

PAPERS ON PALEOPATHOLOGY

presented at the

Thirteenth Annual Meeting



12 - 13 April 1986

Albuquerque, New Mexico

SECTION 1: WORKSHOP/ROUND TABLES

Convener: Donald J. Ortner

RADIOLOGY WORKSHOP: INFECTIOUS DISEASES OF THE HUMAN SKELETON

Donald J. Ortner, Smithsonian Institution, with Ethan M. Braunstein, University of Michigan Medical School and Michael J. Pitt, University of Arizona College of Medicine

The skeletal manifestations of orthopedic diseases are limited and often present a rather continuous morphological gradient between broad categories of disease. In this context, the nature of the lesion as well as the distribution of skeletal involvement become critical variables in differential diagnosis. The vast experience inherent in radiology provides important insight into these aspects of skeletal disease, and, as was the case last year, the workshop emphasized radiology in the study of infectious disease.

In his discussion of differential diagnosis in orthopedic radiology, Dr Braunstein emphasized that there needs to be a change of between 40 and 60 per cent in the density of bone tissue before a lesion can be detected on an x-ray film. This, of course, means that many skeletal lesions apparent in a dry bone specimen would not be seen in a typical clinical x-ray film.

With the paleopathology meetings being held in an area of the American Southwest where coccidioidomycosis is endemic, it was appropriate to have a review of the radiology of that disease. Dr Pitt discussed the skeletal changes associated with coccidioidomycosis in both human and non-human cases.

The third speaker, Dr Ortner, reviewed the skeletal and dental manifestations of leprosy. These include pressure erosion on the shafts of the phalanges and metacarpals resulting from flexion contractures of the hand, destructive lesions around the nose, abnormal development of tooth roots when the disease occurs in children, and destruction of the bones of the feet, often accompanied by fusion of tarsal bones and secondary infection of the lower leg.

TRAUMA IN PALEOPATHOLOGICAL SPECIMENS

Charles F. Merbs, Arizona State University

Slides illustrating a broad range of bone fracture, from relatively minor nasal and phalangeal breaks to massive comminuted and compound fractures of the

cranium and long bones, were shown, with special emphasis on the nature of the fracturing and the subsequent healing, if any, that took place. The possible intervention of a 'healer,' and the effect of trauma on later bone development, including degenerative pathology, were also considered. The last part of the presentation dealt with a particular category of fracture, spondylolysis, with a close look at its etiology and development, and its frequently resultantolisthesis.

As part of this round table, Jerry Melbye presented a paper co-authored by Scott Fairgrieve (both of Erindale College, University of Toronto) on the subject of possible evidence of mutilation and cannibalism in an early contact site between Amerindian and Inuit. This was the Saunatuk Site (NgTn-1), which was excavated by Dr Charles D. Arnold in the summers of 1984 and 1985. It is east of the Mackenzie delta in the region of Eskimo Lakes (an inlet of the Arctic Ocean), and is thought to have been occupied by the Inuktuut people between 300 and 500 years ago. The site consists of the remains of two dwellings, but because the initial discovery was made by bulldozer operations, the skeletal remains have been greatly disturbed. A minimum of 34 individuals was recovered, based on human mandible and mandible fragments. The remaining fragmented bones exhibit cut marks, split long bone shafts, and fracture of all bones, especially crania. A large proportion of the represented population is immature, and there is a conspicuous absence of young adults.

PALEOPATHOLOGY OF DEGENERATIVE ARTHRITIS

Robert Jurmain and Lynn Kilgore, San Jose State University, with Jean DeRousseau, New York University and Howard Duncan, Henry Ford Hospital, Detroit

Two main areas of concern were elaborated: methodology and differential diagnosis. There was unanimous agreement that the ordinal scaling systems used in the past are effective, and the data generated are suitable for a wide range of statistical treatment. It is not usually necessary to determine metrically changes about the joint surface. Discussion then centred on the most appropriate type of ordinal system, which could, ideally, be standardized for use by a variety of observers. Drs. Jurmain and Kilgore suggested that it may not be necessary to score all individual foci within each joint surface. Donald Ortner made the point that indication of the overall involvement of some foci (e.g. percent of rim that is osophytotic or percent of surface that is eburnated) can be crucial. The type of joint degeneration can also be a useful indicator, i.e. the type of porosity, whether fine or coarse grained. Drs. DeRousseau and Duncan noted that the surface changes represent a dynamic situation in vivo, where damage and repair processes are acting simultaneously. It was generally agreed that diagnosis of degenerative joint disease as compared to rheumatoid arthritis was facilitated by the mixed pattern of involvement in DJD: porotic changes on the surfaces and hypertrophic changes on the joint margin.

SECTION 2: IDENTIFICATION, ORIGIN, AND DISPERSION OF HELMINTH PARASITES IN THE PREHISTORIC NEW WORLD

Convener: Karl J. Reinhard

INTRODUCTORY STATEMENT

Karl J. Reinhard, Texas A & M University

During the past 15 years, there has been an acceleration of interest in the study of helminth parasites from prehistoric contexts. In the pursuit of this study, helminthological techniques have been developed in order to examine prehistoric mummies, coprolites, and latrine soils. Centers for the study of 'paleoparasitology' have developed in the Americas as well as in Europe. There are now several dozen individuals recognized as expert in helminthological investigations based on prehistoric materials. This symposium is designed to bring together for the first time several of these researchers, in the interest of establishing interaction among the various laboratories and presenting parasitological information to the larger audience of paleopathologists.

The symposium focuses on research in the New World. Special research problems are presented in the Americas that are of less importance elsewhere. Some of these problems are methodological, and relate to analysis of coprolites, which are frequently excavated from archaeological sites in the arid regions of North and South America. Of special importance in the New World is the question of the origin and spread of helminth infection. Traditional views are that the Americas are largely parasite-free, with few human-specific species. Analysis of prehistoric remains suggests that parasitism among American Indians was nearly ubiquitous, and included several human-specific species. Some of these species were potential health threats to their hosts, and may relate to iron deficiency anemia, as evidenced in osteological analyses of prehistoric skeletal series.

A PLEA FOR PARSIMONY IN THE INTERPRETATION OF PALEOPARASITOLOGICAL DATA

Michael M. Kliks, Cancer Research Center of Hawaii

An appreciation of the valuable data to be derived from the study of ancient human coprolites, intestinal contents, and preserved viscera has led to careful analyses of these most intimate of human artifacts. However, determination of the human provenience of specimens, the population base they represent, and

the specific identification of the organisms recovered remains problematic under even the most favorable conditions. A thorough knowledge of each parasite's morphology and life history, and of the epidemiology of the diseases they may have caused is required for meaningful interpretation of findings. Archeologists, medical parasitologists, palynologists, and other specialists must collaborate and exchange materials and information, in order to extract maximum value from the finds, and still avoid the myriad pitfalls that result from the invasion of free-living saprophagous organisms, and the presence of pseudo-parasites (derived from viscera of food items ingested) and parasite-like artifacts. The activities of coprophagic animals in concentrating and disseminating fecal artifacts from a variety of sources may confound results based on only a few specimens. Additional evidence of the 'humanness' of fecal samples, their seasonality, and dietary information could be obtained through pollen spectra. In the near future, specific molecular markers (e.g. hemoglobin, enzymes, bacterial or viral DNA sequences) may permit the accurate identification of the fecal source of parasite materials. At the present time, cautious identification of organisms recovered (or absent) and parsimonious interpretation of their impact is required.

PALEOPARASITOLOGICAL RESEARCH IN BRAZIL: PRESENT STATUS AND PERSPECTIVES

Luis Fernando Ferreira, ENSP, Fundação Oswaldo Cruz, Ulisses E.C. Confalonieri, Instituto de Biologia, UFRRJ and A.J.G. de Araújo, ENSP, Fundação Oswaldo Cruz, Rio de Janeiro

Research was started in Brazil in 1978 to identify parasitic infections present in pre-Columbian South America. 566 samples have been examined, including human and animal coprolites and six naturally mummified human bodies. The material came from 10 Brazilian sites, three Argentinian sites, and two sites in Chile. Eggs and/or larvae of Trichuris trichiura, ancylostomids, Enterobius vermicularis, Diphyllobothrium pacificum, and Trichostrongylidae were found in human material. Trichuris sp., Capillaria sp. and Parapharyngodon sp. were found in animal coprolites. The differentiation of human from animal coprolites and new lines of investigation such as experimental paleoparasitology and biometrics are discussed.

HELMINTHIASIS AND MUMMIFIED HUMAN REMAINS

Patrick D. Horne, Women's College Hospital, Toronto

Coprolite analysis has provided us with most of the direct information we have for helminthiasis in prehistoric times. The other important source of such information comes from the study of mummified human remains. An important advantage of these studies is that there can be no doubt as to the human origin of the host. These studies have given us helminth information not

provided by coprolite analysis. Sir Marc Ruffer in 1910 was the first to demonstrate eggs of helminths in ancient tissues dating to 1000 B.C. A review of the evidence of helminthiasis from mummified remains is presented, with emphasis on the New World discoveries.

HELMINTHIASIS IN THE PREHISTORIC SOUTHWEST

Karl J. Reinhard, Texas A & M University, Gary F. Fry, Youngstown State University and John G. Jones, Texas A & M University

Analysis of 580 coprolites from the southwestern United States (nine sites) indicates that helminthiasis was more common in Anasazi agriculturalists than among preceding Archaic hunter-gatherers. Hunter-gatherer coprolites from Danger and Hogup Caves exhibit low incidence of infection with Enterobius vermicularis, an unidentified taeniid tapeworm, and probably Moniliformes clarki, but coprolites from Dust Devil Cave contained no helminths. Among agriculturalists, coprolites indicate higher incidence of E. vermicularis. Other genera identified from agriculturalist coprolites include Hymenolepis, Trichostrongylus, Strongyloides, and possibly acanthocephalans. Increased helminthiasis in agriculturalists probably results from concentration of populations and lower sanitation levels.

PALEOECOLOGICAL CHANGES RELEVANT TO PREHISTORIC HELMINTHIASIS

Richard H. Hevly, Northern Arizona University

Aboriginal populations on the Colorado Plateau at the present time are parasitized primarily by Enterobius vermicularis. It is then surprising that in prehistory several more mesic-adapted genera are present (Trichuris, Trichostrongylus, Strongyloides). The presence of a more diverse parasite fauna in prehistory can be explained by climate fluctuations, and also by aboriginal techniques of irrigation. Palynological and dendrochronological data show definite fluctuations in moisture. Floral remains found in the vicinity of archaeological sites indicate that, in some instances, the impact of irrigation created more mesic conditions surrounding habitations. Such local perturbations probably allowed for the establishment of parasites in and near villages.

HELMINTHIASIS AT MT. ELDEN PUEBLO, A LATE PREHISTORIC VILLAGE NEAR FLAGSTAFF, ARIZONA

Glenn A. Anderson, Northern Arizona University

Soil samples from five prehistoric latrines at Mt. Elden Pueblo were examined

for helminth remains. Helminth eggs representing five taxa were found. Nematode parasitism is indicated by the presence of Trichuris trichiura, Ascaris lumbricoides, and Enterobius vermicularis. Cestode parasitism is indicated by eggs of taeniid and hymenolepid species. The presence of T. trichiura is especially interesting. Considering the requirements of this worm for warm, moist, shaded soils, it is unlikely that it could have survived its extracorporal embryonation period in the Flagstaff area. It is more likely that parasitism with this species resulted from seasonal migration of the village inhabitants to the Verde River Valley, where transmission could have readily occurred.

PARASITISM AND POROTIC HYPEROSTOSIS: A STUDY AT MT. ELDEN PUEBLO

T. Michael Fink, Arizona State University

Porotic hyperostosis has long been thought to be a reflection of iron deficiency anemia resulting from prehistoric corn dependency. In the world today, iron deficiency anemia is frequently caused by an interplay of dietary deficiency, infectious disease, and parasitism. An analysis of prehistoric skeletons from Mt. Elden Pueblo indicates both iron deficiency anemia and rickets. Previous soil analysis demonstrated the presence of five helminths parasitizing the population. This suggests that parasitism may have played a role in causing porotic hyperostosis at this site. Likewise, rachitic disease at Mt. Elden Pueblo is tentatively identified as a response to parasitism, as these defects can result from malabsorption and general intestinal damage.

SOCIOECONOMIC IMPLICATIONS OF PARASITISM IN COLONIAL NEW ENGLAND

Stephen A. Mrozowski, Brown University

Examination of privy soils from colonial Newport, Rhode Island reveals the presence of several parasite species. Parasitism in a richer merchant's household and that of a poorer artisan is different with respect to the relative frequencies of Ascaris lumbricoides and Trichuris trichiura. Pollen and botanical analysis demonstrate differences in diet and yard space use that probably affected parasitism in colonial times.

THE ORIGIN AND PREHISTORIC DISPERSION OF HUMAN TRICHIURIASIS IN THE NEW WORLD

Ulisses E.C. Confalonieri, Instituto de Biologia, UFRRJ, Luis Fernando Fernando Ferreira and A.J.G. de Araújo, ENSP, Fundação Oswaldo Cruz, Rio de Janeiro

This paper compares the host distribution of Trichuris species in primates, and the biological characteristics of Trichuris trichiura and T. suis. It is concluded that humans acquired T. trichiura from non-human primate ancestors ('phylogenetic route'), but that T. suis originated from populations of T. trichiura after the domestication of pigs. It is concluded from paleoclimatic conditions of overland human migratory routes from Old World to New World, and from the environmental requirements of T. trichiura that it was not introduced to America by overland human migration. It is also concluded that trans-oceanic contact introduced T. trichiura into America, and possible inland migration routes of this nematode from coastal arrival sites are suggested.

SECTION 3: OBSERVATIONS ON THE USE AND ABUSE OF THE DIFFERENTIAL DIAGNOSIS OF INFECTIOUS DISEASE

Convener: M. Cassandra Hill

A THEORETICAL ENQUIRY INTO THE STUDY OF DISEASE INTRODUCTION AT EUROPEAN CONTACT

Ann F. Ramenofsky, Louisiana State University

Although the introduction of acute infectious disease during the contact period of North America has been studied from differing perspectives, a uniformitarian approach has been most popular. Because this approach relies on modern analogues to identify and reconstruct specific disease events, it can be subject to theoretical contradictions. As demonstrated by the recent history of influenza or the older history of epidemic syphilis, acute infectious parasites change through time. This fact casts some doubt on the reliability of modern analogues for reconstructing past disease events. In contrast to historical uniformity, I suggest three alternatives; the use of all three may provide a sounder baseline for building descriptions of the epidemic environment of post-contact America. The three are: recognition and definition of osteological signatures of acute as opposed to chronic disease, actual studies of the modern infectious process, and mathematical models of epidemic events and spatial diffusion. The three alternatives are considered with reference to the contact archaeological record from the Forested East.

SKELETAL LESIONS OF THE THORAX IN A SOUTHERN ONTARIO MIDDLE WOODLAND BURIAL SITE CIRCA A.D. 230: DIFFERENTIAL DIAGNOSIS

J. Eldon Molto, Lakehead University, Ontario

This paper describes the nature and distribution of skeletal lesions in a young adult male from the LeVesconte Burial Mound, a Point Peninsula site radiocarbon dated at A.D. 230± 55. A differential diagnosis between bacterial and mycotic disease is presented in light of clinical, epidemiological, and archaeo-subsistence considerations.

ENDEMIC TREPONEMATOSIS IN LATE PREHISTORIC GEORGIA

Mary Lucas Powell, Smithsonian Institution

This paper reports one aspect of ongoing paleopathological analysis of 265 skeletal individuals from the late prehistoric Irene Mound site on the Georgia coast near the city of Savannah. The observed demographic and anatomical patterning of bone lesions indicates the presence of an endemic, probably non-venereal treponematosiis apparently intermediate between the modern diseases yaws and treponarid. Characteristic skeletal pathology includes marked expansion of lower long bone shafts, particularly of the anterior tibia crest (resembling modern 'sabre shins'), and focal lytic lesions of the cranial vault (caries sicca), whose stellate configuration has been considered by Hackett and others as pathognomonic of treponemal infection. As in the endemic treponematosiis reported from the late prehistoric population at Moundville in west central Alabama at the 1985 meeting of the PPA, extreme examples of skeletal pathology are rare, and almost all lesions exhibit advanced remodeling at the time of death. This syndrome produced considerable minor skeletal morbidity in each infected generation, but had little evident impact upon mortality. This identification extends our knowledge of the geographic and temporal distribution of this pre-Columbian disease in the Southeastern United States.

STRESS AND SURVIVORSHIP AT EUROPEAN CONTACT ON THE GEORGIA COAST

Clark S. Larsen, Northern Illinois University, S.W. Simpson, Kent State University and D.L. Hutchinson, Illinois University

This study examines the relationship between age at death and frequency, duration, and timing of stress indicators by analysis of dental size and enamel hypoplasias. Amerindian permanent teeth from the contact period (A.D. 1565-1680) Santa Catalina de Guale mission on St. Catherine Island, Georgia were used, and as a result of the examination, we suggest that individuals stressed earlier in life were more predisposed to subsequent stress, thus reducing their ability to survive into later life.

POST-CRANIAL PERIOSTITIS: A PROBLEMATIC IN THE DIFFERENTIAL DIAGNOSIS OF POROTIC HYPEROSTOSIS AND INFECTION

M. Cassandra Hill, University of Massachusetts

Although much attention has been focused on the characteristic cranial lesions known as porotic hyperostosis, postcranial lesions associated with the condition have been generally overlooked. Evidence is presented that the postcranial marrow hypertrophy associated with acute and chronic anemia in children is virtually indistinguishable from generalized periostitis indicative of infection. Although infection is undeniably associated with anemia, it must be approached with caution when attempting a differential diagnosis.

SECTION 4: CONTRIBUTED PAPERS

Moderator: Charles F. Merbs

NUTRITIONAL INFERENCE FROM BONE COLLAGEN IN PREHISTORIC HUMAN SKELETAL REMAINS

Brenda J. Baker, University of Massachusetts

The role of collagen in skeletal manifestations of disease and nutritional stress has been largely ignored by anthropologists conducting paleonutritional investigations. Collagen is the most abundant body protein in mammals, providing 90% of the organic matrix of bone. Collagen is inert after death. This stability ensures that collagen is present in prehistoric human skeletal remains.

Extraction of bone collagen and subsequent analysis of its amino acid composition provide information on the nutritional status of human populations. Dietary deficiencies affect collagen synthesis and cross-linking. These include deficiencies in Vitamins C, D, and E, and a lack of iron and copper in the diet. Defects in collagen synthesis should affect bone formation. Medical and biochemical research indicates the potential for anthropological analyses of collagen in prehistoric human skeletal remains.

NUTRITIONAL STRESS IN THE BURIALS FROM THE MARY ROSE: A POSSIBLE CORRELATION BETWEEN THE HISTORICAL AND SKELETAL RECORDS

Ann Stirland and Jacqui Bowman, Woodend, Nr. Towcester, England

The human skeletal remains from the Mary Rose are a unique and important group, that have been extremely well preserved because of the anaerobic conditions of burial. Porotic hyperostosis and cribra orbitalia are evident. Enamel hypoplasias are also present, and have been measured using Walker's (1985) method. The historical record indicates a severe famine in parts of southern England during the winter of 1527-28. It is believed that this famine occurred during the early (0-5) years of some of the individuals represented by the surviving crania. This paper discusses the possibility of a correlation between the historical and skeletal records.

THE DETAILED ULTRASTRUCTURE OF THE HAIR OF LINDOW MAN

D. A. Birkett, Cleveland County Archaeology Department, Middlesbrough, England

Examination of the hair from Lindow Man (Britain's first bog body) has shown excellent preservation of the normal cuticular scale pattern under scanning electron microscopy, and also of the detailed subcellular structure examined by silver stains and transmission electron microscopy. This study confirms that examination of ancient hair by these methods is worthwhile, as any structural abnormality present in life should be preserved and capable of being found on examination many centuries later.

RECOVERY OF COLON CONTENTS FROM COMPLETELY SKELETONIZED INHUMATIONS: A REQUEST FOR ASSISTANCE

Karl J. Reinhard, Texas A & M University

Recent excavations of two burials in the southwest reveal colon content remains in skeletal context. One Anasazi burial from the Klethla Valley of northern Arizona exhibited dietary remains in the form of seeds and pollen compacted on the sacrum. In a Mimbres burial from New Mexico, the colon contents were found intact next to the sacrum. Analysis indicates that the Mimbres individual was on a corn-gruel diet, and also drank willow tea, presumably to alleviate pain.

HYPERPARATHYROIDISM IN AN 18-YEAR OLD PRE-INCA CHILEAN MUMMY

James R. Blackman and Arthur C. Aufderheide, University of Minnesota, Duluth, Marvin J. Allison, University of Tarapacá, Chile, R. Ted Steinbock, Albuquerque and Norman O. Oldroyd, Orlando

Recently, we had the opportunity to study the body of a well-preserved 18-year old pre-Inca male from northern Chile, utilizing multiple soft tissue techniques (routine histology, special stains, immunoperoxidase techniques, EDXA-scanning electron microscopy, polarizing light microscopy, histochemical techniques for calcium oxalate, renal stone analysis, and x-ray). Gross findings included 1.5 cm paired, dark brown symmetrical neck masses, sharply demarcated and juxtaposed to each side of the trachea inferior to the level of the larynx, fibrinous pericarditis, bilateral diffuse nephrocalcinosis with two renal calculi in the right kidney, dilated ureters, and diffuse osteoporosis. The calculi and renal calcifications were predominantly calcium oxalate and calcium phosphate. We were unable to identify the neck mass as thyroid or parathyroid. The findings were consistent with hyperparathyroidism,

either primary or secondary. Secondary causes include chronic renal disease, sarcoidosis, idiopathic hypercalciuria, medullary sponge kidney, distal renal tubular acidosis, and hyperthyroidism. Primary hyperparathyroidism remains a possibility, and we shall continue to study the neck mass in an effort to elucidate its structure.

LEAD AND BARBADIAN BELLYACHE

Arthur C. Aufderheide and Lorentz Wittmers, University of Minnesota, Duluth, Jerome Handler, Robert Corruccini and Beth Brandon, University of Southern Illinois, Carbondale

It has been demonstrated previously that skeletal lead content reflects an individual's total lifetime lead exposure. During the American Colonial period, such exposure was positively related to socioeconomic status. Wealthy individuals' exposure was primarily acquired by their extensive use of lead-laden containers and kitchenware for food preparation, consumption, and storage. In the continental Colonial plantation populations, high bone lead levels of plantation owners could be used to separate their remains from those of the slave labor force. Our recent finding of similar high bone lead content in a Colonial black Barbadian slave population was completely unexpected. The source of this lead was traced to both social and industrial exposure: houses to concentrate the harvested plantation sugar product, and distillation apparatus to convert the molasses into rum. Both apparatus were constructed with many lead components. Slaves also consumed large quantities of the lead-laden rum product. Armed with this knowledge, the historical sources were scoured, and found to document symptoms and mortality due to lead poisoning of epidemic proportions in Colonial Barbados, unrecognized by contemporary physicians and subsequent historians.

A POSSIBLE CASE OF RHEUMATOID ARTHRITIS IN A SKELETON FROM SUDANESE NUBIA

Lynn Kilgore, San Jose State University

A possible case of rheumatoid arthritis has been identified in a skeleton from the site of Kulubnarti, Republic of the Sudan. The remains were excavated from a Christian period (A.D. 550 - 1450) cemetery on the west bank of the Nile in 1979 by a joint expedition sponsored by the Universities of Colorado and Kentucky.

Lesions consistent with a diagnosis of rheumatoid arthritis are present in the hands and wrists of the skeleton of an elderly female, with an estimated age at death of 50+ years. These lesions are characterized by the bilateral lytic erosion and (in some instances) partial destruction of the distal auricular surfaces of the metacarpals. Similar involvement is also seen in some of the

proximal surfaces of the proximal phalanges, and in several of the carpal bones.

Although it is not possible to state with certainty that these lesions were produced by rheumatoid arthritis, their distribution and erosive nature are certainly compatible with such an hypothesis. Alternatively, the pattern and type of involvement are suggestive of hemochromatosis, which cannot be eliminated as a possibility.

MORPHOLOGY OF THE RHEUMATOID EROSION IN THE DRY BONE OF THE METACARPAL HEAD

James C. Leisen, Henry Ford Hospital, Detroit

Rheumatoid arthritis is a paradigm of chronic erosive arthropathy. To date, there have been no studies on the appearance of the rheumatoid erosion in the dry bone. This information is essential if determinations of rheumatoid arthritis or other erosive arthropathies are to be made from ancient skeletal material. Metacarpal heads were obtained from patients with classic rheumatoid arthritis at the time of joint surgery. They were macerated and studied under the dissecting and scanning electron microscope. Common features included focal defects on the articular surface, giving rise to a porous appearance. These defects were continuous, with resorptive changes at the cartilage-bone junction and related epiphyseal bone not covered by articular cartilage. The scanning electron microscope showed that these erosions consisted of a series of smaller resorption lacunae. This study represents the beginning of a continuing effort to establish criteria for the diagnosis of erosive arthropathy in the dry bone.

PALEOEPIDEMIOLOGY OF TRAUMA IN A NATIVE CENTRAL CALIFORNIAN POPULATION

Robert Jurmain, San Jose State University

Injuries resulting from accidents or interpersonal violence are seen frequently in a large prehistoric skeletal collection from Central California. This site, Ca-Ala-329, is a large shellmound located on the eastern side of San Francisco Bay, north of Fremont, California. Maximum occupation probably occurred between 1000 and 1500 A.D. Approximately 300 skeletons are available for analysis.

Healed fractures are found in 26 of 1433 intact adult long bones (1.8% frequency), as well as occasionally in the cranium, ribs, vertebrae, and, especially, hands and feet. The most frequently fractured bone is the radius, as a result of accidental falls and the parrying of blows. In addition, interpersonal violence is demonstrated by the presence of embedded projectile points

in four individuals, as well as an apparent healed wound in a fifth victim.

A case of traumatic hip dislocation is also illustrated, and its differential diagnosis from an example of congenital hip dislocation is discussed.

NUTRITIONAL SECONDARY HYPERPARATHYROIDISM IN THE PREHISTORIC NEW WORLD: TWO CASES OF GENERALIZED OSTEITIS FIBROSA WITH CARIOUS LESIONS

Francis Ivanhoe and Charles F. Merbs, Arizona State University

In two young adult female archaeological skeletons, one late Pueblo from New Mexico and one late Thule Eskimo from northern Canada, the combination of periosteal reactions, demineralization, large carious defects, and gross bone deformities characteristic of osteomalacia, all of generalized distribution, integrates the diagnosis of hyperparathyroidism. The reconstruction of a serious calcium deficit in the aboriginal diets, without clear evidence of a lack of vitamin D, indicates that the calcioprivic secondary form of fibrous osteodystrophy is involved. It is suggested that nutritional secondary hyperparathyroidism may have been overlooked in a number of diagnoses of carcinomatosis, syphilis, and iron deficiency anemia (porotic hyperostosis), previously made in prehistoric remains from the New World.

EARLIEST EVIDENCE OF ARTIFICIAL MUMMIFICATION IN SOUTH AMERICA: CHINCHORRO CULTURE

Bernardo Arriaza, Arizona State University, Marvin J. Allison, Vivien Standen and Guillermo Focacci, University of Tarapacá

Chinchorro, a hunting/gathering maritime culture that existed along the extremely arid coast of northern Chile, represents the earliest evidence for artificial mummification in South America, and possibly in the world. The Chinchorro people were mummifying their dead, without discrimination as to age or sex, approximately 3,000 years before the first Egyptian mummies were embalmed. From the beginning of their Emergence Period, around 7810 B.P., until their disappearance in approximately 3590 B.P., the Chinchorro utilized a variety of mummification techniques, which may be identified with cultural stages.

SURVEY ABOUT SOME ASPECTS OF REBURIAL (Paper and exhibit)

Gerald D. Hart, Toronto and Kathy Gruspier, Schomberg, Ontario

This paper is the result of a questionnaire, which was developed in order to investigate global views on the reburial issue. 72 replies were received.

Most respondents felt that they could justify study on human remains in some way. Objections to study were based on spiritual, political, or anthropological reasons. Regarding the retention of skeletal material, most felt that reburial, if inevitable, should be delayed as long as possible. Concerning custody of bones, it was felt that identified descendants should have priority. When there were none, the state, in conjunction with concerned professionals, should have control. Benefits of display of remains were multiple and varied. In general, respondents felt that display should avoid sensationalism. It was also felt that display was educational rather than scientific. Some respondents felt that casts or models, instead of the actual bones themselves, should be displayed.

Questions regarding other issues may be broken up into four general categories: wrongs in the past, universality of studies, assessment of political opposition, and the presence of scientific paranoia. Wrongs in the past include lack of adequate storage space and facilities for research. Sharing of knowledge with the communities involved was advocated, as was active involvement of the native peoples. Most people felt that paleopathological studies benefited all mankind. There should be skilled professionals to act as liaison with concerned religious groups. Many felt political views to be the crux of the issue. Some felt that reburial advocates are merely trying to embarrass governments for past neglect. The problem is particularly urgent in North America, New Zealand and Australia. We must work with, not against, the native peoples if we wish to continue research. An underlying problem with most of these objections is scientific paranoia. Some respondents were rigid in their feeling that we have a 'Divine Right' to paleopathology. In addition, anthropometric tests were advocated for those claiming to be descendants. Forensic pathologists were interested in more consultation with archaeologists and paleopathologists.

In conclusion, the reburial issue must be faced. Coordinated and cooperative programs of study are necessary during excavation and beyond. Sufficient funds and utilization of the local people are advocated. Final reports, which should be written in both plain English for lay people, and scientific terms for specialist publications, will benefit people locally and enhance knowledge of our heritage worldwide.

(Diagrammatic tables were on display throughout the meeting)

SECTION 5: EXHIBITS

SKIN DISEASE IN A 16TH CENTURY CHILEAN MUMMY

Patrick D. Horne, Women's College Hospital, Toronto

This exhibit focuses on just one aspect of an extensive examination of the remains of the mummy known as the Prince of El Plomo. The frozen body of an eight- to nine-year old boy, who belonged to the Ultimate Inca culture, was found above the permafrost line at the 5,400 m level on Cerro El Plomo peak, some 45 km east of present day Santiago, Chile. The boy had been sacrificed to the sun god by being buried alive about the year A.D. 1550. Photographs show the excellent state of preservation of the mummy and its grave goods, as well as gross and microscopic aspects of a skin lesion diagnosed as *angiokeratoma circumscriptum*, secondarily infected and ulcerated. The child had also been infected by *Trichuris trichiura*, and an examination of one of two verruca of the hand showed the typical papilloma virus, the causative agent.

DUELISTS, MURDERERS, AND PAUPERS? OSTEObIOGRAPHY OF AN EARLY 'DISSECTING ROOM' POPULATION

Frank P. and Julie M. Saul, Medical College of Ohio

Skeletal remains from a driveway excavation in Sommerville, Massachusetts were determined to be 'dissecting room' discards (rather than recent crime victims or ancient Amerindians) owing to the manner in which bones were sawed and trephined, together with the presence of broken laboratory glassware.

At least six individuals, ranging in age from late fetus and late adolescence on through the late 20s and 40s, were present. Two of these were very robust males, but none of the more gracile remains could be considered certain females. Surprisingly little pathology was noted: a much atrophied maxilla, an osteomyelitic tibia, several tibiae suggestive of treponema, and several vertebrae showing signs of Schmorl's nodes and osteophytes.

Although limited in scope by the paving of the driveway, this small collection provides interesting insights regarding anatomy specimen sources and teaching procedures of the time (probably mid-1800s, according to accompanying ceramic fragments), based on examination of the remains themselves and their location -- a few miles from Harvard and 'Gallows Hill,' and only a few hundred feet from an almshouse.

THE SUCHEY-BROOKS SYSTEM FOR AGING THE MALE OS PUBIS

Judy M. Suchey, California State University

An extensive (n=739) sample of well-documented male pubic bones was examined for age related features. Katz conducted over 100 regression analyses in his evaluation of the traditional systems of Todd and McKern-Stewart. Todd's system was found to overage, and both the Todd and McKern-Stewart systems did not account for age variability seen in advanced pubic bone patterns. A modified Todd six phase system is recommended. Utilizing this statistical evaluation, Suchey and Brooks have defined the six phases, using readily definable morphological traits. This system is illustrated in a poster and model casts.

DISSEMINATED LYMPHOMA WITH SKELETAL CHANGES IN AN AFRICAN GREEN MONKEY (C. AETHIOPS)

David S. Weaver and Christopher P. Jerome, Wake Forest University

An adult female multiparous African Green Monkey presented lymphoma at necropsy. The animal had nasal drainage that was unresponsive to antibiotics for three years prior to death. On skeletonization, osteomyelitis of the nasal region, loss of the anterior maxillary dentition, ovoid erosion of the scapula and proximal humerus, and osseous signs of a probable tumor of the distal humerus were found. The combined effects of intractable infection and repeated clinical and experimental procedures may have encouraged the lymphoma. Published reports of HTLV-III infections in Green Monkeys and other non-human primates raise the possibility that the skeletal changes were attendant to immune collapse. The skeleton is available for examination.

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