

An Analysis of Forensic Anthropology
Cases Submitted to the
Smithsonian Institution by the
Federal Bureau of Investigation
from 1962 to 1994

Gretchen A. Grisbaum and Douglas H. Ubelaker



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A B S T R A C T

Grisbaum, Gretchen A., and Douglas H. Ubelaker. An Analysis of Forensic Anthropology Cases Submitted to the Smithsonian Institution by the Federal Bureau of Investigation from 1962 to 1994. *Smithsonian Contributions to Anthropology*, number 45, 15 pages, five figures, three tables, 2001.—For more than 50 years, the Smithsonian Institution has provided scientific expertise in the analysis of forensic anthropology cases submitted to the Institution by the Federal Bureau of Investigation (FBI) in Washington, D.C. This study presents an analysis of the cases submitted from 1962 to 1994 and reported on by two Smithsonian scientists, J. Lawrence Angel and Douglas H. Ubelaker.

Analysis revealed wide variation in the types of cases submitted. In addition, the rate of submission varied throughout this period, with the highest rate occurring in the late 1970s. The FBI submissions originated most commonly from western and southern regions of the United States and reflected original discoveries frequently in the months of May and November.

The total sample included all major categories of ancestry, sex, and age, but the overall pattern deviated significantly from national homicide statistics. Statistics on taphonomical alterations, trauma, the area of the body associated with trauma, and problems of positive identifications in the FBI sample are discussed.

Finally, temporal changes in report writing and information collected are discussed. These differences appear to reflect not only stylistic preferences of the two scientists involved, but also the academic growth of forensic anthropology. The patterns of change detected in the FBI sample relate to the more general expansion of forensic anthropology and the growing numbers of anthropologists involved in this application of physical anthropology.

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Preface

The present report originates from an internship of the first author in the Department of Anthropology, National Museum of Natural History, Smithsonian Institution, under the direction of the second author. This internship involved participation in the analysis of forensic cases submitted to the Smithsonian by the Federal Bureau of Investigation (FBI). Discussion at that time focused on the variability of the cases submitted, the extent to which the types of individuals represented by those cases reflected national homicide trends, and how the submissions related to developments in forensic anthropology. These discussions led to additional research, a master's thesis by the first author (Grisbaum, 1999), and the information reported herein.

The authors express their appreciation to the National Anthropological Archives of the Smithsonian's Department of Anthropology for assistance in making the J. Lawrence Angel materials available. Robert Montgomery of that unit was especially helpful. Mary Manhein, Robert Tague, and Lamar Meek of Louisiana State University all provided much appreciated advice and encouragement. We thank Erica Jones of the Smithsonian's Department of Anthropology for her assistance with case files. We also thank Meredith Ray McQuoid of the Smithsonian Institution Press for her many editorial contributions to the manuscript.

An Analysis of Forensic Anthropology Cases Submitted to the Smithsonian Institution by the Federal Bureau of Investigation from 1962 to 1994

Gretchen A. Grisbaum and Douglas H. Ubelaker

Introduction

When a human body is discovered, the primary objectives in an investigation are to identify the victim and to establish the cause and manner of death. If the remains are found relatively soon after death, these goals are usually accomplished by the law enforcement agency and the forensic pathologist performing the autopsy. When the remains are not discovered until some time after death, however, the expertise of a forensic anthropologist is often needed. In cases involving skeletal remains, it is the forensic anthropologist who can best establish a profile of age, ancestry, sex, and stature and provide an assessment of trauma.

The primary goal of this study was to provide information on the types of cases analyzed anthropologically at the Smithsonian Institution (SI). Data for this study were obtained from the records of cases submitted to the Smithsonian by the Federal Bureau of Investigation (FBI) during a period of 32 years, from 1962 to 1994. The data were from all FBI cases examined in this time period by either Douglas H. Ubelaker or J. Lawrence

Angel (SI). This report assesses patterns in the types of cases examined and addresses changes in the types of cases submitted during the time under review.

Initially, the cases were analyzed to determine the frequency, regional distribution, and seasonality of the discovery of the remains. This determined the prevalence of one area of the country over another as well as the likelihood of discovery during certain months of the year. In addition, information is provided herein on who initially found the remains.

The cases were then examined with reference to the demographic profile of the individual remains as determined by the forensic anthropologist. The profile data provided herein show the sex, ancestry, and age-at-death composition of the sample. This information was then compared with national trends in homicide victims.

Additionally, postmortem (taphonomic) alterations on the remains were considered. This analysis included information on the completeness of remains sent for examination and the terrain in which they were discovered. These data were analyzed with respect to animal activity noted on the remains, estimated postmortem interval (time since death), and stage of decomposition.

Trauma noted on the remains also was examined. Types of trauma and the area of the body on which it was inflicted are reported.

This report also provides information on cases sent to the Smithsonian via the FBI that were interpreted by Smithsonian anthropologists as being archaeological in origin. Statistics are reported on these cases regarding general demography as well as assessment of traumatic evidence found on the remains.

Finally, the changes that have taken place in the analysis of forensic anthropology cases at the Smithsonian were reviewed.

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These changes are presented herein with respect to the growth and expansion of the field of forensic anthropology itself. In addition, predictions are made about the use of the Smithsonian Institution in anthropological analysis in the future.

Beginning with the work of Aleš Hrdlička (Ubelaker, 1999a, 1999b) and continuing through present activity, Smithsonian forensic anthropologists have played an important role in the development of American forensic anthropology. Central to these contributions have been consultations with forensic scientists at FBI Headquarters in Washington, D.C., on matters relating to this science. This casework can be traced back to FBI contact with Aleš Hrdlička in 1936. Consultation for the FBI on such matters subsequently has been maintained continuously, primarily through the work of Hrdlička, T.D. Stewart, J.L. Angel, and D.H. Ubelaker (all of SI).

Details of the nature of the casework conducted by Hrdlička and Stewart have been documented (Ubelaker, 1999a, 2000). In addition, some statistics are available regarding the activity of recent North American forensic anthropologists, especially diplomates of the American Board of Forensic Anthropology, Inc. (ABFA) (Reichs, 1995, 1998; Wienker and Rhine, 1989; Ubelaker, 1996). This report complements these works by offering data on the nature of cases studied by the Smithsonian for the FBI from 1962 to 1994. Placement of these data in the published record will allow scholarly evaluation of how this Smithsonian activity relates to more general historical issues of the development of forensic anthropology. Some such comparisons are attempted herein, including how the Smithsonian-FBI cases relate to national homicide statistics. The descriptive categories chosen for summarizing this information should facilitate future comparative analysis.

Historical Development of Forensic Anthropology

Forensic anthropology, a specialized, applied branch of physical anthropology, deals with the medicolegal investigation of death. The science grew out of the need for skeletal anatomy expertise in legal proceedings. The forensic anthropologist is called upon by law enforcement agencies to assist in the identification and assessment of badly decomposed or skeletonized human remains. Although the large majority of forensic anthropologists are affiliated with universities, their required assistance in the law enforcement community suggests a trend toward full-time status as forensic experts.

Thompson (1982) distinguished three periods in the development of forensic anthropology: pre-1939, 1939–1972, and post-1972. Forensic anthropology has its roots principally in the anatomical sciences. Before 1939, anatomy departments were the principal contributors to the methodology of human skeletal variation, using collections of cadavers of known age, ancestry, sex, and morbidity. Undoubtedly, at this time, physical anthropologists and anatomists were consulted by law enforcement agencies regarding skeletal remains. Thomas Dwight (1843–1911) of Harvard University, H.H. Wilder (1864–1928) of Smith College in Massachusetts, and George

Dorsey (1869–1931) of the Field Columbian Museum in Chicago were among those anthropologists interested in the forensic aspects of anthropology (Stewart, 1979). During this same period, Earnest Hooton (1887–1954) of Harvard University and Aleš Hrdlička (1869–1943) expressed interest in the field. Among the contributions made by Hrdlička was his key role in the founding of the American Association of Physical Anthropologists in 1930 and the *American Journal of Physical Anthropology* in 1918. Hrdlička also consulted with law enforcement agencies, including the FBI, on a number of skeletal cases (Ubelaker, 1999a, 1999b). Hooton would later publish “Medico-legal Aspects of Physical Anthropology” in *Clinics*, in which he described the dim prospect of new methods in the field of physical anthropology in a forensic context, undoubtedly because of the lack of attention given to the field (Hooton, 1943).

In 1939, W.M. Krogman published “A Guide to the Identification of Human Skeletal Material” in the *FBI Law Enforcement Bulletin*, marking the beginning of the second period of forensic anthropology development. This publication represented the first major contribution by a trained anthropologist on the topic of human skeletal identification for medicolegal purposes. Krogman’s publication allowed the forensic community, as well as other physical anthropologists, to view physical anthropology in a forensic context (Stewart, 1979).

At the close of World War II, several physical anthropologists were consulted in the identification of war casualties. Among the anthropologists who contributed their expertise were H.L. Shapiro of the American Museum of Natural History in New York, F.E. Randall of the U.S. Army’s Office of the Quartermaster General, and Charles Snow of the University of Kentucky. Krogman’s “Guide” became a manual used by the anthropologists in the identification process. A central laboratory was established for this purpose in 1947 in Hawaii and was headed by Charles Snow. Not long before, in the early 1940s, T.D. Stewart began his routine consultation with the FBI for forensic skeletal cases (Ubelaker, 1990). This relationship, initiated by Hrdlička, represented an early phase of a long history of collaboration between the FBI and the Smithsonian Institution in forensic anthropology.

The Korean conflict marked the second major anthropological contribution to the identification of war dead, when Stewart and Ellis Kerley and Charles Warren of the U.S. Army’s Identification Laboratory in Kokura, Japan, provided their expertise. In addition, anthropologists were enlisted to investigate skeletal changes indicative of age in the American casualties. Unlike previous studies conducted on anatomy school cadavers of known age that, in addition, represented persons who had suffered from diseases and nutritional deprivation, the studies on the war dead had as their sample a population of healthy, well-nourished individuals (Thompson, 1982). This sample offered an understanding of the progression of natural age indicators.

In 1962, Krogman wrote the first textbook on forensic anthropology. *The Human Skeleton in Forensic Medicine*

(revised and updated: Krogman and İşcan, 1986) is a compilation of techniques and case histories of the identification of human remains. In the text, Krogman identified methods for the determination of age, ancestry, sex, and stature, as well as individualizing characteristics and restoration of facial features on the skull. This textbook has been described as “the most comprehensive and authoritative book” on forensic anthropology (İşcan, 1988:205).

A turning point for forensic anthropology came in 1972. At that time, the American Academy of Forensic Sciences (AAFS) instituted the Physical Anthropology section. The Academy itself was incorporated in 1950 to “promote education for and research in the forensic sciences; to encourage the study, improve the practice, elevate the standards and advance the cause of the forensic sciences; to promote interdisciplinary communication...” (American Academy of Forensic Sciences, 1987:xii).

The Physical Anthropology section of the AAFS began with 14 members in 1972 and has grown tremendously since then, with 237 members in 1998 (American Academy of Forensic Sciences, 1998). With the formation of the new section, forensic anthropologists were given the opportunity to present a wealth of anthropological papers and were provided a forum in which to exchange ideas and opinions. This substantial increase in communication among forensic anthropologists resulted in a phenomenal boost in research.

Coinciding with the development of the new AAFS Physical Anthropology section was the increase in the number of textbooks on forensic anthropology. In 1979, Stewart published *Essentials of Forensic Anthropology*. This textbook was the first to include a chapter on courtroom procedures associated with expert testimony. The post-1972 era marked an emergence of material written by anthropologists for other anthropologists and, equally as important, for other scientists and law enforcement personnel.

Current literature in forensic anthropology encompasses a wide range of topics and issues. Anthropologists are no longer limited to research involving the estimation of age, ancestry, sex, and stature, as was prominent during the emergence of the field. Although a large amount of research is still being conducted on improving and testing these techniques, the anthropologist's scope has reached far beyond them (Galloway et al., 1993).

Although the field of forensic anthropology has experienced tremendous growth during the last few decades, limited information exists concerning the historical changes and advancements in the field as related to large collections of forensic anthropological remains spanning long periods of time. The University of Tennessee is currently assembling information from cases into a nationwide database. Through the cooperation of local forensic anthropologists, information collected on these cases ranges from age, ancestry, and sex to manner of death, degree of decomposition, seasonality, and location of discovery of the remains (Moore-Jansen and Jantz, 1989). This collection represents a large number of cases and will undoubtedly

contribute to future research in the field; however, these cases are not only of forensic origin but include donated remains as well.

Marks (1995) conducted a study on 22 years of analysis at the University of Tennessee. His work discussed general distribution of casework over the time period under review, with consideration given to demography and distribution of caseload.

With regard to national representation of forensic anthropology, the number of forensic anthropologists in the United States has increased significantly in recent years, which suggests that many law enforcement agencies are seeking the expertise needed in skeletal cases. This also suggests, however, that the use of these anthropologists on a regional level might reduce the number of cases being sent to the Smithsonian Institution through the FBI.

As the number of forensic anthropologists has increased, so has the interest in recording greater numbers of scientific variables associated with the forensic cases. Standardization of record collection has received much attention (Moore-Jansen and Jantz, 1990), with emphasis being placed on a wide range of factors being recorded. This increased awareness of the need for the “whole picture” in relation to forensic anthropology unquestionably will allow for a wealth of research to be conducted on these cases.

Historical developments in the general field of forensic anthropology are closely linked with activity in forensic anthropology by scientists at the Smithsonian Institution. The Smithsonian's involvement in physical anthropology began with the hiring of Czech-born Aleš Hrdlička in 1903. Hrdlička was a pioneer in American physical anthropology and played a key role in founding the American Association of Physical Anthropologists and its journal, the *American Journal of Physical Anthropology*. Although Hrdlička is best known for his study of the peopling of the new world and anthropometry, his research interests and activities were broad and included forensic topics. Hrdlička's training included legal medicine, and his early work focused on forensic issues regarding the biological basis for abnormal behavior. At the Smithsonian's Department of Anthropology, he became involved in legal issues relating to American Indian ancestry and skeletal analysis. Perhaps as early as 1918, the FBI became aware of Hrdlička's expertise, and at least by 1936, the FBI began to send specimens to Hrdlička for identification (Ubelaker, 1999a). Records are not clear regarding the magnitude of these case consultations, but Hrdlička examined at least 37 cases for the FBI and maintained correspondence with FBI Director J. Edgar Hoover.

After Hrdlička's retirement in 1942 and death in 1943, T.D. Stewart assumed responsibility for the FBI casework (Ubelaker, 1999b). Before that time, Stewart had some involvement with the cases sent to Hrdlička, his immediate supervisor, but apparently was not aware of all of Hrdlička's forensic work. Stewart remained the primary contact for the central FBI laboratory from 1942 until 1962, when he accepted an administrative post as Director of the National Museum of

Natural History (then called the Museum of Natural History). Stewart reported on at least 167 cases for the FBI from 1946 to 1969. The actual number of forensic cases during this period was larger, but records are incomplete and Stewart's Smithsonian colleagues often reported on cases when he was not available.

When Stewart began his administration as museum director in 1962, the Smithsonian hired J. Lawrence Angel, who largely assumed Stewart's forensic caseload with the FBI (Ubelaker, 1990). Angel was born in London, England, on 21 March 1915. The son of an English sculptor, Angel became interested in the study of bones when he saw a skeleton that his father kept in his studio (Ubelaker, 1989). At age 13 he moved to the United States and attended the Choate School in Connecticut and then Harvard University. At Harvard, Angel studied under Earnest Hooton and Clyde Kluckhohn, who stimulated his interest in physical anthropology. Angel received his doctorate in physical anthropology from Harvard in 1942. He taught at the University of California–Berkeley, the University of Minnesota in Minneapolis, and Jefferson Medical College in Philadelphia before joining the Smithsonian's Department of Anthropology. Angel's arrival at the Smithsonian marked the end of T.D. Stewart's consultation on FBI cases, and the two jointly consulted on only two FBI cases in later years (Ubelaker, 1990).

Angel's contributions to the field of physical anthropology were substantial. He reported extensively on microevolution, cultural and biological relationships, anthropometric methods, paleodemography, and paleopathology. His forensic interests began relatively late in his career, when he joined the Smithsonian staff. Angel's first forensic case at the Smithsonian came on his initial day of employment there when the FBI asked for his assistance. While at the Smithsonian, Angel consulted for the FBI and other law enforcement agencies on approximately 565 forensic cases (Ubelaker, 1990). He served as the primary contact in forensic anthropology for the FBI laboratories until 1977, when Douglas H. Ubelaker assumed that responsibility. Until his death in 1986, Angel actively contributed to the awareness of forensic anthropology by law enforcement organizations and scientists alike. With his vast curiosity and attention to detail, he played a key role in the expansion and heightened professionalism of forensic anthropology.

Ubelaker was born on 23 August 1946, in Horton, Kansas. He was educated at the University of Kansas in Lawrence, receiving his doctorate in physical anthropology there in 1973. Like Angel and many other forensic anthropologists, Ubelaker's interests were not confined to forensic sciences. He has also conducted extensive fieldwork and related research in Ecuador, the Dominican Republic, and the United States, focusing on the issues of skeletal biology.

Ubelaker joined the Department of Anthropology staff of the Smithsonian's National Museum of Natural History in 1971. In 1977, Angel took sabbatical leave to prepare a manuscript for publication, and arrangements were made for Ubelaker to as-

sume responsibility for the FBI consultation work. Ubelaker has continued this consultation without interruption and had reported on more than 682 cases for the FBI and others as of the typesetting of this manuscript (August 2000). Like his FBI consultant predecessors at the Smithsonian, Ubelaker has supplemented his forensic casework with teaching (George Washington University, Washington, D.C.), research in other areas of physical anthropology, and lecturing.

This report presents results of a study conducted solely from the FBI case files of Angel and Ubelaker and reviews their contributions, made through the Smithsonian Institution, to the field of forensic anthropology.

Material and Methods

STUDY SAMPLE

The Smithsonian Institution provides its expertise directly to local law enforcement agencies representing many regions of the country; however, the sample used for this project consisted solely of cases submitted to the Smithsonian Institution by the FBI for anthropological analysis. All cases analyzed for this project were submitted from 1962 to 1994, which encompassed all of the FBI cases analyzed by either Angel or Ubelaker, from the beginning of Angel's employment at the Smithsonian until 1994. Cases involving an oral report instead of a written one were excluded. Also excluded were analyses by Smithsonian scientists (Houck et al., 1996; Owsley et al., 1995; Ubelaker et al., 1995) on cases from the Branch Davidian incident in Waco, Texas, in 1993. Although these cases technically were part of the sample, they were excluded because of their large number and unique circumstances.

DATA COLLECTION AND ANALYSIS

The data were collected during an eight-week period in 1994 at the Smithsonian. Financial assistance to G.A. Grisbaum through a grant from the Freeport–McMoRan Corporation is gratefully acknowledged. All cases analyzed by Ubelaker were recorded from files in his office at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. These files consisted of the requests from local law enforcement agencies to the FBI for assistance, the data sheets used by Ubelaker, final reports, photographs, and any additional correspondence between Ubelaker and the local law enforcement agency or the FBI.

The case files of Angel were retrieved from the National Anthropological Archives of the Department of Anthropology, Smithsonian Institution, Washington, D.C. These files were similar to those of Ubelaker, although there were significant differences that are discussed later.

A total of 565 cases were reviewed for this study. A data collection form was designed to retrieve the pertinent information from the case files (Figure 1). Each case was documented with

DATA COLLECTION SHEET

Case # _____

State recovered in: _____ Terrain: _____

Remains discovered by: _____ Date of Recovery: _____

Age: _____

Ancestry: _____

Sex: _____

Percentage of remains recovered: _____

	Single Elements	Paired Elements (Left)	Paired Elements (Right)
Cranium	_____		
Mandible	_____		
Hyoid	_____		
Clavicle		_____	_____
Scapula		_____	_____
Humerus		_____	_____
Radius		_____	_____
Ulna		_____	_____
Hands		_____	_____
Ribs	_____		
Vertebrae	_____		
Pelvis	_____		
Femur		_____	_____
Tibia		_____	_____
Fibula		_____	_____
Feet		_____	_____
Total	_____	_____	_____

Estimated postmortem interval: _____

Trauma noted: _____ Animal activity: _____

Area of body in which trauma occurred: _____

Animal bones recovered with remains: _____

Stage of decomposition: _____

Reconstruction or superimposition used: _____ Positive ID: _____

FIGURE 1.—Data collection sheet for summarizing each FBI case submitted to the Smithsonian Institution.

regard to whether it was examined by Angel or Ubelaker, along with its corresponding case number. When the origin of the remains was known, the state where they were discovered was noted; otherwise the place of origin was listed as unknown. The date of recovery of the remains was noted, but in cases for which the recovery date was not available, the date on which it was sent by local authorities to the FBI for analysis was used. If neither was available, the date was recorded as unknown.

Data recorded included who found the remains. For purposes of standardization, these had to be narrowed to the following categories: children, outdoor recreationists (which included hikers, hunters, and anglers), workers, homeowners, animals, and other (including law enforcement personnel). If the information was unknown, it was recorded as such.

The context (e.g., terrain if outside) in which the remains were discovered was characterized as one of the following: water or associated with water (which included beaches and river banks), exposed outdoors, buried outdoors, either exposed or buried outdoors (used when it was known that the remains were found outside, but unclear whether or not they were exposed), indoors, other (which included animal crematoriums, cars, ice chests, dumps, mailboxes, and mine shafts), or not available.

Individual characteristics were also recorded for each case in the study. Age at death was defined by the following categories: fetal, infant (less than one year), child (1–12 years), adolescent (13–18 years), young adult (19–34 years), middle-aged (35–60 years), and elderly (more than 60 years). It was also recorded if age at death was unavailable or if the examiner was unable to determine this information. Sex of the remains was noted as male, female, undetermined, or unavailable. Ancestry was defined as Black, White, admixture, Native American, Asian, unavailable, or undetermined.

The bones recovered were identified and recorded. A value was assigned to each bone distinguishing the whole, partial, or fragmentary condition of the bone. Whether the data collected here are truly representative of the remains recovered is not clear. Often only portions of the remains were sent to the Smithsonian for analysis.

The percentage of the skeleton sent for analysis was calculated by assigning percentages to certain bones or groups of bones. The cranium, mandible, and hyoid were assigned 10% collectively. Clavicles and scapulae were also assigned 10% collectively. Ribs and vertebrae were collectively 10%, with subjective assignment of percentages being made in cases of recovery of partial ribs or vertebrae. The pelvis was assigned 10%. Humeri and femora were given 5% each, totaling 20%. Radii, ulnae, tibiae, and fibulae were assigned 2.5% for each, totaling 20%. Hands and feet were each assigned 5%, totaling 20%. Again, partial representation of the individual hand or foot bones was subjectively assigned a value. Generally, all percentages were assigned based on representation of skeletal size. For example, although more than 50% of the bones in the

skeleton are found in the hands and feet, they were assigned a small percentage based on actual size.

Estimated postmortem interval, or time since death, was assigned to the following categories: days (1–13 days), weeks (2 weeks–7 weeks, 6 days), months (2–24 months), less than 10 years, greater than 10 years, archaeological, or not available. As with the percentage of skeletal remains, estimated postmortem interval also required some interpretation. Often there were postmortem intervals that could possibly encompass two categories. In these cases, the category was chosen that most closely represented the actual data. For example, a postmortem interval of eight weeks would be placed into the weeks category as opposed to the months category.

Trauma noted on the remains and the location on the body where it occurred were also recorded. The types of trauma were categorized as blunt force, sharp force (including stabbing, severing, and dismemberment), high velocity (gunshot wounds), fire (including explosions), fractures, multiple (meaning trauma from two or more of the above categories), and other (including strangulation, sharkbite, and boiling in acid). The area of the body to which the trauma was inflicted was recorded as head and neck, axial, appendicular, multiple (meaning the trauma occurred to more than one region of the body), or none. As with all other variables, notation was made if this information was not available.

Redefined stages of decomposition were devised solely for this study because definitions in the current literature on decompositional stages were not applicable. Five basic stages are often assigned in relation to decomposition: fresh, bloated, active decay, advanced decay, and dry (Smith 1986). These categories proved insufficient in this sample because the vast majority of cases would fall into the latter two, without differentiating more advanced decay. Therefore, the following stages were devised with concentration placed on those most often seen by the anthropologist: fresh (including preserved remains), decomposing soft tissue, adipocere (with some decomposing tissue remaining), mummified (including dried, desiccated tissue), skeletonized (dry bone with no tissue remaining), fragmentary, and burned or charred remains.

Animal activity indicated on the bones, such as rodent gnawing or carnivore chewing, was recorded as either not present, minimal, moderate, severe, or not available in the record. Animal bones present in addition to human remains sent for analysis were also noted. In cases for which only animal bones were sent for examination, the type of animal represented was noted if available.

For each relevant case, the use of techniques of computerized superimposition, clay facial reconstructions, or drawings was recorded. These procedures are sometimes used in an attempt to lead to a positive identification of the deceased.

Whether or not a positive identification was made in the case was documented. This was recorded as either yes, no, or tentative. Data regarding positive identification presented a problem because that information was not always available in the

records. In addition, it was not always clear by which means the identification was made (i.e., odontological or skeletal). In some cases the remains might have been identified by local officials before they were sent to the FBI and the Smithsonian for analysis. This issue is discussed in greater detail later in this paper.

All archaeological cases were entered into a separate database from the more recent cases; age, ancestry, and sex estimations, as well as trauma, date of recovery, and state from which the remains were recovered were recorded for each archaeological case. The assessment of ancestry for these cases posed different questions than for nonarchaeological, forensic cases. Forensic cases were placed into fewer ancestry categories. One interesting point in reviewing the archaeological cases was that the ancestry language was more specific than for their forensic counterparts. Whereas the forensic cases were described as White, Black, admixture, Asian, or Native American, the archaeological cases were often more specifically described, such as Plains Indian, Pueblo Indian, or Hawaiian.

All data obtained for this study were entered into a database in SPSS Base 7.5 for Windows and were subjected to multiple queries to identify patterns. Summary statistics and graphics were then obtained using SPSS (1997).

Results

NONARCHAEOLOGICAL CASES

This section provides summary information on the cases of human remains, nonhuman remains, and mixed human and animal remains analyzed by the Smithsonian Institution for the FBI from 1962 to 1994.

NUMBER AND TYPES OF CASES.—A total of 500 nonarchaeological cases were examined. Twenty-six of these cases contained no substantial skeletal material. They represented instances of radiographic or photographic submission or cases of cross sections of bone sent for analysis. These cases were eliminated from the analyses and were not considered part of the nonarchaeological sample. Table 1 summarizes the 474 cases containing substantial skeletal remains sent during the period under study. The vast majority of cases were those consisting solely of human remains (71.9%). Cases consisting of both human and nonhuman remains accounted for 13.7%, and those representing only nonhuman remains composed 14.3% of the nonarchaeological sample.

REGIONAL DISTRIBUTION OF ORIGIN OF CASES.—Figure 2 defines the geographic regions for analysis of the distribution

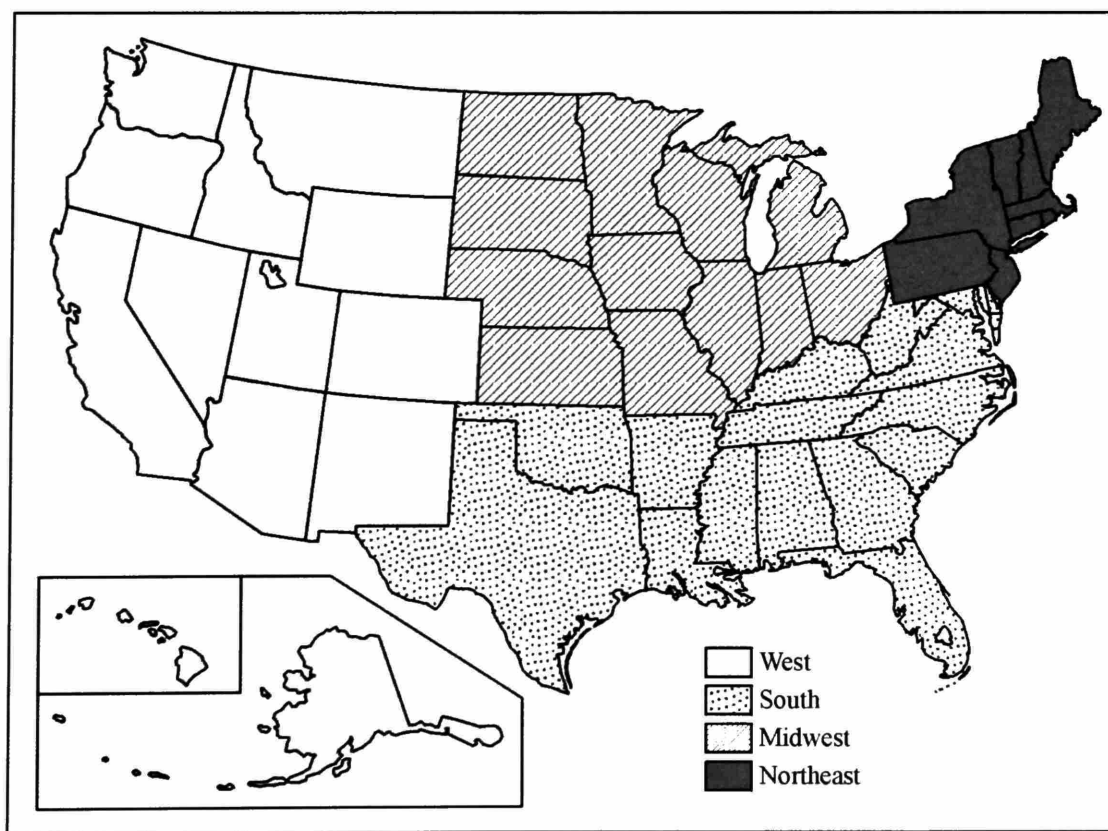


FIGURE 2.—Regional designations for examining distribution of FBI cases by geographic origin in the United States.

of cases examined. In addition to the four regions depicted in the figure, a category was added to include those cases originating from areas outside the United States. These areas included Guam, Hong Kong, Japan, Lebanon, Mexico, Palmyra Island (of the Line Islands, south of Hawaii), the U.S. Virgin Islands, and the West Indies. The western region accounted for the most case origins, with 35.2% of the examined cases (Table 2); the southern region contained 32.8%; the northeastern had 14.8%; and the midwestern had 14.5%. Two and one-half percent of the sample consisted of foreign submissions, and those for which the place of origin was unknown were only 0.2% of the sample.

MONTH OF RECOVERY.—All of the human skeletal case reports were reviewed to determine the prevalence of certain months of the year when human remains were found. Figure 3 shows that remains were more likely to be discovered in the months of November (13.1%) or May (12.1%). The least likely month of discovery throughout the period in this sample was February. The month of recovery was unknown in seven cases.

CIRCUMSTANCES OF RECOVERY.—Circumstances of recovery provide valuable data on forensic cases. For the majority (60.1%) of the studied cases, data indicating the discoverers of the remains were not available. Among the cases in which these data were available (39.9%), outdoors recreationists located 11.1%, children and workers discovered 5.7% each, homeowners found 4.9%, animals located 1.7%, and others located 10.8% of the cases.

DEMOGRAPHY.—The sexual composition of this study showed a meaningful difference between the number of males and females in the nonarchaeological sample (Table 3). Males constituted 58.1% of the sample and females accounted for 32.5%. Cases in which the sex was undetermined represented 8.4%, and those in which the sexual determination was not available were only 1% of the sample.

The sexual composition of the sample changed with time and reflected differences between the sexes. Figure 4 shows that males had a much stronger representation in the sample as a whole, but the male proportion decreased with time. For example, from 1960 to 1974, the ratio of males to females was clearly greater than 2:1. After 1975, however, the percentage of females gradually rose; from 1990 to 1994, the percentage of males was 48.8% and the percentage of females rose to 41.9%. A possible explanation for the increase in the percentage of females could be that the number of undetermined also rose substantially during the 1980s. If these undetermined cases were actually mostly males, then no disparity from earlier trends would have existed.

Regarding ancestry in the Smithsonian's nonarchaeological case sample, more than one-half (54.2%) of the individuals presented for analysis were White, 9.1% were Black, 6.9% were Native American, 4.7% were Asian, and 0.2% were of Black-White admixture. Cases in which ancestry information was not available in the records accounted for 1%, and undetermined ancestry was assigned 23.9% of the time. In a majority

TABLE 1.—Number of FBI cases containing skeletal material submitted to the Smithsonian Institution, 1962 to 1994.

Years	Remains			Total cases
	Human only	Human and animal	Animal only	
1960–1964	29	3	0	32
1965–1969	56	8	4	68
1970–1974	55	17	8	80
1975–1979	66	21	17	104
1980–1984	57	7	5	69
1985–1989	35	3	11	49
1990–1994	38	5	10	53
Unknown	5	1	13	19
Total	341	65	68	474

TABLE 2.—Regional origin of FBI cases submitted to the Smithsonian Institution, presented as percent of total cases (regions defined in Figure 2; N/A = origin not available).

Years of recovery	United States regions				Foreign origin	N/A	Total
	Northeast	West	Midwest	South			
1960–1964	9.4	28.1	15.6	46.9			100
1965–1969	12.5	34.4	21.9	28.1	3.1		100
1970–1974	12.5	44.4	8.4	33.3	1.4		100
1975–1979	9.3	41.4	19.5	27.6	1.1	1.1	100
1980–1984	20.3	29.7	12.5	29.7	7.8		100
1985–1989	23.6	21.1	13.2	36.8	5.3		100
1990–1994	20.9	34.9	9.3	32.6	2.3		100
Unknown	16.7	33.3		50.0			100
Total	14.8	35.2	14.5	32.3	3.0	0.2	100

TABLE 3.—Sexual composition of each age-group in the nonarchaeological sample, presented as percent of total cases (N/A = not available; age categories are defined in "Material and Methods").

Age at death	Male	Female	N/A	Undetermined	Total
Fetal	50.0			50.0	100
Infant	50.0			50.0	100
Child	25.7	40.0		34.3	100
Adolescent	26.1	65.2	4.3	4.3	100
Young adult	56.0	40.7		3.3	100
Middle-aged	74.5	22.8		2.8	100
Elderly	78.3	17.4		4.3	100
N/A	20.0	20.0	60.0		100
Undetermined	36.8	21.1		42.1	100
Total	58.1	32.5	1.0	8.4	100

of cases for which undetermined ancestry was assigned, the cranium was not available for analysis. In addition, ancestry was routinely undetermined for many fetal, infant, and children's remains.

When comparing ancestral composition with sexual composition of the sample, the percentage of males and females within a particular group remained rather consistent. Black remains were shown to be 59.5% male and 37.8% female. White remains were 61.4% male and 36.4% female. The other categories showed similar distributions.

Patterns in the age composition of the sample were also found. The age-groups represented most often (with sexes combined) were young adults and the middle-aged, which ac-

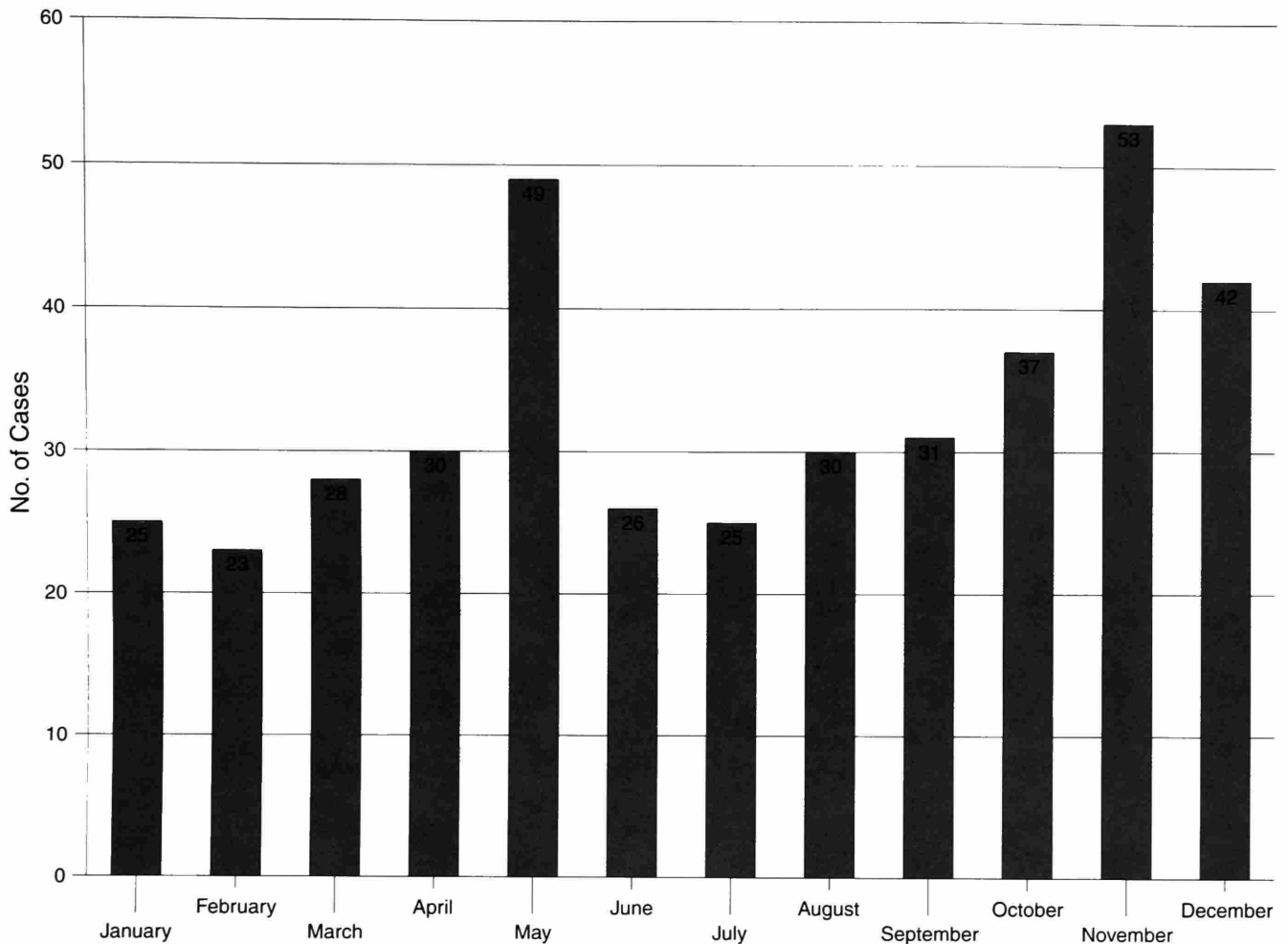


FIGURE 3.—Distribution of human remains by month of discovery.

counted for 36.9% and 35.7% of the sample, respectively. Children constituted 8.6%, adolescents and the elderly were each 5.7%, infants were 1%, and fetal remains were 0.5% (data not shown).

When the sexual determination was compared with age at death, notable differences were found in two separate assessments. In the first comparison, sexual composition of each age-group was assessed (Table 3). In a second comparison, assessment of age at death for each sex category, most males were middle-aged (45.8% of total males) and most females were young adults (46.2% of total females; data not shown).

TAPHONOMY.—It is important to consider the distinction between recovery and submission when interpreting the percentage of remains exhibiting taphonomic alterations. Often, the records did not clarify the extent to which the remains submitted represented those recovered. Many cases were sent for analysis of alterations occurring on one bone, and it is likely that a greater portion of the remains were indeed recovered but

not submitted. In addition, case records indicated that those cases submitted solely for purposes of facial reproduction or superimposition were not sent in their entirety.

The remains in all cases reviewed for this study were assigned a percentage based on the amount of skeletal material sent for analysis. The largest number of cases (28.1% of the nonarchaeological sample) examined involved submission of only 10% of the entire skeleton. As noted previously, there are a number of ways in which this percentage could be obtained, including the cranium and mandible cumulatively representing 10%. Submission of only the cranium and mandible, however, occurred in 9.6% of the cases—a much lower percentage than might have been expected.

The second most frequently occurring category of submitted remains was that of 5% of the skeleton present, representing 11.1% of the sample. The skeleton was 95% present in 9.4% of the caseload. Interestingly, 100% complete skeletons constituted only 2.7% of the sample.

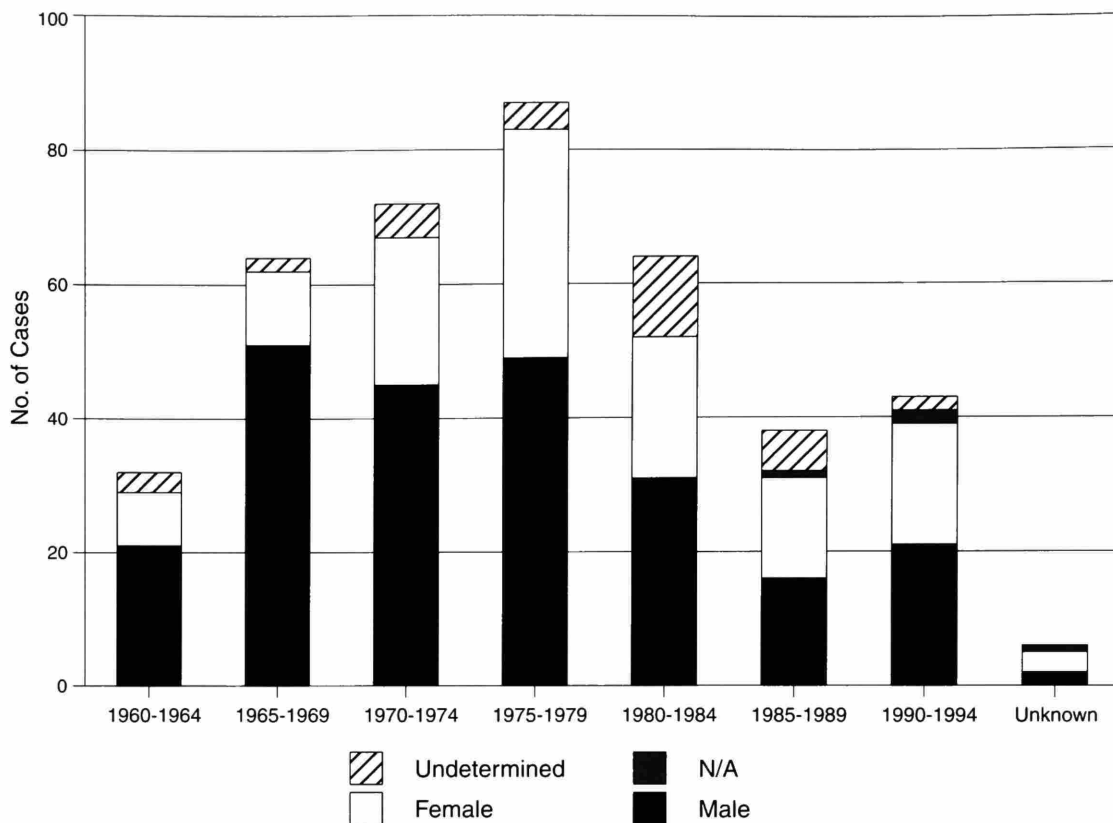


FIGURE 4.—Changes in sexual composition of FBI cases over time (N/A = data not available).

Information about the context from which the remains were recovered was not available in the files for 30.8% of cases (Figure 5). When the context was noted in the record, those categorized as exposed or buried outdoors occurred most often (23.9% of cases). Remains that were retrieved from water or associated with water constituted 15.8% of the sample, as did those classified as exposed outdoors.

The extent of alterations on the remains due to animal activity also was recorded for each case. In 57.9% of cases this information was not available. Severe animal-activity-related alteration was noted in 14.3% of cases, moderate alteration in 10.3%, and minimal alteration in 7.4%. Cases that lacked any such alterations represented 10.1% of the overall sample. As might have been expected, the majority of animal-related alterations occurred on remains that had been either exposed or buried outdoors where there was an increased probability that animals would have access to the remains. These results may not be representative of the sample, however, due to the large number of cases for which such information was not available.

POSTMORTEM INTERVAL.—The most common estimated postmortem interval (PMI) was the category of less than 10 years, which accounted for 31% of the sample. Second in occurrence was months, observed in 28.3% of cases. Those cases estimated to be greater than 10 years postmortem constituted

15.3%, whereas the PMI categories of days and weeks accounted for only 6.9% cumulatively. This low representation of days and weeks was to be expected because the sample was primarily a skeletal one and not likely to represent cases with a recent PMI.

As expected in examining stage of decomposition, the greatest number of cases were described as skeletonized (41.1%). The second largest representation occurred with those cases that comprised desiccated tissue or mummified tissue (18.2%). Adipocere or decomposed tissue represented 11.3% of the sample; decomposing soft tissue occurred in 8.1%; burned or charred represented 6.7%; and fragmentary occurred in 1.5%. The assignment of fresh or preserved accounted for 3.4% of the sample; cases in this category often represented remains that had been found in a container of preservative and sent for analysis. It should also be noted, however, that often cases labeled as fresh by the anthropologist represented primarily bone tissue. In addition, cases in which skeletal portions were removed at autopsy from fresh remains were recorded as fresh.

TRAUMA.—The largest percentage of FBI cases analyzed at the Smithsonian lacked any evident trauma (40.7%). The most common type of skeletal trauma was high-velocity trauma, or gunshot wounds (10.6%). Fractures were documented in 7.7% of the overall sample. Less frequently noted types of trauma

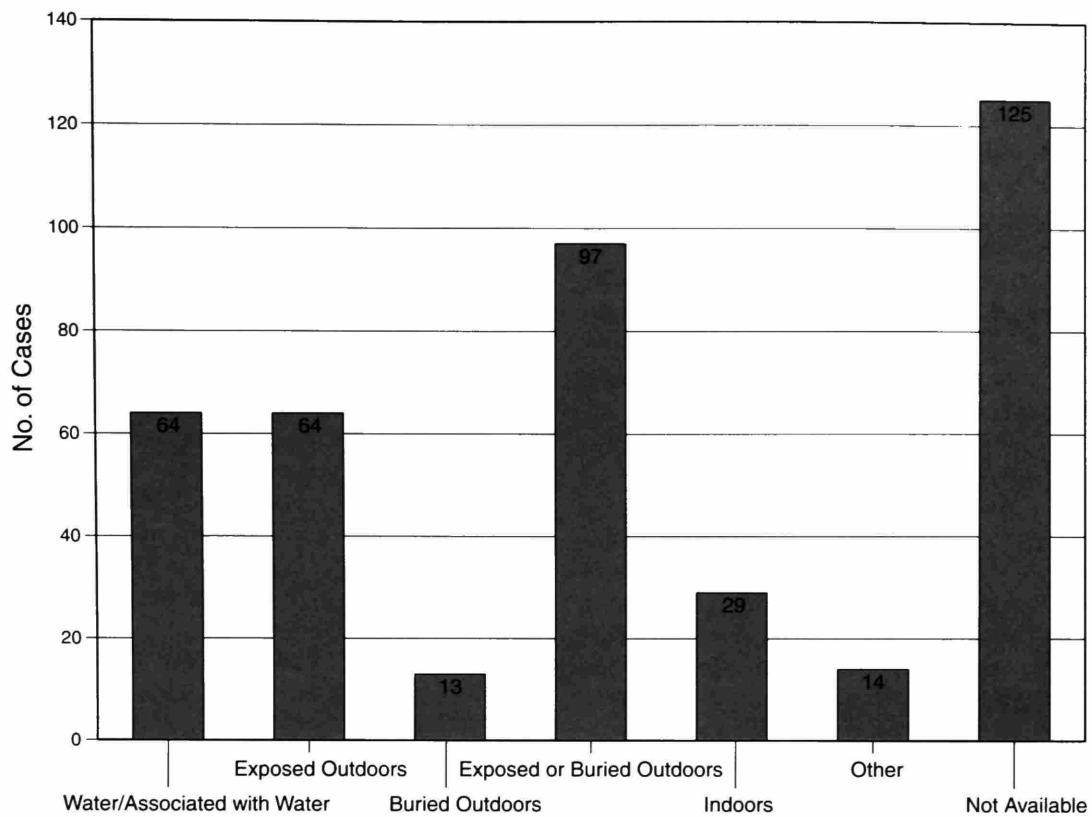


FIGURE 5.—Distribution by recovery context of FBI cases submitted to the Smithsonian Institution.

were trauma associated with fire (4.9%), sharp-force (6.9%), blunt-force (3.4%), multiple trauma (2.7%), and other (2.2%). In 20.9% of cases no information concerning trauma was available in the records.

Head and neck injuries accounted for 57.1% of all documented trauma, although this represented only 16.7% of the overall sample. Among all other cases in which evidence of trauma was documented, 16.9% displayed such evidence on multiple areas of the body, 16.0% had trauma on the axial portion, and 10% exhibited trauma on the appendicular region.

When we assessed which areas of the body were affected by each type of trauma, the strongest association occurred with high-velocity trauma about the head and neck. In addition, blunt-force trauma most frequently occurred in the same area. When we assessed which types of trauma affected each area of the body, the axial portion of remains was found to be most susceptible to high-velocity trauma, and sharp-force and fracturing were next likely to occur on this area.

ARCHAEOLOGICAL CASES

There were 65 archaeological cases, totaling 89 individuals submitted to the Smithsonian during the interval studied. Ar-

chaeological cases consisted of those judged to be of sufficient antiquity that they were no longer of medicolegal concern.

The sexual composition of the archaeological sample was similar to that of the nonarchaeological, forensic sample. Males constituted 47.2%, females represented 33.7%, and sex was undetermined in 19.1% of the sample. Although males accounted for approximately 11% less of the archaeological remains than the forensic ones, sex was undetermined in approximately 11% more archaeological remains than forensic ones.

Native American (termed American Indian in the records) was the most frequently stated ancestry in the archaeological sample, representing 38.2% of these remains. Black was assigned in 12.4% of the sample, White in 7.9%, and Plains Indian in 6.7%. The term "Indian," assumed to refer to Native American, was assigned in 7.9%. Ancestry was not determined for the remaining 26.9% of the sample.

As with sexual composition, age composition in the archaeological sample was similar to that in the forensic sample. Middle-aged was assigned to a slightly higher percentage of remains than young adult (34.8% and 33.7%, respectively). Children constituted 14.6% of the archaeological sample, a substantially greater percentage than in the forensic cases (8.6%). Elderly was assigned to 5.6% of remains, and infant and adolescent were each 2.3% of the sample.

Regarding trauma noted in archaeological remains, most of the sample lacked documented trauma (95.5%). In fact, the only types of trauma noted in these remains were high-velocity in 1.1% of the sample and cranial perforation in 3.4%.

Although the focus of this study has been primarily on the more recent forensic cases, similarities between the recent and archaeological cases can be noted. Additionally, the fact that forensic anthropologists are so frequently called upon for archaeological analysis is notable. Of the entire caseload reviewed for this study, 17.8% of remains were archaeological. This illustrates the importance of forensic anthropologists having training and experience in the study of archaeologically recovered remains.

Discussion

NONARCHAEOLOGICAL CASES

Overall, the variation in number and type of forensic cases sent to the Smithsonian by the FBI presents interesting patterns. The observed variation in number of cases presented for analysis throughout the 32-year period can be explained in relation to the growth of the discipline. The 1970s witnessed a substantial increase in the FBI-Smithsonian caseload (Table 1), which coincided with the formation of the Physical Anthropology Section of the American Academy of Forensic Sciences. With the addition of this section, the number of publications increased as did communication among forensic anthropologists. The increased visibility of forensic anthropology within the disciplines of forensic science and law enforcement could account for the peak in the submission of cases to the Smithsonian.

The decline in the Smithsonian's caseload in the mid-1980s could be explained by the growing number of anthropologists being consulted nationally (Ubelaker, 1990). As the number of forensic anthropologists increased, their local forensic involvement would certainly have increased as well. With more anthropological analyses performed at local levels, law enforcement groups would not need to consult a national agency to the extent seen previously.

From the early 1990s to 1994 (the last year for which data were analyzed) a rise in caseload occurred again. Perhaps this increase was due to media attention, especially television, given to the forensic sciences in recent years. Other factors may have included financial resources and/or crime rates.

Regarding the regional distribution of the caseload, one must note the size of the regions with highest representation. The western and southern regions constitute the largest geographical areas; therefore, these regions could consistently maintain the highest caseloads submitted to the Smithsonian. These distributions did not change substantially throughout the period under study (Table 2).

There was a much greater probability for remains to be discovered during November or May, with December and October

being the next most likely months, respectively (Figure 3). These results were not unexpected because skeletal remains are often found in the spring or fall due to the increase in outdoor activities at these times. The rise in discoveries in the later months of the year is almost certainly due to hunting seasons. This would account for the large percentage of cases discovered by outdoor recreationists.

Although the sexual composition of the Smithsonian's sample changed with time, a study of forensic anthropology cases reported at the University of Tennessee did not reveal a temporal increase in the number of females; in fact, the male-dominant disparity between the sexes has increased since the 1980s (Marks, 1995). Similarly, United States crime statistics displayed nearly a 3:1 ratio of male homicide victims to female victims during the years under review in this study. For example, in 1970, males constituted 78.3% and females 21.7% of national homicide victims. In 1980, males accounted for 77.3% and females 22.7%. Similarly, in 1990, males represented 78.0% and females 21.9% (United States Federal Bureau of Investigation, 1970, 1980, 1990).

The demographic findings of age at death for each sex are consistent with both the national crime statistics (United States Federal Bureau of Investigation, 1970, 1980, 1990) as well as those of the University of Tennessee forensic anthropology sample (Marks, 1995). Despite these findings, however, this study suggests that disparity in sexual composition in anthropological cases at the Smithsonian is changing, which is not consistent with United States crime statistics (United States Federal Bureau of Investigation, 1970, 1980, 1990). One explanation for this disparity could be the nature of the anthropological cases. In general, those remains analyzed by an anthropologist have been recovered from remote areas, perhaps reflecting either criminal attempts to conceal the body or non-homicidal deaths in locations not conducive to immediate discovery. In our opinion, however, no attempt at concealment is made for the majority of homicides in the United States, and remains are recovered soon after death; thus it is difficult to make valid comparisons between the two sets of data.

The ancestral composition of the nonarchaeological sample also is inconsistent with national crime statistics. It must be emphasized that a sizable percentage of undetermined ancestry was recorded, but it is not clear why the large disparity exists between the sample reported on here and the national data.

Taphonomy and postmortem interval are closely related. We would expect that the longer any remains are in an outdoor environment, the more likely they are to have evidence of animal activity and the more likely that stage of decomposition would be advanced.

Interestingly, the data do not support a strong relationship between the estimated PMI and the percentage of remains represented; as stated previously, however, the percentage of remains sent for analysis was not necessarily indicative of percentage of remains recovered. Although not supported with the present data, logically PMI should affect bone representation.

Analysis is complicated by the difficulty in establishing PMI and the lack of controlled, comparative studies (Kerley, 1978).

The results also indicated that certain age-groups were more likely to be associated with trauma. The young-adult and middle-aged categories accounted for the majority of trauma. Young adults accounted for 46.5% of all high-velocity trauma and 46.7% of all sharp-force trauma. Middle-aged individuals accounted for 42.9% of all blunt-force trauma and 32.6% of all high-velocity trauma. The fetal and infant categories were the least likely to present evidence of trauma.

A large portion of the overall sample contained no documented trauma. These cases may represent individuals whose death did not involve foul play; but even in cases involving foul play, evidence is not always apparent on the skeleton. Also, many cases forwarded for anthropological analysis had been initially examined by forensic pathologists or other specialists who likely would have detected major skeletal evidence of foul play. Such a specialist might have screened such evidence and forwarded only those cases for which evidence of foul play was not documented.

PROBLEMS OF IDENTIFICATION

Positive identifications can be obtained in a number of ways. When the integrity of soft tissue has been preserved, the usual means of identification involves visual identification or fingerprinting. Once the soft tissue has decomposed or has lost its diagnostic value to the pathologist, the means of identification becomes more complex. Dental comparison is the easiest means of identification of such cases if comparative antemortem records are available. This frequently occurs when a putative identification requires verification.

The anthropologist's expertise is generally used to ascertain a profile of the deceased to narrow the search of missing persons. The anthropologist provides law enforcement personnel with a profile of the age, ancestry, sex, and stature of the individual, along with any other useful information available. This information is then compared with missing persons records to find a possible match. Once a possible match is obtained, records are retrieved on that individual to determine if identification can be positively established. If dental records are not available, the anthropologist may be asked to compare postmortem and antemortem radiographs to establish if identification can be made. This can include a frontal sinus comparison or the comparison of other unique skeletal features.

When these forms of identification cannot be obtained, techniques of computerized photographic superimposition or facial reproduction (Ubelaker et al., 1992; Ubelaker and O'Donnell, 1992) are often employed. Facial reproduction is used as a last effort in the hopes of producing material that can be used for positive identification. In the sample under review, the use of these techniques was found in only 8% of the cases. Their use, however, has increased with time.

In this study, a number of issues relate to statistics on positive identification. After analyzing the sample, it was clear that the number of cases for which a positive identification was indicated was not representative of the true value. When local anthropologists aid in the identification process, they are often informed of the results of their analysis. These anthropologists generally have a working relationship with the local law enforcement officials and are kept abreast of the case after its removal from the laboratory. Because the cases submitted to the Smithsonian came from the FBI and not directly from local law enforcement offices, anthropologists at the Smithsonian were unlikely to receive subsequent communication from regional law enforcement personnel. In discussing his work for the FBI, T.D. Stewart stated, "Although I have repeatedly asked the FBI for follow-up information and they routinely request it from the agencies they serve, it seldom gets back to me" (Stewart, 1948:319). Smithsonian anthropologists were usually informed if remains had been identified before their submission and were aware of those cases in which they had established positive identification. They were less aware of whether remains were identified after their analyses or even whether their work played an important role in the identification.

Conclusion

The Smithsonian Institution has received a wide variety of cases submitted by the FBI from 1962 to 1994 that have encompassed all demographic ranges and have exhibited varied forms, including antemortem, perimortem, and postmortem trauma. Furthermore, Smithsonian anthropologists have provided many forensic services throughout this period, including demographic profiling, assessment of trauma, and attempts at obtaining a positive identification. These are but a few of the requests made of the agency.

The data indicate that the Smithsonian's caseload has changed over the years. Peaks in the 1970s and 1990s have thus far been explained as a reflection of the profession as a whole, with increased local forensic activity leading to a decrease in the Smithsonian's activity. These trends also have been shaped by Smithsonian policy. For many years, Ubelaker has encouraged local law enforcement officials that contacted him directly to consider using local expertise, especially ABFA diplomates available in the area. When Ubelaker has agreed to become involved, he has encouraged law enforcement agencies to submit their cases through the FBI to facilitate his examination.

The regional origin of case submissions was commonly in the largest geographic areas, the South and West. Dates of recovery favored the months of May or November—times of increased human activity in rural areas and greater visibility than summer months; much of this activity involved game hunting and other outdoor recreation.

The demographic composition of this sample was shown to be dissimilar to that of national crime statistics. Whereas

nationally there was extreme disparity between males and females, the present study showed a lessening of this gap during the time period under review. No clear explanation exists for this difference in sexual composition between the Smithsonian's nonarchaeological sample and the national statistics. One possible explanation, however, is that the sample under review is not representative of all homicides in the United States. For example, the Smithsonian sample contains greater numbers of individuals whose remains were found in isolated areas. Such remains present a different profile from homicides in which the victim was found near the time of death. In addition, the number of cases assigned as undetermined may account for the sexual and ancestry disparity between the samples. Age composition, however, was similar to national crime statistics.

Regarding the percentage of remains sent for analysis, the entire skeleton was very rarely involved. This does not necessarily indicate that the whole body was not recovered. Often the anthropologist was called upon to assess remains for traumatic findings or other specific attributes when only a small portion was sent for analysis.

In the evaluation of taphonomic factors involved in the cases, evidence of animal activity occurred most often on remains found either exposed or buried outdoors. The majority of cases, however, did not have information available on animal activity. This illustrates the need for more complete record keeping to properly assess taphonomic factors, as well as other issues examined herein. The stages of decomposition and estimated postmortem intervals were consistent with what would be expected from primarily skeletonized remains.

Analysis also revealed temporal change in the manner of report writing and stylistic differences between the scientists involved. Although these differences do not necessarily indicate changes in the information obtained through anthropological analysis, they do reflect the extent of documentation and nature of concluding opinions. The early records frequently remarked on bony indications of occupational stress and handedness, a factor not often discussed in more recent reports. Occupational stress is often stated in anthropological analysis with suggestions of the deceased being a laborer, for example; however, the early reports related much more specific occupational indi-

cators. In one case, the report suggested that the remains may have belonged to a horseback or motorcycle rider due to the "huge PECUNIAL crests of the pubic bone for resisting intra-abdominal pressure." The early reports often remarked on handedness, in one case stating "depressed left occiput, thick left humerus and general bone development" as indications of left handedness (case files at the Smithsonian's National Anthropological Archives of the Department of Anthropology).

The earlier reports were also more speculative regarding trauma. In a 1966 case, the report noted "projectile or horn" trauma to the upper thorax, stating: "If this had come from a medieval cemetery, I would assume a lance thrust." In addition, it called attention to the relationship between trauma and pink teeth. Pink teeth were described as an indication of violence, evidence of quick and incomplete oxidation of hemoglobin, or the possibility of carbon monoxide poisoning or strangulation. The early reports also reveal Angel's remarkable eye for detail as well as his thoroughness: in his report of a 1977 case involving remains found near the water, he wrote "no obvious taste of salt."

More recent reports indicate a major shift toward standardization in anthropological analysis and an increase in documentation. These more recent reports are also less speculative and more descriptive. This temporal shift in report writing not only represents stylistic differences by the individuals involved, but also scientific developments and growing standardization of the techniques used.

The field of forensic anthropology is broadening. Efforts to increase involvement of anthropological expertise on the local level and the growing availability of that expertise are leading to changes in the types of cases sent to the Smithsonian Institution for analysis. Increasingly, remains are sent with special requests for computerized superimposition, facial reproduction, or trauma analysis. In addition, fragmentary cases are more often sent, reflecting recognition of the increased potential for identification of such cases through molecular analysis.

Currently, the FBI-Smithsonian collaboration in addressing forensic issues remains intact. Although this relationship remains stable, the nature of the cases examined continues to evolve, along with the field of forensic anthropology itself.

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