FORENSIC ANTHROPOLOGY

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From

THE TO-BE-FORGOTTEN

THOMAS HARDY

These, our sped ancestry,
Lie here embraced by deeper death than we;
Nor shape nor thought of theirs can you descry
With keenest backward eye.

They count as quite forgot;
They are as men who have existed not;
Theirs is a loss past loss of fitful breath;
It is the second death.

We here, as yet, each day
Are blest with dear recall; as yet, can say
We hold in some soul loved continuance
Of shape and voice and glance.

But what has been will be—
First memory, then oblivion's swallowing sea;
Like men foregone, shall we merge into those
Whose story no one knows.

For which of us could hope
To show in life that world-awakening scope
Granted the few whose memory none lets die,
But all men magnify?

FORENSIC ANTHROPOLOGY

The Structure, Morphology, and Variation of Human Bone and Dentition

By

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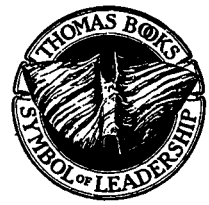

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DEDICATION

To T. Dale Stewart

Whose contributions to forensic anthropology inspired the writing of this book.

PREFACE

SINCE PHYSICAL ANTHROPOLOGY emerged as a branch of science some 200 years ago, analysis of skeletal and dental morphology has been one of its primary avenues of investigations. It is not surprising that physical anthropologists emphasize the critical value of bone. They are completely dependent on the evidence provided by human osteological remains for any information regarding morphology, past biological relationships, adaption, and the direct traces of micro- and macro-evolutionary events.

In the past three decades there has been a rapid increase in the fundamental knowledge of human osteology. This book is written with the purpose of incorporating relevant information on human osteology into a single text. It is virtually impossible, however, to either review or cite all the published accounts dealing with the human skeleton. We have attempted to include all necessary data presenting new ideas and concepts and updating important literature. The authors realize that certain information may not be of interest to some students, but it has been included for the benefit of others engaged in various aspects of research in human osteology and forensic studies.

This text evolved from several years of teaching human osteology and recognizing the value of the human skeleton in forensic and anthropological studies. The primary objective of this text is to accommodate the needs of students in these disciplines. It is designed for students in physical anthropology, archeology, and forensic medicine to provide them with the necessary knowledge and understanding of the structure and variability of the human bone and dentition.

INTRODUCTION

THE UTILITY OF THE HUMAN SKELETON is not restricted to physical anthropologists. Bone has always been a subject of great interest to students in many disciplines. Anatomists, surgeons, histologists, and biochemists, among other scholars, have focused on the analysis of the physical property and morphological variability for centuries. Interest in the anatomy and physiology of the human skeleton dates back to the fourth century BC when Herodotus (484-425 BC) described the natives of Asia Minor and commented on the thicker skulls of Egyptians compared to Persians. Herodotus attributed the differences to the fact that the shaven-headed style of the Egyptians exposed them to the rays of the sun. Hippocrates (460-377 BC) supported the theory of the influence of environment on human morphology and related the differences between various human groups to climate. Aristotle (384-322 BC) recognized that man's brain is larger than that of other animals in proportion to total body mass and noted that only man deliberates and meditates.

Erasistratus (320-357 BC) and Horophilus (335-280 BC) practiced human dissection at the university of Alexandria. Galen (131-200 AD), practicing exclusively on animals, wrote several monographs on muscle and fetus formation and underscored the similarity between apes and man. Following Galen, the infant scientific method fell into decadence and was replaced by the library methods of scholarship in Europe. Scientific style and inquiry continued, however, among the Arabs.

In 1240, Fredrick II of Germany decreed that all medical students must study anatomy and witness at least one dissection of a human cadaver. Partly as a result of this decree, Fredrick was excommunicated by the Pope. Against opposition, the investigation of human anatomy continued from that time to be part of medical education. In *De humani corporis fabrica,* published in Basel in 1543, Andreas Vesalius corrected the many errors of Galen's anatomical work and expanded it to create the modern subfield of anatomy. Comparative anatomy quickly arose with its importance for modern anthropology.

In the United States, physical anthropology began with Samuel G. Morton in 1830. Morton's interest was primarily in comparative human anatomy, phrenology, and in questions relating to the origin and biological affinity of the American Indians. In 1839 his truly monumental work, *Crania Americana,* was published "to give accurate delineations of the

skulls representing different American Indian groups from all parts of the United States and to determine by the evidence of osteological facts whether the American Indians of all epochs have belonged to one race or to a plurality of races."

Joseph Leidy and J. Aitken Meigs continued Morton's work. Leidy published many scientific papers on various aspects of human skeletal biology. Meigs most important contributions were "The cranial characteristics of the races of men" and "The catalogue of human crania in the collection in the National Sciences in Philadelphia" (both in 1857) and "Observations on the occiput in various races" (in 1860).

Other nineteenth century osteologists in the United States include Jeffries Wyman (1814-1874), who gave us our first knowledge of the gorilla. In addition to his study of the skull, Wyman also examined the bones of the postcranial skeleton. George Peabody, Henry Bowitch, Frank Russel, Harrison Allen, Daniel Brinton, and Washington Matthews also made important contributions to human osteological research during the late nineteenth century.

Perhaps the father of North American physical anthropology is Aleš Hrdlička, long time curator at the Smithsonian Institution. Hrdlička's contributions included anthropometric and anthroposcopic observations, as well as medical studies, particularly of American Indian natives. Hrdlička founded the *American Journal of Physical Anthropology* in 1918. E.A. Hooton is another distinguished American physical anthropologist. Hooton's major contribution was the publication of his massive research of human skeletal remains, THE INDIANS OF PECOS PUEBLO, in 1930. For its time, and for many years to come, Hooton's work set the standard for studies of human skeletal remains.

This book is written with the intention of updating the work of earlier authors and providing the student with an easy to use handbook for recovering, analyzing, and reporting on human skeletal specimens. It is our hope that this text will give the necessary background for all interested students in the medical and biological sciences.

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M.Y.El-N.
K.R.M.

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FORENSIC ANTHROPOLOGY

CHAPTER I

RECOVERY AND TREATMENT OF BONE

THE RECOVERY OF BONE is usually the responsibility of an archeologist or a police officer. The care with which the recovery is performed varies greatly, but it is usually better if an archeologist performs the work, since his discipline includes knowledge of the careful excavation techniques needed. A police officer has many other duties and cannot devote the time that would be required to obtain the archeologist's skills. Ideally, a physical anthropologist should be called in to excavate bone found by either the archeologist or the police. In practice, this rarely happens. The cleaning, preservation, and storage is usually carried out by a qualified physical anthropologist. The police usually do nothing to bones to alter their original condition as found. An archeologist can usually be counted upon to clean, store, and preserve bone adequately, but not always perfectly in the opinion of most osteologists. The authors intend in this section to outline methods of excavation and treatment of bone which are satisfactory to the physical anthropologist.

THE SITE

The foremost rule is: Allow no damage to occur to the bone beyond that which may already have been done. Without the bone no data exists for the physical anthropologist to work with; the bone or bone fragment which is missing is often the very part which would have answered some critical question such as age, sex, race, or cause of death. If bones are missing, returning to the discovery site may be beneficial in recovering the missing parts.

If recovery is your responsibility, map the site during the first visit. On that occasion you will notice things which you will become used to and miss in subsequent trips. The same caution goes for photographs. Photos help greatly to revisualize the site, but do not rely upon them to provide a map. Many things are distorted or obscured on photos which are made clear in a drawing. The map should include those features which are likely to be permanent in order to provide a way to reorient yourself if the site is visited again at a later date. Also include the grave (s) if visible, and any artifacts or weapons, clothing, etc. found on the surface. Keep notes as you dig. A portable cassette tape recorder is a convenient way to do this since you will say things you might not write down.

Methods for mapping a discovery site are presented by Brooks (1975) and Morse, Crusoe, and Smith (1976). The techniques are very simple to apply, and should prove adequate for most purposes. Furthermore, they are flexible enough to be readily modified if circumstances require it. Brooks recommends staking out contiguous five by five foot squares covering the area of most interest, such as the skeleton. In areas where the surface material is less densely concentrated, ten by ten foot squares may be used. The squares provide a visual aid in sketching the site and a framework for locating objects spatially in some detail. The squares may be designated in any of several ways. For instance; the ten by ten foot squares may be given letters of the alphabet and the five by five foot squares numbered 1 through 4 for each larger lettered square. In this way, only one small square would be numbered A-3, for instance.

Specific objects may be located within the drawing of the square by measuring their distance from any two adjacent edges. For instance, three feet one inch south of the north wall and two feet five inches east of the west wall. Some indication of magnetic north must be included in the map or sketches and in all photos.

A sketch of the skeleton should be made before any removal of the bone takes place. Note its position, direction, attitude, and preservation, and any bones missing or other disturbance. Photograph profusely since this is far better and cheaper than not getting the one picture that would have answered your question later. When removing the skeleton, clear all dirt away from the bones before attempting to pick them up. Bones often look more substantial than they are. Do not take chances. Never pick a bone up in the middle. Grip it at both ends and slowly rock it loose from the soil. Lift it only when it is free of the matrix. Try to empty the braincase of dirt since the weight of a ball of dried dirt in the skull will provide a battering ram which will demolish cranial joints. This can be done by using a small tool and removing dirt through the foramen magnum, or other opening if the skull is broken. Note that the attachment between the face and the braincase is very fragile and difficult, if not impossible, to restore. Do not pick the vault up without supporting the face. Teeth have often fallen out of the jaws even when the skull appears to be undisturbed. Count teeth and be sure that all are accounted for. Screen the fill for such small items.

Bag the bones in paper sacks or equivalent for removal to the lab. Label each sack with the site and burial number. Some advocate bagging each bone separately, but this is not necessary if enough padding is provided to keep the bones from rubbing together. Neither is it necessary to bag each hand and foot separately, although this is not a bad idea. Place the

bags in a *roomy* box. Do not jam them in since this defeats all your efforts. Take a soil sample from the abdomen and another from the soil away from the bone, but still in the grave, for possible chemical analysis by soil chemists, toxicologists, etc.

Do not forget: *photograph, draw, and describe at the time.* No matter what you think, you will not remember!

AT THE LAB

At the lab, unpack the bags of bones carefully. If the soil permits, brush the dirt from the dry bones. If this cannot be done, wash them under slowly running lukewarm water. Do this in a washtub, a sink with the stopper closed, or whatever appropriate means will prevent the loss of teeth, broken bone fragments, bullets, or other small objects. Allow the bones to air dry in the shade at room temperature to avoid cracking. After the bones are totally dry, usually twenty-four to forty-eight hours, restoration and preservation may be accomplished if needed. Any of a number of acrylic resins may be used for the purpose of preservation so long as they are soluble in a convenient vehicle like acetone. Mix the resin-acetone solution to a milklike consistency, or thinner, for maximum penetration. Be careful around acetone since it is very flammable.

Preservation

To treat a bone with preservative, submerge it in the resin-acetone solution at least until bubbles cease to form on the surface of the solution. Pull the bone out of the solution with tongs and allow to drain until dripping stops, then set the bone on a mesh screen such as one-fourth inch hardware cloth to finish drying. Turn the bone often to prevent it from adhering to the puddles of resin which are bound to form. The bones should be completely dry in about eight to twenty-four hours and can be stored, or reconstructed if necessary, for study. Bones which are still wet from washing when immersed will become covered with a white film as they dry. If this happens, resubmerge the bones in acetone to drive off the water and wash away the film. When they are fully dry, repeat the preservation process.

Restoration

Depending on how extensive the damage has been, restoration of the skeleton may or may not be a difficult and time-consuming project. If the breaks are the common ones, such as clean midshaft breaks of the long bones with no loss of fragments, restoration is simple. A badly crushed skull will tax patience, skill, and knowledge, in addition to being time-consuming.