

BIOARCHAEOLOGY (ANTHROPOLOGICAL ARCHAEOLOGY)

Mario ŠLAUS

Department of Archaeology, Croatian Academy of Sciences and Arts, Zagreb, Croatia.

Keywords: Bioarchaeology, archaeological, forensic, antemortem, post-mortem, perimortem, traumas, Cribra orbitalia, Harris lines, Tuberculosis, Leprosy, Treponematosi, Trauma analysis, Accidental trauma, Intentional trauma, Osteological, Degenerative disease, Habitual activities, Osteoarthritis, Schmorl's nodes, Tooth wear

Contents

1. Introduction
 - 1.1. Definition of Bioarchaeology
 - 1.2. History of Bioarchaeology
 2. Analysis of Skeletal Remains
 - 2.1. Excavation and Recovery
 - 2.2. Human / Non-Human Remains
 - 2.3. Archaeological / Forensic Remains
 - 2.4. Differentiating between Antemortem/Postmortem/Perimortem Traumas
 - 2.5. Determination of Sex
 - 2.6. Determination of Age at Death
 - 2.6.1. Age Determination in Subadults
 - 2.6.2. Age Determination in Adults.
 3. Skeletal and dental markers of stress
 - 3.1. Linear Enamel Hypoplasia
 - 3.2. Cribra Orbitalia
 - 3.3. Harris Lines
 4. Analyses of dental remains
 - 4.1. Caries
 - 4.2. Alveolar Bone Disease and Antemortem Tooth Loss
 5. Infectious disease
 - 5.1. Non-specific Infectious Diseases
 - 5.2. Specific Infectious Disease
 - 5.2.1. Tuberculosis
 - 5.2.2. Leprosy
 - 5.2.3. Treponematosi
 6. Trauma analysis
 - 6.1. Accidental Trauma
 - 6.2. Intentional Trauma
 7. Osteological and dental evidence of degenerative disease and habitual activities
 - 7.1. Osteoarthritis
 - 7.2. Schmorl's Nodes
 - 7.3. Tooth Wear Caused by Habitual Activities
 8. Conclusion
- Glossary
Bibliography
Biographical Sketch

1. Introduction

1.1. Definition of Bioarchaeology

Bioarchaeology is the study of human biological remains within their cultural (archaeological) context. The term was first coined in 1972 by the British archaeologist Graham Clark as a reference to zooarchaeology, or the study of animal bones from archaeological sites. Redefined in 1977 by Jane Buikstra, bioarchaeology in the US now refers exclusively to the scientific study of human skeletal remains from archaeological sites, a discipline also known as osteoarchaeology or paleo-osteology. In England and most other European countries the term bioarchaeology can still refer to analyses of any biological remains recovered from archaeological sites although analyses of faunal remains are more commonly referred to as environmental archaeology.

One of the main goals of archaeology as a science is to reconstruct the life ways of past populations. In this context, very reliable indicators of the quality of life in past populations are their biological remains, i.e. bones and teeth. However, as recently as a few decades ago many archaeologists did not appreciate the full potential of osteological research as a source of information on biocultural behavior and human adaptation. Such views are best reflected in one archaeologist's statement to a reporter visiting a prehistoric archaeological excavation in Colorado: "Human bones don't provide that much information. After all, we know we are dealing with the remains of Indians." (Steel and Olive, 1989). The enormous potential that bioarchaeology can bring to our understanding of the past has only recently been realized. The following factors have contributed to this.

The first is the development, and use of standardized and reliable methods for the determination of sex and age-at-death in human osteological remains. The second factor concerns the development of large, archaeologically well-documented osteological collections that have become available only within the last few decades. The third reason is the development and application of multivariate statistical methods in bioarchaeological analyses. These analyses were greatly facilitated by the use of personal computers and statistical software packages that have also become available in the last few decades. The fourth, and probably most important factor was a change in the focus of analyses from the description of one individual and his osteological characteristics, to an emphasis on analyses of complete populations that became the main focus of study. Because of these changes, human bones recovered from archaeological sites became, just like historical documents or archaeological artifacts, a document of past that must be studied if we are to understand our history.

1.2. History of Bioarchaeology

The first physical anthropological analysis is associated with a paper that was published in 1755 by Jean Joseph Sue, a professor of anatomy in Paris. In the paper Sue published the results of detailed measurements of four bodies as well as maximum lengths of macerated long bones of 14 individuals. Throughout the 19th century and the first half of 20th century anthropological studies were primarily concerned with descriptions of individual skeletons and the pathological changes that were observed on them. The

gradual shift in interest from the analysis of isolated individual towards research of whole populations started in the second half of the 20th century. The American Lawrence J. Angel from the National Museum of Natural History in Washington DC was one of the first scholars who used such an approach. He published several articles in which he reported on the demographical and pathological characteristics of the early Bronze Age population from Karatas in Turkey (Angel, 1968; 1970; 1976). He also published two papers that became the foundations of modern palaeopathology (Angel, 1966) and paleodemography (Angel, 1969).

During this time European anthropologists focused their interest on craniometric analyses. Hungarian anthropologists, Pál Liptak (1953, 1954, 1955, 1957) and Sándor Wenger (1955, 1957, 1968) pioneered these analyses. Their interest was focused on questions of historical anthropology, especially the reconstruction of population migrations during the Early Middle Ages. This interest led to the development of several large, archaeologically well-documented osteological collections that served as a data base for the paleodemographic analyses of Gyula Acsádi and Janos Nemeskéri. Their analysis resulted in the first book about paleodemography (*History of human life span and mortality*), published in 1970 in Budapest.

A similar pattern consisting of a preliminary interest in craniometric analyses, followed by the development of large osteological collections and the subsequent diversification of bioarchaeological analyses was present in Czechoslovakia where the most important anthropologists were Hana Hanáková (Hanáková and Stloukal, 1966) and Milan Stloukal (Stloukal and Hanáková 1966, 1971, 1974). The pioneers of bioarchaeological analyses in Germany were Ilse Schwidetzky (1967, 1972) and Friedrich Rösing (Rösing and Schwidetzky 1977, 1981). In Great Britain Calvin Wells (1982) published the results of paleopathological and paleodemographical analyses from the late Antique site of Bath Gate.

The founder of bioarchaeology in the United States was Aleš Hrdlička, director of the Department for physical anthropology in the Smithsonian Institution in Washington. His work led to the development of osteological collections in the Smithsonian Institution. These collections represent some of the most important scientific resources in bioarchaeology. Hrdlička also founded the “*American Journal of Physical Anthropology*” the most important journal for bioarchaeological research today. Dale T. Stewart and Lawrence J. Angel continued Hrdlička’s work.

2. Analysis of Skeletal Remains

2.1. Excavation and Recovery

When dealing with human bones from archaeological sites the following methods and procedures should be employed:

1. Bones should be left in the ground until the whole skeleton is excavated;
2. The excavated skeleton must be photographed and drawn with the name of the site, number of the grave, and orientation marker clearly shown;
3. During recovery of the skeleton all relevant data should be written on a grave

- data sheet;
4. Recovery of the bones should proceed slowly and carefully. An inventory of skeletal remains should be kept as work progresses to ensure that nothing is missed;
 5. Wet bones must be dried before transport and not left in direct sunlight for long periods of time;
 6. Cranial, long bones and short bones should be stored separately in paper bags;
 7. All relevant data (the name of the site, grave number, date of excavation, etc.) should be written on the paper bags in waterproof ink.

The objective of any excavation is to recover the maximum amount of information. In this context the following, simple, rules should also be enforced during all archaeological excavations:

1. Never pick up the skull by inserting fingers into eye orbits.
2. Never pick up the skull by the foramen magnum.
3. Handle skull and mandible carefully so that no teeth are lost.
4. Do not pack heavy bones on top of fragile ones.
5. Do not apply any chemical agents to the remains.

2.2. Human / Non-Human Remains

Distinguishing human from animal bones can be complicated – similarities, for instance, between bear and human metacarpal bones are well known and thoroughly described (Stewart, 1959; Angel, 1974; Hoffman, 1984). In most cases, however, there are clear morphological, radiological and microscopic differences between human and animal bones.

Morphological differences are easier to identify in complete bones. They consist of the following:

1. Articular surfaces and epiphyseal areas tend to be larger and more sculpted in non-human remains.
2. Muscle attachment sites are generally larger and more rugged in non-human mammals.
3. Long bone shafts are straighter and less rugged in humans than similar-sized mammals.
4. Fused bones (except in pathological cases) are generally non-human.
5. The thickness of compact bone in relation to total bone diameter is usually around $\frac{1}{4}$ in humans, $\frac{1}{3}$ in non-human mammals, and $\frac{1}{8}$ in birds.

Radiographic differences in long bone shafts are present in the following:

1. Spongy bone in humans shows circular or oblong trabeculae.
2. No sharp border delineates between the cortex and trabeculae in humans.
3. Animal bones have homogeneous dense trabecular patterns.
4. Unlike human bones, animal bones exhibit a sharp delineation of cortex and spongy bone.

5. In non-human mammals small dense bony spicules extend from the cortex into spongy bone.

Microscopic differences are present in the following:

1. Non-human bone shows concentric layers of bone called laminae or plexiform bone.
2. Human bone shows lamellae and Haversian systems.
3. Plexiform bone usually occurs in carnivores, human infants and non-human primates. It is the primary bone type in Bovidae (cows), Suidae (pigs) and Cervidae (deer, elk).

-
-
-

TO ACCESS ALL THE 18 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

- Acsádi G., Nemeskéri J. (1970). *History of Human Life Span and Mortality*. Budapest: Akadémiai Kiadó.
- Angel J. L. (1969). The bases of paleodemography. *American Journal of Physical Anthropology*, 30, 427-437.
- Aufderheide A. C., Rodriguez-Martin C. (1998). *The Cambridge Encyclopedia of Human Paleopathology*. Cambridge: Cambridge University Press.
- Bass W. M. (1995). *Human Osteology: A Laboratory and Field Manual of the Human Skeleton*. 4th ed. Columbia: Missouri Archaeological Society.
- Fazekas I. G., Kósa F. (1978). *Forensic Fetal Osteology*. Budapest: Akadémiai Kiadó.
- Gilbert B. M., McKern T. W. (1973). A method for aging the female os pubis. *American Journal of Physical Anthropology*, 38, 31-38.
- Hunt E. E., Gleiser I. (1955). The estimation of age and sex of preadolescent children from bone and teeth. *American Journal of Physical Anthropology*, 13, 479-487.
- İşcan Y. M., Kennedy K. A. R. (Eds) (1989). *Reconstruction of Life from the Skeleton*. New York: Alan R. Liss.
- Krogman W.M., Yaşar İşcan M. (1986). *The Human Skeleton in Forensic Medicine*. 2nd ed. Springfield: C.C.Thomas.
- Larsen C. S. (1997). *Bioarchaeology. Interpreting behavior from the human skeleton*. Cambridge: Cambridge University Press.
- Mann R. W., Murphy S. P. (1990). *Regional Atlas of Bone Disease. A Guide to Pathologic and Normal Variation in the Human Skeleton*. Springfield: C.C.Thomas.
- Ortner D. J. (2003). *Identification of Pathological Conditions in Human Skeletal Remains*. 2nd ed. New York: Academic Press.
- Phenice T. W. (1969). A newly developed visual method of sexing the os pubis. *American Journal of Physical Anthropology*, 30, 297-301.

Pindborg J. J. (1970). *Pathology of the Dental Hard Tissues*. Philadelphia: W. B. Saunders.

Scheuer L., Black S. (2000). *Developmental Juvenile Osteology*. New York. Academic Press.

Steinbock G. T. (1976). *Paleopathological Diagnosis and Interpretations*. *Bone Diseases in Ancient Human Populations*. Springfield: C.C.Thomas.

Ubelaker D.H. (1989). *Human Skeletal Remains: Excavation, Analysis, Interpretation*. 2nd ed. Washington: Taraxacum.

Biographical Sketch

Mario Šlaus is a bioarchaeologist and forensic anthropologist. He works in the Department of archaeology of the Croatian Academy of Sciences and Arts and is a Professor at the Department of forensic medicine at the School of Medicine, University of Zagreb, and the Department of archaeology at the University of Zadar. He has a PhD in skeletal biology. His research interests are in the areas of bioarchaeology and forensic anthropology. He has authored, or co-authored over 70 journal articles and is the author of two books dealing with bioarchaeological analyses of archaeological populations from Croatia. He is the founder and curator of the Osteological collection of the Croatian Academy of Sciences and Arts that currently contains the remains of approximately 5300 skeletons from 39 archaeological sites in Croatia. He is also a forensic anthropologist and has participated in the identification of approximately 3000 individuals recovered from individual and mass graves related to the 1991 War in Croatia.