

Paleoepidemiology: Is There a Case to Answer?

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Paleopathology is the study of disease, physiological disruptions and impairment in the past. After two centuries of mainly descriptive studies, efforts are being made towards better methodological approaches to the study of diseases in human populations of ancient times whose remains are recovered by archaeology. Paleoepidemiology can be defined as an interdisciplinary area that aims to develop more suitable epidemiological methods, and to apply those in current use, to the study of disease determinants in human populations in the past. In spite of the limits of funerary or other archaeological series of human remains, paleoepidemiology tries to reconstruct past conditions of disease and health in those populations and its relation to lifestyle and environment. Although considering the limits of studying populations of deceased, most of them represented exclusively by bones and teeth, the frequency of lesions and other biological signs of interest to investigations on health, and their relative distribution in the skeletal remains by age and sex, can be calculated, and interpreted according to the ecological and cultural information available in each case. Building better models for bone pathology and bone epidemiology, besides a more complex theoretical frame for paleoepidemiological studies is a big job for the future that will need the incorporation of methods and technology from many areas, including the tools of molecular biology.

Key words: paleopathology - methods - paleoepidemiology - archaeology - bioarchaeology

The image of perfectly healthy people living in intimate contact with nature seems to be one of the most permanent utopias of western culture, much enhanced on the 16th century by the discovery of the New World and people that seemed to live in a timeless, long lost paradise. The study of past human remains has brought us the knowledge that disease has been a companion of man for all times and that, in this sense, paradise on earth is not to be found. Paleopathology, a field of investigation shared by medicine and anthropology, for more than two centuries has helped to prove that diseases followed people and animals since we have register of their presence on Earth. Definitions of health, for the past as for modern populations, strongly depend on cultural aspects that are frequently not well known for human groups studied by archaeology. Nevertheless, it can be postulated that for all known human societies, disease, impairment and disability are concepts intimately linked to the concept of health. So, paleopathology can help to reconstruct human life in the past by searching for signs of disease in paleontological, archaeological and historical documents.

Although some morphological descriptions dated from the 16th and 18th centuries could be interpreted as tentative diagnosis in old bones (Aufderheide & Rodriguez-Martin 1998), it is consensus in the literature that paleopathology started with Johann Friedrich Esper's description of a tumor in the fossilized bone of a cave bear (Pales 1939). This study, as many others at that time, were in fact no more than exercises of academic curiosity.

Human paleopathology, as a scientific discipline, started at the mid of the 19th century, along with the beginning of archaeological and paleontological research in human remains, when bones and mummified bodies strongly attracted the interest of pathologists like Rudolf Virchow, who described the first Neanderthal (Armelagos et al. 1971). The opportunity of recovering large amounts of archaeological remains at sites like the Pueblos of the Southwest of the United States, or the Nubia cemeteries, in Africa, improved research. The emphasis on description and differential diagnosis, besides the enthusiastic application of new techniques like microscopy and radiology characterized the first decades of paleopathology. Authors such as Pales, Jarcho and Rodriguez-Martin proposed a chronological division for the history of paleopathology and most of them agree that from the 19th century to World War II it reflected mainly a medical contribution to the anthropological sciences. In fact, the beginning of paleopathology coincides with the rise of scientific medicine and probably helped to prove the power of pathology as a new scientific field able to identify disease even in ancient specimens.

The first decades of the 20th century were marked by names like Mark Armand Ruffer, Elliot Smith and Léon Pales, and a great number of papers were published (Armelagos et al. 1971, Tyson 1997), but except for evidence of disease in the past the results did not improve prehistoric or historic knowledge. Questions about the antiquity or geographical distribution of syphilis or leprosy, descriptions of practices like trephining, and skull deforming were subjects of great interest. Bone pathology, dental pathology, pathology of mummified soft tissues, parasites in preserved feces, diseases or pathology represented in art objects, or descriptions in written documents were studied as sources of valuable information (Pales 1939, Armelagos et al. 1971, Buikstra & Cook 1980, Aufderheide & Rodriguez-Martin 1998). Even when big

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samples were studied, the individual diagnoses were summed up and frequencies calculated but not interpreted or discussed as to their meaning as population processes.

In 1930 Hooton published the comparative study of the Pueblo skeletal series and for the first time data on mortality, time changes of frequency of lesions, sex and age ratio of lesions and cultural/environmental context were associated to the diagnosis. Hooton's publication is considered the first example of a paleoepidemiological discussion in paleopathology (Buikstra & Cook 1980), and remained unique until the 1960s when another North American osteologist, Lawrence Angel produced the first paleoepidemiological studies, named as such. Angel, who had been Hooton's student, published population approaches exploring the complex relationships between health and culture through time (Ortner & Kelley 1990). Following this trend, a more recent major contribution came from Grmek (1983) with the study of 6th century BC Greek pathocenosis.

The possibility of investigating the process of health changes in populations instead of just describing pathologies was sustained by the changing paradigm of the New Anthropology. After the 1950s, classifying was no longer accepted as a final goal for research in physical anthropology, and as a consequence investigations on human remains also came to be devoted to the understanding of human life in the past (Washburn 1970). Less pathography was published while the search for nexus between pathological conditions and the cultural/environmental context was improved. As more anthropologists started to work with paleopathology and to apply to it anthropological theories, the field became less medical and ever more an important subfield of anthropological investigation. Although starting in America, paleoepidemiology interested Europeans as well and recent theoretical contributions to the study of skeletal remains have come from Waldron (1994).

Patterns of disease came to be an important element to think about lifestyle and history of human groups of the past. Data on violence, accidents, nutritional deficiencies, oral health, exposure to biological or other environmental pathogens, epidemics, congenital anomalies, among others, help to understand social, cultural, environmental and genetic changes. Paleoepidemiology is a field of research still in the making, that faces many challenges and presents many open methodological questions, and the goal of this paper is to bring to discussion some aspects of its interaction with archaeology and paleopathology.

A POPULATIONAL APPROACH TO HEALTH IN THE PAST: PALEOEPIDEMIOLOGY

The term paleoepidemiology was introduced in the literature as meaning epidemiology applied to the past populations, or epidemiology of the diseases of the past (Angel 1966). The use of this term and many others such as paleopathology, paleodemography or paleoparasitology is not free of contention. Can we really talk of a paleoepidemiology? Are we able to propose anything like an epidemiological investigation considering the available information in archaeological sites? *Stricto sensu* most of the epidemiologists will certainly disagree with the idea

of epidemiological interpretations based on small amounts of scattered bones. Most of the modern epidemiological methods of investigation are not seen as fit to be used to the study of archaeological series, although more and more papers include epidemiological discussions and this number has been growing fast in the last few years (Tyson 1997).

Epidemiology can be defined as the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control of health problems (Last 2001). *Paleoepidemiology is the try to count the dead and their pathological signs in archaeological series, in order to reconstruct the spatial, temporal and social distribution of health and disease in past populations based on biocultural models* (Waldron 1994).

Modern epidemiology and paleoepidemiology deal with very distinct limits conditioned by the nature of the available data, and although sharing common principles, the research in archaeological material imposes the development of new methods and techniques or adaptations of existing ones. Inquiring the dead, paleoepidemiology may be closer to the historical death inquiries, as Graunt's mortality bills of the 17th century (Ranger & Slacks 1995), even though including the advances in laboratory analysis and dealing with direct human remains. Missing information is often difficult to evaluate and unknown biases may hinder analysis. The identification and discussion of the characteristics of the most probable sources of biases is a challenge in the development of these studies and will require an interdisciplinary effort. For instance, what can be the implications for epidemiological analysis of taphonomic phenomena? Such questions must be answered if paleoepidemiology is to exist. Time scale is another central problem, for many archaeological collections come from cemeteries used for decades and chronology often includes intervals of centuries. Special sites like Plague pits, battle cemeteries or catastrophic burials resulting from natural disasters as in Pompeii and Herculaneum, are very rare. Current epidemiological methods focus mainly on the study of time series that include information on diseases, at their best, for no more than two centuries, and consider intervals of weeks, months and years. Epidemiological research today is also highly interested in new interdisciplinary boundaries that may allow methodological developments to add to the very proficuous production of the second half of the 20th century, mainly based on mathematical and statistical tools. From the case studies in small Indian groups to more systemic ecological interpretations and the efforts towards prospective secular tendency studies in whole countries (Ranger & Slack 1995), we can see that paleopathology has been progressively approaching epidemiology and establishing the basis of a new interdisciplinary field of investigation, shared by archaeology, pathology and epidemiology.

Although any kind of information about pathology or human biology may be used in paleoepidemiology, most data comes from the analysis of funeral remains represented by skeletons. The provenience of the remains, the nature of the burial site and preservation of bones, the

representativeness of burial series as well as the kind of biological information considered in the study will influence paleoepidemiological investigations. The possibility of dealing with definite temporal sequences of data, as well as having adequate information about socio-cultural and environmental contexts configure good conditions for epidemiological analysis. Historical epidemiology often deals with mortality series that approach those requisites since its object of study is, in general, referred to historical populations and data comes from death registers, organized as such at the time of the original registration of the event (Landers 1992).

The nature of archaeological data frequently imposes upon direct paleoepidemiological research, designs similar to cross sectional studies. In archaeology we have what is possible to find and so the choice of *groups to be studied and compared* has to be made taking into account not only the aspects of morbidity and causes of death, but also information on how burial and recovering occurred. There are no death registers and we largely ignore what would have been informed as the cause of decease by the contemporary observers since many lethal diseases and events leave no obvious mark on bones or mummified tissues.

Quantitative approaches to the study of disease refer to categories like *frequency* – the proportion of disease cases in a series of archaeological remains – or *distribution* – spatial, temporal or social variations of the number of cases. Considering the series as a population, some measurements can be possible: *crude rates, age-specific measurements, proportional mortality rates*. Considering the data as coming from a closed population and covering decades of morbidity, measurements that can be obtained in archaeological series can sometimes be considered as approaches to *period prevalence*.

Exploratory analysis and *comprobatory analysis* are steps of the research draft in paleoepidemiology, as in other fields, but in most cases the small number of individuals make it inadequate to apply *statistical significance tests* to the results, and the conclusions of paleoepidemiological investigations are mainly supported by biocultural significance instead of statistical significance.

Another important consideration in paleoepidemiological research is that funeral remains represent archaeological series that must be carefully described before comparing to living populations. Many archaeological funeral collections have sex/age at death ratios comparable to a mortality intercensus cohort representing a *natural population* (Hassan 1984). But it is important to consider that funeral series are always the expression of *differential risks of death*, and each element represents a unique situation of peculiar health and social conditions that can easily have unbalanced mortality (Waldron 1994). Funeral series can be studied by the application of techniques to calculate *life tables*, a useful application of paleodemographic techniques to the distribution of mortality profiles. These are used specially to evaluate the impact of some infectious diseases, violence, and other population health problems in the past. In spite of the problems related to the use of life tables in archaeology, they stand as

useful tools and ever more refined models have been proposed (Hassan 1984, Buikstra & Koningsberg 1985, Boquet-Appel & Masset 1985, Wood et al. 1992). As not all diseases contribute directly to death, the cohort of deceased variably expresses the living population, depending on its pathocenosis (Grmek 1983). When considering the impact of those diseases that have direct influence in death ratios, it is important to remember that, even for those diseases, the funeral series will certainly be different from the living original population.

Epidemiologic information about health and disease in modern small living populations like the American Indian groups (Coimbra & Santos 1994) offer interesting models of biocultural processes and human ecology that help to interpret diseases in the past using the concept of *determinant* in a comparative perspective. One of the challenges in paleoepidemiology is to find the best variables to describe the disease under study. Different symptoms and signs can be chosen, even in the bones, and the problem is to decide which build up more appropriate diagnostic criteria to represent each disease. In living populations information can be missed because the access to health services is not equally distributed, the quality of diagnosis is heterogeneous, severity of disease varies, and many other factors. In paleoepidemiology the archaeological sources of information are frequently few and heterogeneous and precise identification of pathological conditions is hardly possible. We agree with Jarcho (1966) and Buikstra and Cook (1980) that there is still a need for paleopathologists and paleoepidemiologists to build more precise models for bone diagnosis and interpretation in skeletal populations, incorporating the pathological models for bone diagnosis that are being developed by the forensic sciences and anthropological osteology.

The manifestations of diseases in bones are, generally, late expressions of pathological conditions, and today they become more and more scarce as a result of therapeutics, especially in the case of chronic infections like hanseniasis, syphilis and tuberculosis. Except for some anatomical collections like Todd's Collection, at the Smithsonian Institute, Washington, USA, or the Coimbra Identified Collection, Anthropological Department, Coimbra University, Coimbra, Portugal, it is very difficult to obtain proper series to build pathological models.

Bones, as biological tissues, show two basic distinct reactions to injury: osteolysis and osteosynthesis. The combination of both will be present in every lesion, making differential diagnosis often difficult, and pathognomonic lesions rare. The diagnosis must consider every subtle sign of abnormality in each individual as well as the pattern of lesions in the whole skeletal series; lesions in different stages and pathognomonic lesions as well as unspecific stress indicators. As abnormal signs must be considered at the level of the individual and at the level of the population (Buikstra & Cook 1980), one of the most important problems for diagnosis may be the cutoff point for "normality". It is very often impossible not to be anachronical, in the sense that there is no way to establish parameters of normality valid for past populations and the use of contemporary criteria is the only possibility, with the necessary relativization on interpretation of

results. A good example of this is the use of rib periosteal reactions as a possible sign for pulmonary tuberculosis (Kelley & Micozzi 1984, Santos 2000, Prat & Mendonça de Souza, in this volume), recently developed as an alternative model to supply the absence of information on the soft parts in most of the archaeological remains. Many osteological investigations (see Tyson 1997, for examples) using skeletal collections have been useful for the purpose of modeling a *skeletal epidemiological analysis*. An important aspect to consider in paleoepidemiology is that many of the described lesions represent long standing problems of health, still present or not, at the moment of death. The diagnosis must consider if the lesions are acute or chronic, active or healed, and the time of their occurrence, whether close to the moment of death (and perhaps directly associated to it) or far from it; associated or not, directly or indirectly, with death.

One decade ago Wood et al. (1992) discussed “The Osteological Paradox” discarding the possibility of using the funerary data to infer about health in prehistory. The core of their argument was that in most cases the bones of the deceased do not show signs of disease, simply because in many acute conditions there is no time for bone or teeth sequelae. People die and keep “healthy” from the point of view of skeletal analysis and the blurring effect of this osteological paradox, allied to the theoretical and methodological limits of paleodemography would make it almost impossible to discuss health in the past. Goodman’s answer to Wood’s query reminds us that all the information available in bones must be used to compensate the limits and uncertainty imposed by the nature of archaeological data. And that a systemic approach is generally helpful to minimize the errors introduced by the osteological paradox. This is a good proposal for a paleoepidemiological approach. Even if people die “healthy” mortality can be checked, and age-specific frequencies can inform more about disease in populations than isolated bone descriptions. Unspecific stress indicators associated with pathological signs are also helpful to reconstruct general conditions of health in the funerary series, even considering the osteological paradox as a *confounder*. The arguments of Wood et al. (1992) also did not consider the possibility of a paleoepidemiological approach supported on biocultural significance.

Another important theoretical issue to be considered when we propose the use of epidemiological methods to the study of archaeological findings is that even when we are able to find pathological signs that inform about disease, impairment or disability, nothing about illness or sickness can be directly inferred from funerary series. We may be able to identify infection but not infectious disease and what it meant to the populations under study. On the other hand, what is the meaning of negative data, represented by the loss of soft tissue or its modification by mummification processes? Of course, the absence of evidence does not necessarily mean the absence of disease. Sometimes it is indirect evidence that strongly suggests pathological conditions, as in the case of bone atrophy that suggests muscle paralysis, but even in this case etiology may be just speculation. Even when definite pathological signs are present differential diagnosis

can be a hard task, as discussed by Miller et al. (1996) who tested interobserver error for differential diagnosis showing that only 28.6% of specific diagnosis were correctly done in bone series, against 42.9% of diagnosis for major categories of disease like infection, trauma, tumors, and so on. Thus the osteological paradox is not the only problem, as misdiagnosing can be still more difficult to deal with. Refining methods and techniques is necessary to deal with these limits. Also we must consider that for most discussions of health conditions of past populations, a syndrome approach to diagnosis may be more than enough and precise etiological diagnosis according to modern classification of diseases, not at all necessary.

Waldron (1994) brings to paleoepidemiology a most interesting and rich discussion, after accepting the difficult job of dealing with archaeological series. Pointing to the major limits and problems, he assumes that the correct approach is just to do the best with the available information, as in so many other research fields. Proposals on the application of quantitative methods in archaeology have been published specially after the 1950s (Orton 1982, Shennan 1990) and most of the problems found in funeral remains are shared with other archaeological materials but Waldron reminds us that funerary series have their own problems. They are generally small, scattered and badly preserved and probably never random in any possible sense, being almost impossible to infer what in fact it represents from the original living population. A funeral series can be roughly compared to a mortality cohort of a living population, but the continuous interaction of selective factors beyond death selection by different diseases, such as cultural practices, burial taphonomy and human interventions contribute to make burial series different from the matrix living population in qualitative and quantitative ways, and the interactions of these factors are still not well known.

Is it possible to consider a funerary series as a *sample* of the living population? According to most of the authors a skeletal series should be considered in fact an available *population* and studied as a whole, even though this procedure carries an inherent bias since it is impossible to establish the relative weight of the different processes, intrinsic or extrinsic, that contribute to the constitution of a burial series. Because of this, each cemetery probably represents a unique situation, and eventually the deceased recovered can be close to, but not exactly mirror, the death pattern of the original living population. According to Waldron (1994) four extrinsic factors and one intrinsic factor are the most important to take into account in paleoepidemiology. The extrinsic factors, considered to be almost entirely independent of human biology, are the proportion of dying that are effectively buried in the site (a consequence of social circumstances and choices), the proportion of remains surviving to be discovered (a consequence of taphonomic processes, including land use), the proportion of dead effectively discovered (a consequence of the technique and extension of the field research), and the proportion of the remains that can be recovered for analysis (also a consequence of techniques and resources used in research). The intrinsic factor is the nature of the burial series that makes it a dead

population, not a living one. This last factor is frequently overlooked. As stated by Waldron (1994) "We are dealing with a population: which has suffered and died from diseases that are largely non-random, which is a social or cultural rather than a biological sampling, which is an unknown proportion of the total dead population, and which has suffered a number of depredations in the time between burial and recovery".

A small number of cemeteries offer a large number of individuals representing a short period of time. A very few of them can be completely and properly excavated, and rare cemeteries have a big number of burials, but even in this last case the problem with sampling in funeral archaeology is more than a matter of numbers. Selective risk of death, selection of burial places among other factors, is especially important in urban and socially stratified sites. As death is a powerful selective risk, morbidity expressed in burial series certainly represents a special distribution, and its relation to the distribution of morbidity in living populations of the past must be better understood. To understand the nature of the series (or sample) means to think about what is represented there. Of course, cemeteries do not represent random samplings of any population, living or not. The question to be answered in relation to archaeological findings is what is the pattern? And to answer this question we, very often, do not have enough information. For many living populations we have enough information to allow inferences on morbidity from mortality data, but even severity of disease expressed through lethality, which we believe is a rather stable characteristic of many diseases, may have varied extensively over long periods of time. Disappearance or emergence of diseases might also be considered. Such points are extensively discussed by Grmek (1983) and constitute one of the basis of his proposal of the model of pathocenosis, to allow a structural view of disease in the past.

Another characteristic of funeral series is that they may be considered to represent a *closed population*. Previous to any discussion about the *representativeness* or significance of the number of burials or pathologies, it must be considered what in fact is the material we recover in archaeological research. That is an especially important point because statistical significance can be achieved simply by aggregating series from different times or cultural groups. Besides discussing the biocultural significance of what is being tested, *exploratory analysis* may be useful to decide about *aggregating* or *segregating* series.

DISCUSSING METHODOLOGY: IS THERE A CASE TO ANSWER?

Most of the studies in paleopathology are still descriptive or pathographic and that is probably because most of the archaeological materials are not adequate for anything else. Some of the studies are very detailed and include important differential diagnosis but very few archaeological series seem proper to a paleoepidemiological approach, and a first important decision in this field is to choose when is it possible to try a paleoepidemiological analysis. Another important decision is to see if there is a hypothesis to be tested. After Orton (1980) we could say

that a desirable thing is to propose a clear question: *is there a case to answer?*

A biocultural model usually is a good starting point for paleoepidemiological cases (Mendonça de Souza 1999). The nature of archaeological data and the availability of models for pathology and epidemiology generally guide methodological choices. Specific questions and objectives, sets of chosen variables, techniques to be employed, will be the direct consequences of the case to answer. Qualitative and quantitative treatment of data and its association to context, chronology, and special methods of analysis will provide information to new prehistoric biocultural models about disease and their relationship to life-style (Martin et al. 1991, Mendonça de Souza 1999).

The use of complex models to represent disease conditions in the past is a consequence of multiple causality for most of the health problems in populations. Informations about the context are necessary to draw a picture of health in the past and to try a systemic approach at analysis. Even if we consider that funerary series can give us a picture of health for a past group, results in paleoepidemiology are generally unique, and their explanatory power will seldom reach more than one funeral series, simply because each living group has a unique history of life and disease and the funerary series represents, at their best, a specific cohort in time and space, a glance at one group's life. Comparative investigations in different archaeological collections and case studies in modern groups demonstrate that the main reason for this is less the differences in representativeness of the series and more, the multiplicity of the biocultural processes in different human groups (Goodman & Leatherman 2001).

The reconstruction of the epidemiological scenario for a prehistoric group living in a specific time and place depends not only on the presence of and relationships between the etiological factors, but also on the chronological sequence of events that hit any particular group. The variability of life conditions and historical sequences in prehistoric times force us to consider *a priori* that most of the findings are unique situations, and the absence of large populations and homogeneous conditions of life make it almost impossible to find the same results in different case studies. The scarcity of data in archaeological series may lead to what is called *atomistic fallacy*, that is to attribute to a population, associations that are valid only for the individuals or small series, an error to be cared for in paleoepidemiological inference.

Inference in paleoepidemiology, as elsewhere, aims to propose causal associations, that is to say, to establish asymmetrical relationships between variables (Susser 1977). Such associations are proposed not only considering statistical significance but also biological plausibility. This last aspect deserves some comments. In the archaeological context, what we call "biological plausibility" may be heavily influenced by anachronical suppositions of permanence over time of prevailing models of the natural history of diseases. That is to say, there is no way to be reasonably sure that we can separate "biological" (understood as "natural") from "social" aspects of the deter-

minants of disease in pre-historical populations as we so often pretend to do for present-day populations. Our consideration of the stability of the basic human physiological processes for, at least, 50,000 years seems biologically sound, but disease distribution in populations depends, among other things, on the relative frequency of biological traits whose selection can be heavily based on social determinants. This is certainly a promising line of investigation for paleoepidemiology that has barely been tackled, although research on the human genome is bringing back the interest in discussions on biological determinants of human diseases and human behavior.

EPILOGUE: DO NOT THROW OUT THE BABY WITH THE BATH WATER!

The study of health related conditions in human archaeological remains has come to constitute some of the most informative data for prehistory in spite of so many uncertainties. Using a biocultural approach it is possible to explore the processes that link social and cultural practices and their impact to human biology, helping to reconstruct life in the past (Iscan & Kennedy 1989, Larsen 1997, Goodman & Leatherman 2001). Paleoepidemiology is a more complex but also informative method to cope with disease and its social and cultural causal relations focusing not individual but population changes.

The limits to apply paleoepidemiological approaches have already been discussed and methodological solutions to override some of them are the great concern for many researchers. As far as most archaeological data is residual, scarce and incomplete and can not be reproduced by experimentation, very few data allow conclusive inference, and the limits and uncertainties have to be clearly defined and accepted. Statistical significance is not obtained for many results but cultural significance, which is not simply a matter of quantity, also must be clear. Susser (1977), points out that in epidemiology we have to consider that difficulties in validating results need not to invalidate theory, as long as we consider the limits and errors we may be dealing with.

From dozens of analyzed sites, only a few allow new hypothesis or models to be proposed to explain prehistoric health and disease. Methods in paleoepidemiology have to be developed to respond to the need of advancing from bone diagnosis to skeletal funerary epidemiology. In the last 30 years of intensive investigations, paleoepidemiological contributions specially helped to understand what archaeological series mean and how they can be used to infer about health and disease. Despite the criticism of some (Wood et al. 1992) and the pragmatic defense of others (Waldron 1994) research in paleoepidemiology contributes each day with more and more interesting information to prehistorical and historical reconstruction. As proclaimed by archaeologists, the limits and difficulties in this field of research do not justify “throwing out the baby with the bath water”. The continuous engagement of professionals and the developments of theory and methods in paleoepidemiology is helping to face the limits and bring more information about diseases in human populations of the past.

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