. Our sample consists of six sacrificial victims from a Lambayeque period (A.D. 800-1375) mass burial at Pacatnamu on the north coast of Peru, and a small sample (n=4) of camelid bones included for comparative purposes. Bones were examined visually with the naked eye, with a hand lens, under a light microscope, and using a scanning electron microscope. Cut marks were recorded in terms of frequency, location, morphology, anatomical association, and inferred activity. Cross-sections of cut mark casts were made to obtain more detailed information on cut mark morphology and tool material. The utility and value of cut mark analysis in reconstructing Precolombian human sacrificial practices is discussed.

A TWIST OF FATE? TORTICOLLIS IN AN UNUSUAL SKELETON FROM PREHISTORIC ARIZONA

Brenda J. Baker, Arizona State University and Sharon A. Hurlbut, Archaeological Consulting Services, Ltd., Tempe

The skeleton of an old adult female (60+) from a Gila phase site (A.D. 1275-1350) in central Arizona presents unusual pathology. Marked asymmetry affects the entire skeleton. The skull is skewed inferioposteriorly to the left, with the face twisted to the right. The foramen magnum is constricted, with asymmetrical condyles and a paracondylar process on the left side. Articular facets of the cervical vertebrae are unequal in size, with unilateral osteoarthritis. Bones of the left arm and leg are visibly shorter and less robust than those of the right. These attributes are consistent with congenital torticollis. In addition, a large piece of irregularly ossified tissue fits inside the cranium in the area above lambda. The extra ossification is associated with a resorptive lesion on the internal table of the right parietal. It is unclear whether the peculiar ossification is related to the torticollis. Birth trauma and alternative explanations are explored.

FIELD VIDEO ENDOSCOPY - A PILOT PROJECT AT CENTRO MALLQUI, EL ALGORROBAL, PERU

Ronald Beckett, Quinnipiac College and Sonia Guillén, Centro Mallqui

This project was conducted to determine the feasibility of using video endoscopy as a data collection tool in the field. The project was conducted at Centro Mallqui in El Algorrobal near Ilo, Peru. Several Chirabaya
mummies served as the subjects for this project. Instrumentation included video endoscope, camera control unit, light source, video capture, and a laptop computer. Although the instrumentation can be operated by battery, most of the work at Centro Mallquí was conducted using a transformer and a gas generator. Portability and image quality proved to be strengths of field video endoscopy. Recommendations regarding power include using: 1) transformed power when available, 2) gas powered generator for back up, and 3) battery back up as needed. Other than power source, there were no other limitations apparent. Video endoscopy appears to be a practical tool for anthropological field studies.

THE MYSTERIES OF THE MUMMIES: EDUCATING THE PUBLIC ABOUT HUMAN REMAINS

Trisha Biers, San Diego State University and San Diego Museum of Man

Do people who are not involved with physical anthropology understand the value of researching human remains? If not, then it is the responsibility of museums to use their collections appropriately, and to create awareness of how important the skeletal record can be today. The San Diego Museum of Man featured an exhibit titled The Mysteries of the Mummies from July 13, 1998 to September 7, 1999. During this time, the museum saw a large increase in attendance, and the exhibit became one of the most popular in the Museum's history. Visitors learned about the elements of mummification, trophy skulls, and other culturally diverse mortuary practices. With the media attention on both NAGPRA and the latest discoveries in the world of mummification, the general public can easily be confused as to what is appropriate and what is not. It is the job of museums to help educate the public about the value and importance of the examination and exhibition of human remains, while at the same time being sensitive to the beliefs of others.

PRESSURES ON OSTEOLOGICAL COLLECTIONS - THE IMPORTANCE OF DAMAGE LIMITATION

Anwen C. Caffell, Charlotte A. Roberts, Robert C. Janaway, and Andrew S. Wilson, Universities of Bradford (ACC, RCJ, ASW) and Durham (CAR), UK

Physical Anthropology has been taught in the Department of Archaeological Sciences at the University of Bradford at both undergraduate and postgraduate levels since the late 1970s. This poster summarises the results of a study assessing the impact of use on the archaeologically derived skeletal collections curated by the Department. A recent survey of a sample of adult skeletons from two different archaeological sites, and the evidence of damage to those skeletons in the form of bone element loss, postmortem fractures and surface erosion over a number of years of use is reported. The results showed that the heavy use skeletons suffered most damage and loss, and hands, feet and teeth were lost most. Repaired and failed repair breaks also occurred, particularly in the heavy use group. Packaging was also poor in general. Limitations of the study are discussed with some recommendations.
PITFALLS OF THREE-DIMENSIONAL COMPUTED TOMOGRAPHY

Gerald Conlogue, John Posh, Janet Monge and Roger Colten, Quinnipiac College (GC, JM, RC) and St. Luke’s Hospital (JP)

The fundamentals of computed tomography and three-dimensional reconstruction are described. Using examples of two mummy imaging studies, the limitations of the modality, use of preset protocols and the creation of false positive pathology are discussed. The need to utilize the assistance of a radiographer familiar with the equipment, manual manipulation of imaging factors and paleopathology to carry out the study is emphasized.

ENDOSCOPY AS AN ADJUNCT TO DETERMINING AGE AT DEATH IN MUMMIFIED REMAINS

Laura Duclos, Ronald Beckett, Sonia Guillén, and Gerald Conlogue, Quinnipiac College (LD, RB, GC) and Centro Mallqui (SG)

Video endoscopy can serve as an adjunct to determining the age at death of mummified individuals. Video endoscopy is a nondestructive methodology and may eliminate the need to unwrap the individual. The video endoscopic image provides sufficient detail to examine disarticulated joints for ridging, furrowing, granularity, and porosities. Pubic symphysis visualization and measurement can be conducted. Endocranial views can provide images of the sagittal, lambdoidal, and coronal sutures. Dentition can be examined for occlusal surface wear, inventories, caries assessment, enamel defects, and premortem dental modifications. These data can be correlated with radiographic data to assist in the assessment of age at death.

A PRELIMINARY STUDY OF SPINA BIFIDA OCCLUTA IN A “TRANSITIONAL” BM III/PI POPULATION FROM RIDGES BASIN, COLORADO

Ardi Eggleston, University of Illinois, Urbana-Champaign

For various reasons, the most commonly represented neural tube defect (NTD) in the archaeological record is spina bifida occulta. High frequencies of this defect in a skeletal population have usually been attributed to familial proximity and genetic homozygosity. However, due to the fact that clinical studies suggest that the maternal risk for carrying a baby with an NTD may be minimized with folic acid supplementation, I suggest that a high frequency of this defect may be a broader indicator of population-wide stress. The purpose of this study is to present a preliminary examination and interpretation of spina bifida occulta in 18 adult skeletons from “transitional” Basketmaker III/ Pueblo I sites from the Ridges Basin area near Durango, Colorado. Results show a frequency of spina bifida occulta in this population of 33%. Based on recent clinical findings, I suggest that dietary stress may be largely responsible for this high frequency.

burying history: data preservation in the San Diego museum of Man as a result of nagpra

Tori Heflin, San Diego State University and San Diego Museum of Man
Research utilizing skeletal collections is affected by NAGPRA (The Native American Graves Protection and Repatriation Act). One collection of skeletal remains and one collection of cremains once housed at the San Diego Museum of Man have already been repatriated, and two more collections of skeletal remains are scheduled for repatriation. The San Diego Museum of Man has taken steps to insure that valuable data have been acquired from the skeletal remains before they are repatriated. In this way, researchers will be able to conduct studies of these skeletal collections in the future, even if the bones themselves are not present. For each individual, a skeletal inventory is conducted, a variety of metric and nonmetric measurements are taken, sex and age are determined, and stature is estimated. The bones are also observed carefully to detect any pathologies and abnormalities, and/or nutrition and health status indicators, which are then photographed. Through this process, we hope to preserve as much data as possible for future research.

A FORENSIC RADIOGRAPHIC EVALUATION OF A 1000 YEAR OLD PERUVIAN MUMMY TO DETERMINE MANNER OF DEATH

William Hennessy and Janet Monge, Quinnipiac College

Since the discovery of x-radiation credited to Dr. William Conrad Roentgen in 1895, x-rays have been used to aid forensic scientists in determining various manners of death. One of the earliest forensic applications occurred in 1896 in England to investigate a murder scene to locate bullets fired into the head of a female. Initially requiring 70 minute exposures, and prior to advances in modern imaging equipment, professional personnel expertise, and image quality, modern radiography can assist in a forensic investigation of ancient mummified remains in a quick and cost efficient manner. Trained radiologic technologists, applying medical-clinical positioning principles, knowledge of anatomy and critical adaptive methodologies, can surmount many of the challenges inherent in numerous mummified remains, especially body and extremity contractures and rotations. We report on a possible manner of death scenario derived from forensic evaluation of radiographic data.

CRANIAL ASYMMETRY AS A MARKER OF SEVERE METABOLIC DISTRESS

Mary Cassandra Hill, Tuscaloosa, AL

Physiologists, public health professionals, and biological anthropologists have discussed the long term consequences of malnutrition for decades. Stunting, or growth failure, of the skeletal elements is one of the most frequently cited effects of poor nutrition. Along with various long bone measurements, cranial base height is one of the anthropometric devices used to evaluate growth failure. This study shows that premature closure of cranial sutures, particularly those related to the cranial base elements, is associated with severe metabolic distress. Thus, in the absence of traits that are reflective of genetic syndromes, asymmetry of the cranial vault may be a useful indicator of malnutrition.

PROTO-HISTORIC SMALLPOX IN EASTERN OHIO

Loren R. Lease and Boyd P. Brown III, Ohio State University
A skeleton was excavated from Riker's, a proto-historic site located on the Tuscarawas River in east central Ohio. The remains of a juvenile, thirteen to eighteen years old, display pathological conditions consistent with smallpox. Archaeological evidence for smallpox is quite rare. Due to its virulence, smallpox typically kills before distinct indicators on the skeleton develop, making these remains particularly noteworthy. Differential diagnosis was conducted considering tuberculosis, septic arthritis, chronic osteomyelitis, and trauma/dischlocation. It is concluded that the lesions are most consistent with smallpox. However, the conclusion is complicated by Carbon-14 analysis of the skeleton, which dated the remains to 1287-1406 AD. Two possible explanations for the dichotomy are considered. One is based on characteristic dating anomalies from this site. The other explanation presented focuses on the possibility of earlier European contact, specifically with Basque cod fishermen.

EMPLOYING COMPUTED RADIOGRAPHY TO EXAMINE MUMMIFIED REMAINS

Bob Lombardo, Gerald Conlogue and Roger Colten, Quinnipiac College

The fundamentals of computed radiography (CR) are described. A study of a mummified cat, which has a partially decalcified skeleton, is used to compare images obtained with conventional and computed radiography to demonstrate pathology. The advantages of employing CR in a field situation are discussed.

A PRELIMINARY STUDY OF DEGENERATIVE JOINT DISEASE AT THE ARCHAIC PERIOD BARRETT SITE, MCLEAN COUNTY, KENTUCKY

Catherine M. Berdy, Fort Campbell, Kentucky, Mary K. Sandford and Grace E. Kissling, University of North Carolina, Greensboro

We examine patterns of degenerative joint disease (DJD) in 94 adult skeletons from the Archaic period Barrett Site, McLean County, Kentucky. Using scoring criteria from Standards for Data Collection from Human Skeletal Remains (Buikstra and Ubelaker, 1994) we looked at both the degree and extent of such joint surface and joint margin modifications as lipping, porosity, and eburnation. Surface osteophytes and periarticular resorptive foci also were noted. We compare the results of our study with other investigations of degenerative joint changes in archaeological skeletal series (Bridges, 1991; Jurmain, 1990) while addressing the effectiveness of the "Standards" scoring method for DJD. Finally, we illustrate the usefulness of digital photography in assessing skeletal pathology.

A POSSIBLE CASE OF HYPERPARATHYROIDISM FROM A BRITISH ARCHAEOLOGICAL SITE

Simon Mays, English Heritage, Juliet Rogers and Iain Watt, Bristol Royal Infirmary

A partial skeleton of an adult female (dated AD 1420-1640), excavated from a British site, shows demineralisation of compact bone, together with subchondral bone resorption at some joints. The gross and radiographic appearance of the lesions appears compatible with a diagnosis of hyperparathyroidism.
FURTHER INVESTIGATIONS OF CRANIAL LESIONS FROM THE BARRETT SITE, MCLEAN COUNTY, KENTUCKY

April Morgan, North Carolina Department of Health and Human Services, and Mary K. Sandford
University of North Carolina, Greensboro

Previously, Sandford et al. (1998) documented cranial lesions consistent with treponemal disease on Archaic human skeletal remains from the Barrett site in McLean County, Kentucky. Investigations of the crania revealed three distinctive lesions termed diffuse pitting, remodeled punctate, and vermicate. These lesions suggest a disease process that is progressive, chronic, and episodic. In this study, we further assessed these three lesions using a sample of 150 adult crania from the Barrett site. We determined the frequencies and distributions of the cranial lesions through macroscopic observation, and noted associations between lesion type, severity, major muscle attachments and pathogenic stage. Our poster also demonstrates the potential of high resolution digital photography for scoring, categorizing and evaluating cranial lesions.

THREE-DIMENSIONAL VOLUME RENDERING OF CT DATA IN THE EVALUATION OF A 1000 YEAR OLD PERUVIAN MUMMY

Mark Perna, Michael Rothman, John Posh, and Janet Monge, Quinnipiac College (MP, MR, JM) and St. Luke’s Hospital (JP)

The Peruvian mummy in this study has been thoroughly evaluated with x-rays, CAT scan, and MRI. Our goal was to determine if post processing of the CT data using a three-dimensional volume rendering program (3D VR) could yield additional information by providing a more global survey. 3-D volume rendering uses complex mathematical computations and volumetric scan data to create 3-D images of the surface of the structure being imaged as well as the anatomy within that structure. This paper describes how the data were processed, the type of images that this program can create, and how they can be used in the nondestructive analysis of mummified remains.

A COMPARISON OF TWO NONDESTRUCTIVE TECHNIQUES FOR THE EVALUATION OF ENDOCRANIAL FEATURES - VIDEO ENDOSCOPY AND ‘VIRTUAL FLY-THROUGH’ COMPUTED TOMOGRAPHY

John Posh, St. Luke’s Hospital and Ronald Beckett, Quinnipiac College

Methods such as direct visualization in disarticulated crania, standard radiographic evaluation, and endocranial modeling have been used to examine the endocranial environment. With intact crania, video endoscopy and ‘virtual fly-through’ computed tomography can provide images of the endocranial vault. A comparison of images produced by these two techniques was made using four human skulls. Features compared were instrumentation, field application, processing, image quality, derivable data, and cost effectiveness. The poster presents images of endocranial features derived from each modality as well as pro and con comparisons.
EVIDENCE FOR TREPONEMAL INFECTION IN THE HUMAN SKELETAL REMAINS FROM THE CAMPBELL FARM SITE, PENNSYLVANIA

Chris Reed, University of Pittsburgh

The subject of treponemal infection in pre-Columbian America has been the center of an ongoing debate about the recognition of telling pathology in skeletal material and whether European contact introduced syphilis into the native populations of the Americas, or vice versa (Larsen 1997). Any new evidence or material regarding the presence of treponemal infection in prehistoric North America is a welcome link in the chain of evidence at the center of the debate. The skeletal material from the protohistoric site of Campbell Farm in southwestern Pennsylvania is one such link. The bones were excavated in various field seasons from 1964 to 1979. Some of the material shows the typical signs of treponemal infection: saber shins and stellate scars on the cranium (Ortner and Pustchar 1981). At the Campbell Farm site were two settlements, associated with two different phases, an Allegheny and an Earlier Drew phase. Due to incomplete records, it is difficult at best to reasonably associate the burials with a particular settlement.

EVALUATION OF THE SPINE IN A 1000 YEAR OLD PERUVIAN MUMMY WITH 3-D ‘VIRTUAL FLY-THROUGH’ COMPUTED TOMOGRAPHY

Michael Rothman, Mark Perna, Linda Varnis, John Posh, and Janet Monge, Quinnipiac College (MR, MP, LV, JM) and St. Luke’s Hospital (JP)

The evaluation of the spinal canal in mummified remains is usually completed with a combination of x-ray and OT1. These techniques provide a focused, 2-dimensional look at the structures but fail to give a true sense of the inside of the canal. This paper details how one specimen was evaluated with CT and the data processed using a commercially available 3-D Virtual Navigation software program. The 3-D virtual navigation allowed us to visualize the inner surface and contour of the spinal canal and get a better nondestructive evaluation of this spine.

DEVELOPMENT OF A USEABLE RESEARCH COLLECTION: THE UNIVERSITY OF IOWA-STANFORD COLLECTION

Shirley J. Schermer, Robert G. Franciscus, and Robin M. Lillie, Office of the State Archaeologist (SJS, RML), University of Iowa (RGF)

The University of Iowa recently acquired legal possession of one of the largest collections of documented human skeletal remains in the United States. Officially transferred in 1998 from Stanford University's School of Medicine, this collection of nearly 1,000 individuals comes from a pre-antibiotic and pre-modern health trend population obtained in the first half of the century. Composed entirely of willful body donations for the express purpose of research and teaching, the collection provides a much-needed resource in academia given the rapidly shrinking availability of human skeletal material in the United States. The Stanford Collection, the considerably larger skeletal aggregate from which the San Diego Museum of Man pathology collection was gleaned, has the potential to become a major research and teaching resource for
ANKYLOSIS OF THE SPINE OF A PIG FROM THE 19TH CENTURY - DISCUSSION OF CAUSES

Wolf R. Teegen and Katharina Dittmar, University of Leipzig and Michael Schultz, University of Göttingen, Germany

The Julius-Kühn-Collection of the Martin-Luther University, Halle-Wittenberg (Germany), is one of the largest collection of skeletons of domestic animals in Europe. Several hundred pig skeletons are preserved. During restoration and cataloging of the skeletons a complete fused spine was noted by J. Wussow, head of the collection. The spine belonged to a female pig of 8 years of age, dating to the late 19th century. It was studied by macroscopic, microscopic and radiological techniques. The ligamentum longitudinale ventrale was completely ossified, but the intervertebral spaces were generally not affected. Between two thoracic vertebrae, a fracture with callus formation is visible; furthermore, the facies articularis anterior et posterior of the corpus vertebralis were completely destroyed. The fracture was not fused, probably due to pseudarthrosis. Ossification of the longitudinal ligaments is often caused by immunopathological processes. One explanation could be erysipelas, a common bacterial disease in pigs caused by *Erysipelothrix rhusiopathiae*. Other bacterial infections which cannot be excluded are able to cause similar morphological alterations. The alterations resemble those seen in the human spine affected by *morbus bechterew*.

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ADDRESSES OF PRESENTERS:

Laurel Anderson, 1021 Audubon Street, New Orleans, LA 70118
Adauto Jose G de Araujo, Rua Voluntarios da Patria 381, Apto 1005, Botafogo 22270-000, Rio de Janeiro, Brazil
Brenda J. Baker, Department of Anthropology, Arizona State University, Box 872402, Tempe AZ 85287-2402
Joan E. Baker, PO Box 10057, Fort Irwin, CA 92310
Lenore Barbian, National Museum of Health and Medicine, AFIP, Walter Reed Medical Center, Bldg. 54, Washington DC 20306-6000
Ronald G. Beckett, 4 Bright Hill Drive, Clinton, CT 06413
Pia Bennike, Laboratory of Biological Anthropology, University of Copenhagen, Blegdamsvej 3, DK 2200, Copenhagen, Denmark
Hillell Bercovier, Kuvin Center for the Study of Infectious and Tropical Diseases and Ancient DNA, Hadassah Medical School, Hebrew University, Jerusalem, Israel
Catherine M. Berdy, Fort Campbell, KY
Carrie Anne Berryman, 1618 Carlsbad Trace, Fayetteville, AR 72704
Trisha Biers, 305 Oakbranch Drive, Encinitas CA 92024
Chryssa Bourbou, 26 Rethymnou Street, GR-73134, Chania, Crete, Greece
Boyd P. Brown III, Department of Anthropology, Ohio State University, Columbus OH 43210
Scott E. Burnett, Department of Anthropology, Arizona State University, Box 872402, Tempe, AZ 85287-2402
Michele R. Buzon, 1725 De La Vina Street #10, Santa Barbara, CA 93101
Anwen C. Caffell, Department of Archaeological Sciences, University of Bradford, Richmond Road, Bradford BD7 1DP, UK
Francisca Cardoso, Departamento de Antropologia, Universidade de Coimbra, 3000-056, Coimbra, Portugal
Petra Carll-Thiele, Zentrum Anatomie, Kreuzbergring 36, D-37075, Gottingen, Germany
D. Troy Case, 10365 East Voltaire Ave, Scottsdale, AZ 85260-9019
Roger Colten, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
Gerald Conlogue, Diagnostic Imaging Program, Box 221, Quinnipiac College, Hamden CT 06518
Alana Cordy-Collins, Department of Anthropology, University of San Diego, 5998 Alcala Park, San Diego, CA 92110
Eugénia Maria Cunha, Departamento de Antropologia, Universidade de Coimbra, 3000-056, Coimbra, Portugal
Jerome S. Cybulski, Archaeological Survey of Canada, 100 Laurier Street, PO Box 3100, Station B, Hull PQ, J8X 4H2, Canada
Katharina Dittmar, Brandvorwerkstrasse 29, D-04275, Leipzig, Germany
Kate Domett, Department of Anatomy and Structural Biology, University of Otago, Dunedin, New Zealand
Helen D. Donoghue, Royal Free Hospital and University College London, School of Medicine, 46 Cleveland Street, London W1P 6DB, UK
Laura Duclos, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
Ardi Eggleston, Department of Anthropology, University of Illinois, Champaign-Urbana, IL 61801
Luiz Fernando Ferreira, Praia do Flamengo, 64 Apto 702, Flamengo, 22210-030, Rio de Janeiro, Brazil
T. Michael Fink, 907 N. 85th St., Scottsdale, AZ 85257-4564
Helen Fletcher, Royal Free Hospital and University College London, School of Medicine, 46 Cleveland Street, London W1P 6DB, UK
Robert G. Franciscus, Department of Anthropology, University of Iowa, Iowa City IA 52242
Charles Greenblatt, Kuvin Center for the Study of Infectious and Tropical Diseases and Ancient DNA, Hadassah Medical School, Hebrew University, Jerusalem, Israel
Sonia Guillén, Avenida Arnaldo Marquez 2014, Jesus Maria, Lima 11, Peru
Leslie Harlacker, Department of Anthropology, Indiana University, 701 E. Kirkwood Avenue, SB 130, Bloomington, IN 47405
Tori D. Heflin, PO Box 91529, San Diego, CA 92169
Maciej Henneberg, Department of Anatomical Sciences, University of Adelaide Medical School, Adelaide SA 5005, Australia
Renata J. Henneberg, Department of Anatomical Sciences, University of Adelaide Medical School, Adelaide SA 5005, Australia
William F. Hennessy, 236 Grassy Hill Road, Lyne, CT 06371
Mary Cassandra Hill, 3478 Firethorn Drive, Tuscaloosa, AL 35405-2750
Dan Holiday, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
John Holton, Royal Free Hospital and University College London, School of Medicine, 46 Cleveland Street, London W1P 6DB, UK
Sharon Hurlbut, 3134 E. McKellips Road #185, Mesa, AZ 85213
Robert C. Janaway, Department of Archaeological Sciences, University of Bradford, Richmond Road, Bradford BD7 1DP, UK
Robert Jurmain, Department of Anthropology, San Jose State University, San Jose CA 95192-0113
Gila Khila, Kuvin Center for the Study of Infectious and Tropical Diseases and Ancient DNA, Hadassah Medical School, Hebrew University, Jerusalem, Israel
Grace E. Kissling, Department of Computer Sciences, University of North Carolina, Greensboro NC 27402
Loren R. Lease, 3027 Sunset Drive, Columbus, OH 43202
Galit Lev, Kuvin Center for the Study of Infectious and Tropical Diseases and Ancient DNA, Hadassah Medical School, Hebrew University, Jerusalem, Israel
Robin M. Lillie, Office of the State Archaeologist, University of Iowa, 700 Clinton Street Building, Iowa City, IA 52242-1030
Bob Lombardo, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
Carina Marques, Departamento de Antropologia, Universidade de Coimbra, 3000-056, Coimbra, Portugal
Larry Martin, Natural History Museum, Dyche Hall, University of Kansas, Lawrence KS 66045
Simon Mays, Ancient Monuments Laboratory, English Heritage, Fort Cumberland, Fort Cumberland RD, Eastney, Portsmouth, PO4 9LD, England
Janis M. McEwan, 451 Heffernan Drive, Edmonton AB, T6R 1T1, Canada
Charles F. Merbs, Department of Anthropology, Arizona State University, Box 872402, Tempe, AZ 85287-2402
Janet Monge, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
April Morgan, North Carolina Department of Health and Human Services, Raleigh NC
Donald J. Ortner, Department of Anthropology, National Museum of Natural History, Smithsonian Institution, Washington DC 20560
Ildrico Pap, Hungarian Natural History Museum, Budapest, Hungary
Mark Perna, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
John C. Posh, Director of MRI Research, St. Luke’s Hospital Network, 801 Ostrum Street, Bethlehem, PA 18017
Mary Lucas Powell, 1660 Traveller Road, Lexington, KY 40504-2002
J. Christopher Reed, Department of Anthropology, 3H01 Forbes Quad, University of Pittsburgh, Pittsburgh, PA 15260
Karl J. Reinhard, School of Natural Resources, University of Nebraska-Lincoln, Lincoln NE 68588
Charlotte Roberts, Department of Archaeology, University of Durham, Science Site, South Road Durham, DH1 3LE, UK
Juliet Rogers, Paleopathology Study Group, University Department of Medicine, Bristol Royal Infirmary, Bristol UK
Michael Rothman, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
Bruce M. Rothschild, Arthritis Center of Northeast Ohio, 5500 Market Suite 119, Youngstown, OH, 44512
Mary K. Sandford, Department of Anthropology, University of North Carolina, Greensboro NC, 27402
Andrew K. Scherer, Department of Anthropology, Texas A & M University, Mail Stop 4352, College Station, TX 77840-4352
Shirley J. Schermer, Office of the State Archaeologist, 700 Clinton Street Building, University of Iowa, Iowa City, IA 52242
Michael Schultz, Zentrum Anatomie, Kreuzbergring 36, D-37075, Göttingen, Germany
Cory Sparks, Department of Anthropology, University of Tennessee, Knoxville TN 37996-0720
Mark Spigelman, 41 Ashworth Mansions, Elgin Ave, London, W9 1JP, UK
Kate Spradley, 640 Lindell, Fayetteville, AR 72701
Wolf R. Teegen, Institute of Prehistory, University of Leipzig, Germany
Mark Thomas, Center for Genetic Anthropology, The Departments of Biology and Anthropology, Darwin Building, University College London, Gower Street, London WC1E 6BT, UK
Anne Titelbaum, Department of Anthropology, Tulane University, New Orleans LA 70118
Linda Varnis, Bioanthropology Institute, Quinnipiac College, Hamden CT 06518
John W. Verano, Department of Anthropology, Tulane University, New Orleans LA 70118
Phillip L. Walker, Department of Anthropology, University of California, Santa Barbara CA 93106
Iain Watt, Department of Radiology, Bristol Royal Infirmary, Bristol UK
Andrew S. Wilson, Department of Archaeological Sciences, University of Bradford, Richmond Road, Bradford BD7 1DP, UK
Cassady Yoder, 2316 Franklin, Bryan, TX 77801
Melissa Zabecki, Department of Anthropology, University of Arkansas, Fayetteville, AR 72701
Committee for the 27th Annual Meeting

Joan Baker (Texas A&M University)
Jeff Francis (University of Texas - San Antonio)
Charles Merbs (Arizona State University)
Elizabeth Miller (California State University - Los Angeles)
Donald J. Ortner (Smithsonian Institution)
Mary Lucas Powell (University of Kentucky)

Volunteers

Laurel Anderson (Tulane University)
Heather Backo (Tulane University)
Janet Beck (Smithsonian Institution)
Scott Burnett (Arizona State University)
Troy Case (Arizona State University)
Heather Edgar (Ohio State University)
Agnes Stix (Smithsonian Institution)
Anne Titelbaum (Tulane University)
Melissa Zabecki (University of Arkansas)

Meeting Report Editor
Mary Lucas Powell

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