PALAEOPATHOLOGY: STUDYING THE ORIGIN, EVOLUTION AND FREQUENCY OF DISEASE IN HUMAN REMAINS FROM ARCHAEOLOGICAL SITES

Roberts CA
Department of Archaeology, Durham University, UK

Alves Cardoso F
Federal University of Pará, Brazil, and CRIA - Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa, Portugal

Bernofsky K, Henderson C, Jakob T, Plomp K, Ponce P and **Sharman J**
Department of Archaeology, Durham University, UK

Spencer R
Institute of Human Genetics, International Centre for Life, Newcastle University, UK

Keywords: activity, age, analytical methods, bioarchaeology, context, diet, DISH, DNA, ethics, ethnicity, geometric, holistic, inheritance, limitations, medical history, multidisciplinary, occupation, respiratory, sex, skeletons, stress, Sudan, syphilis

Contents

Summary

This chapter provides an introduction to palaeopathology (paleopathology), or the study of disease in the remains of humans (and other animals) from archaeological sites. A subdiscipline of bioarchaeology (bioarcheology), itself a subdiscipline of archaeology and also anthropology, it aims to reconstruct the history of disease over long periods of time by placing biological evidence within cultural context to explain the patterning seen.

It is multidisciplinary by nature and uses a variety of analytical methods, from visual or macroscopic analyses to ancient pathogen DNA assessment.

The text provides a history of study, key issues that scholars are currently contending with, examples of research in the field, and controversies that are being discussed.

Section 1 is a brief overview of what palaeopathology is and how it is studied with its limitations, and provides a backdrop to the sections 2 and 3 where specific research on human remains is now discussed, followed by controversial and often long-standing debates.

1. Palaeopathology: The Discipline and How It is Studied *(Roberts)*

1.1. Definitions

It is a truism to say that every living person in the world today has suffered, or will suffer, a health problem, and this can be said to be true of the past. Being ill affects our very existence and our ability to function as part of any society, again a truism for our ancestors. It can therefore be argued that palaeopathology (paleopathology) provides an extremely relevant window on past experience of disease and its impact on the history of the world.

However, we should remember that the perception of health and disease in any individual or population will vary, and has varied, throughout time. Today the World Health Organisation defines health as ‘a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity’. However, even today different cultures can view disease within their communities very differently and may even see some diseases as a “normal” part of their lives.

This is why using medical anthropological studies that consider the health of people living “traditionally” provide useful data to help understand palaeopathological data, even though they are distanced in space and time from our ancestors.

It should also not be forgotten that humans are extremely good at adapting to changing situations, and evidence of health and disease illustrate individual and group abilities to adapt to their environment, however beneficial (or not) that environment is to healthy living.

Figure 1. Pathological bone (depressions in the surface of the vertebral bodies indicate the intervertebral disk has degenerated, probably because of age)

Palaeopathology essentially can be defined as the study of (*logos*) ancient (*palaeo*) suffering (*pathos*) in both humans and other animals. It is a discipline that aims to trace the origin, evolution and history of disease over long periods of time through pathological changes which represent diseases suffered in life and observed in human remains buried at archaeological sites (Figure 1) .

This evidence of both acute injuries and chronic illnesses tells us a great deal about how individuals and populations experienced various challenges to their health.

The data provide direct primary information about disease in the past, and they are interpreted in conjunction with contemporary descriptions or representations of disease from documentary and iconographic data, where available.

However, for those parts of history where there are no written or illustrative records, human skeletal remains furnish the only evidence that can be used to reconstruct the history of disease. By studying disease in our ancestors' remains, a deep time perspective can be achieved.

1.2. Palaeopathology in Bioarchaeology and Medical History

Palaeopathology is a subdiscipline of bioarchaeology, and bioarchaeology comprises the overall study of human remains from archaeological sites. It should be noted that, as per the North American definition, bioarchaeology incorporates only human remains, but many regions of the world, especially Europe, consider that bioarchaeology deals with the study of any biological remains, including those of humans.

In the UK, bioarchaeology is considered a part of Archaeology, and in North America it is seen as a part of physical or biological anthropology in Anthropology.

Bioarchaeology encompasses the study of demography, and normal and abnormal variation seen in human remains, the latter of which is essentially palaeopathology.

Demographic aspects of bioarchaeology involve the determination of age at death and sex of excavated human remains (see below Section 2.1) to see at what age people died and whether that differed by sex.

Focusing on features that reflect normal variation, this includes taking measurements, for example to determine stature, and recording 'non-metric' or 'epigenetic traits', or abnormalities in the detailed structure of the skeleton (Figure 2).

Palaeopathology can also justifiably be regarded as a part of the study of medical history, whose scholars focus primarily on documentary and iconographic evidence for disease.

It can be argued that palaeopathology is as much a part of archaeological study as archaeology is of palaeopathology. Neither can stand independently of the other.

The ultimate aim in understanding the past is to use data derived from all forms of archaeological evidence, whether those are artifacts, structures or environmental evidence, including human remains. It is of key importance to use all these sources of information, including palaeopathology.

Figure 2. Non-metric trait/normal variation in the skeleton (bregma bone in skull)

1.3 Palaeopathology in Higher Education and 'Contract Archaeology'

Palaeopathology is a global discipline potentially practiced anywhere where human remains are excavated from archaeological sites, but it is less advanced where relevant training in it is lacking, such as in the developing world. As a discipline,

palaeopathology 'exists' in the developed world mainly in two spheres, that of higher education and 'contract archaeology'.

In higher education, this may consist of research within institutions both in the 'field' (research based excavations – see 2.5, or work using museum skeletal collections – see Section 2.2) and/or in the laboratory (analyzing skeletons and samples thereof).

Palaeopathology is taught at both undergraduate and postgraduate levels in many universities as part of archaeology and anthropology degrees and even as options in other disciplines such as biology.

At postgraduate level, it may be in the form of masters level one year taught courses (as in the UK), which have developed in the late 20th century, but also as PhD studies.

Furthermore, shorter courses in palaeopathology have also provided intense periods of training in various countries, particularly again in the UK.

Palaeopathology is also studied as part of the ongoing archaeological excavation process that is undertaken all around the world by specialist contract archaeology units in advance of modern building developments.

In many instances, human remains are discovered, excavated and studied as part of the archaeological site report; part of that study includes recording the evidence for disease.

1.4 History of Development of Palaeopathology and Its Infrastructure

Palaeopathology has had a long history stretching back to the 17th century, although most early work focused on animal remains (Figure 3). It was not until the 19th century that scholars focused on human remains.

Most of those early scholars were medically trained or worked in dentistry, anatomy or nursing, with little understanding of the archaeology of the site from which the remains derived; this often led to an absence of contextualization of the palaeopathological data, i.e. using the context of the remains to explain the findings.

In more recent times, i.e. latter half of the 20th century and into the 21st, most people working in the field are archaeologically or anthropologically trained, thus rectifying the lack of a contextual approach of earlier times.

Early studies also focused on individual skeletons or mummies, but more recent work has taken a 'population' based approach, where groups of individuals are considered, thus shedding a more realistic light on disease history in populations from different temporal and geographic contexts.

The field has developed at different rates around the world and this is most likely affected by the availability of training (see above Section 1.3), and also excavated remains to study as a result of, and in advance of, modern developments.

Figure 3. Pathological animal bone (fracture to distal end of a sheep/goat bone)

While the American Association of Physical Anthropologists has been established since 1913, representing members with a wide range of interests in 'physical anthropology' including palaeopathology, the Paleopathology Association has existed since 1973 solely for those members whose interests lie in palaeopathology.

Its motto is *mortui viventes docent* ('the dead teach the living'), which reflects the relevance of the past to the present, helping us understand why we are what we are today.

In addition to member organizations, regular conferences, seminars, and specialist conferences bring scholars together regularly, and work is published mainly in the *American Journal of Physical Anthropology*, *Journal of Archaeological Science* and the *International Journal of Osteoarchaeology*, with the new *International Journal of Palaeopathology* devoted solely to palaeopathology launched in 2011.

1.5 Types of Human Remains Studied

The majority of scholars working in palaeopathology focus their attentions on skeletal remains (bones and teeth) because these are the human remains that are most commonly preserved and excavated from archaeological sites.

Deliberate disposal of the dead is a unique human attribute and has been evident for thousands of years. In early periods of time in Britain, for example the Palaeolithic (10,500-8000 BC), individuals were typically buried in caves.

In later periods, larger numbers of burials are found in collective burial sites, including Neolithic chambered tombs (4000-2500 BC) and Bronze Age barrows (2600-800 BC).

In much later periods of time, discrete burials in organized urban cemeteries dominate the Roman period (AD 43-410), rural cemeteries with pagan and Christian burials (Figure 4), some accompanied by grave goods, in the early medieval period (c.410-c.1050 AD), and from the 11th century through to the 19th century, late and post-medieval large, mainly urban, cemeteries dominate the burial tradition.

It is often urban cemeteries more than rural ones dated to the Roman and late and post-medieval periods that are excavated. This reflects the fact that most modern developments are in urban contexts.

From the Roman period onwards, written records may aid in final interpretations of the human remains studied, especially in fairly recent periods such as post-medieval Britain, where contemporary records may be available for individual burials (e.g. the Christchurch, Spitalfields crypt population in London; see also Sections 2.1 and 3.2).

Figure 4. Early medieval burial from the Bowl-Hole cemetery at Bamburgh Castle, Northumberland, England

Inhumed burials of course comprise the majority of human remains for studies of palaeopathology, but for some periods of time in Britain, for example during the Bronze and Iron Ages (late 800BC-100 AD), Roman and early medieval periods, cremation was

practiced. Any disease that can affect the skeleton can potentially be observed in skeletal remains.

However, analyzing cremated bone is not as informative with regard to palaeopathology because of the fragmented nature of the remains. In some parts of the world, the environmental conditions are such that whole bodies may be preserved. This includes arid desert environments preserving mummies in Egypt and north-west China, the frigid

Arctic that maintains bodies in a frozen condition (e.g. the victims of the 19th century Franklin expedition), and waterlogged conditions in peat bogs in north-west Europe that have yielded the famous 'bog bodies' (e.g. in Denmark). Studying evidence of pathological changes in preserved bodies has a key advantage over the study of skeletons because any disease affecting the soft tissues of the body may be identified. It may also be possible to identify the presence of disease by analyzing the contents of preserved feces (coprolites) deposited at specific sites or as part of the intestinal contents of the bodies; this might be through the presence of preserved eggs of parasites such as roundworm and whip worm.

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Biography Sketches

Karen Bernofsky completed a BA in anthropology at the University of British Columbia, Vancouver, Canada, followed by an MSc in 2006 and a PhD in palaeopathology in 2010 from the Department of Archaeology, Durham University, UK. The focus of her research has been on the prevalence of, and attempting to determine the etiology of, respiratory disease in past populations in England.

Francisca Alves Cardoso received her undergraduate degree in Anthropology and MSc in Human Evolution at the University of Coimbra, in Portugal, in 1997 and 2002, respectively. In 2008 she was awarded a PhD in Biological Anthropology / Palaeopathology by Durham University, U.K. She is currently a Research Fellow at the Center for Research in Anthropology, Portugal, and is affiliated to the Federal University of Pará, Brazil. Her research focuses on the importance of socio-economic variables in the analysis of human skeletal remains, including their effects and consequences on the interpretation of age-at-death, sex and palaeopathological lesions. She has been exploring issues regarding gender and occupation in 19th and 20th Portuguese populations from Lisbon and Coimbra. More recently she has been developing bioarchaeological studies in the Brazilian Amazon, with an emphasis on bone preservation and conservation, sex/age and identity, population mobility and ancestry. She collaborates with the Anthropology and Paleopathology Laboratory of the Department of Anatomy/Institute of Forensic Medicine, Seoul National University College of Medicine, Korea. She has co-authored papers on activity-related skeletal changes, as well as on past population health at Mesolithic Portuguese sites.

Charlotte Henderson received her BA from the Department of Philosophy at Durham University, UK in 2001, and her MSc and PhD from the Department of Archaeology, also at Durham University, in 2002 and 2010, respectively.She is currently an Honorary Research Associate at the Department of Archaeology, Durham University and postdoctoral research fellow at the University of Coimbra, Portugal. She is a member of the International MSM Working Group on Methods (http : / / w w w. u c. pt / e n / cia / msm / msm _ after) researching qualitative and quantitative methods for recording entheseal changes. She is also a member of the Centre for Ethics and Cultural Heritage at Durham University, and of the British Association of Biological and Osteoarchaeologists, the Paleopathology Association, and the American Association of Physical Anthropologists. Her research interests focus on human remains, and mainly the identification of activity-related stress and diseases which mimic those changes. Her specific research interests focus on quantitative recording of entheses. She was winner of the 16th European Meeting of the Paleopathology Association poster presentation prize for "Quantitative recording of entheses" Santorini, Greece, 28th August - 1st September, 2006.

Tina Jakob Tina Jakob, gained her PhD in Archaeology from the Department of Archaeology, Durham University, UK in 2005. She holds an MSc in Osteology, Palaeopathology and Funerary Archaeology from the University of Sheffield, UK (2000) and an MA in Pre- and Protohistory, Physical Anthropology and Art History from Eberhard-Karls-University Tübingen, Germany (1998). She was the membership

secretary of the British Association for Bioarchaeology and Osteology for five years (2005-2010) and is now a non-executive member of the BABAO committee. She is currently a Teaching Fellow in the Department of Archaeology, Durham University, where she enjoys teaching human osteology and palaeopathology to undergraduate and postgraduate students. Her PhD research focused on differences in skeletal and dental health between archaeological populations in England and Germany in the early medieval period. However, research interests have recently expanded to prehistoric skeletons from Central Sudan, where she has become involved in excavations of a cemetery dating to before 8000 BP. Previously she has worked on archaeological excavations and surveys in Jordan, Turkey, the UK and Germany.

Kimberly Plomp is currently working on her PhD research at Durham University, Durham, UK, in the Anthropology and Archaeology Departments. She received her MSc in Human Osteology and Palaeopathology from the University of Bradford in 2009, and her BA in Anthropology from the University of Alberta, Edmonton in 2007. Research interests include: shape analysis of pathological lesions using geometric morphometrics, using palaeopathological data of osteoarthritis to infer etiological factors, and developing recording methods to strengthen and objectify palaeopathology.

Paola Ponce received a BA (Hons) in Biological Anthropology from the Universidad Nacional de La Plata, Buenos Aires, Argentina in 2002. She later moved to the UK and followed an MSc (2004) in Human Osteology and Palaeopathology at the University of Bradford (UK), and recently finished her PhD (2010) in palaeopathology in the Department of Archaeology at Durham University, UK. Her research interests include the bioarchaeology, including palaeopathology, of Amerindians and British skeletal remains, and occupationally related diseases of hunter-gatherers of South America and at the transition to agriculture. She is a member of the Association of Biological Anthropology of Argentina, the British Association for Biological Anthropology and Osteoarchaeology, and the Paleopathology Association.

Charlotte Roberts Professor Archaeology. A bioarchaeologist of over 25 years with a background in nursing (SRN) archaeology (BA, 1982, University of Leicester, UK), environmental archaeology (MA, 1983, University of Sheffield, UK) and palaeopathology (PhD, 1988, University of Bradford). She is specifically interested in documenting the interaction of people with their environments by exploring patterns of health and disease holistically and with contextual data, especially those health problems that are common today. Appointed Lecturer in 1989 and Senior Lecturer in 1994 at the University of Bradford, respectively, at Durham University in 2000 she was appointed a Reader, and was finally promoted to Professor of Archaeology in 2004. Her job focuses on research on and teaching of palaeopathology, especially the one year MSc Palaeopathology course which she directs. She is President of the Paleopathology Association 2011-2013, and an editorial board member of the *American J. Physical Anthropology*, the *International J. of Osteoarchaeology*, *Human Evolution*, *J. of Archaeological Science*, and the *International J. of Palaeopathology*. Author of over 150 journal papers and book chapters, and author/co-author of six books, she is a member of the Paleopathology Association and the American Association of Physical Anthropologists. She is a regular contributor to national and international conferences, and holder of UK research council funded grants. Webpage: http: / / w w w . dur . ac . uk / archaeology / staff / ? id = 163.

Jennifer Sharman is currently working towards a PhD in Bioarchaeology in the Department of Archaeology at Durham University, UK. She received a BSc (Hons) with distinction in Biological Anthropology and Archaeological Science from the University of Toronto, Canada, in 2003, and an MA in Bioarchaeology from the University of Western Ontario, Canada, in 2007. Her current research analyses the variability in human skeletal ageing rates and sexual dimorphism via documented collections of human skeletal remains from Canada, England, Portugal and South Africa; other research interests include palaeopathology and palaeodemography. She is a member of the Canadian Association for Physical Anthropology, the European Association of Archaeologists, and the British Association for Biological Anthropology and Osteoarchaeology.

Rosa Spencer received a BA (Hons) with first class honours in Biological Anthropology from the University of Alberta, Edmonton, Canada in 2001, followed by an MSc (2002) and PhD (2009) in Palaeopathology from the Department of Archaeology, Durham University, UK. Her PhD research focused on exploring the etiology of DISH using chemical and biological techniques, but she has taught

in, and researched, a variety of fields including forensic anthropology, palaeopathology, biomolecular archaeology, and human genetics. Dr Spencer is currently a Research Associate at the Institute of Human Genetics in the International Centre for Life, University of Newcastle, UK. She is a member of the British Association of Biological Anthropology and Osteoarchaeology, and the American Association of Physical Anthropologists.