PART VI Forensic Taphonomy

Introduction to Part VI

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Forensic taphonomy was identified by Dirkmaat et al. (2008) as a key development in the field of forensic anthropology in the last 15 years. In this section of the book, the history of the field and its significant impact on forensic anthropology is explored further. Here some of the basic concepts of the field are outlined. Beary and Lyman in Chapter 25 provide an excellent, in-depth discussion of the development and unique role of taphonomy in forensic contexts, as well as general principles of forensic taphonomy and recent developments in forensic taphonomic research and methods.

Paleontologists were the first to analyze skeletal assemblages carefully and attempt to address issues of missing bone elements, congregations of skeletal deposits, surface damaged bones, and other issues. These original efforts later led to attempts to go beyond the bones and reconstruct populations as a whole, individual behaviors, habitat occupation, and ecological distribution, among other issues. Early pioneers in the field embraced the title *taphonomy* (from the Greek *taphos*, meaning burial), as originally presented by Ivan Efremov, a Soviet paleontologist, and also a science fiction author, in the early 1940s (Efremov 1940; Chudinov and Sokolov 1987). Defined as the study of what becomes of an organism after burial, it focused on the conversion of bone to fossil, dealt with preservation issues, and represented a great leap forward in geological and paleontological research. These general concepts spilled over into human paleontology (paleoanthropology) in the 1970s with the work of Brain, Behrensmeyer, and others, dealing primarily with early African hominin sites. Paleontology mostly was used to argue for or against the existence of an osteodontokeratic culture of hominin tool assemblages (Shipman and Phillips-Conroy

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1977) and for examining bone weathering to "give specific information concerning surface exposure of bone prior to burial and the time periods over which bones accumulated" (Behrensmeyer 1978: 161).

At the onset, forensic anthropology was a discipline almost solely concerned with providing accurate reconstructions of biological profiles of individuals represented by skeletal remains found in forensic settings. The purpose was to provide identifications of the deceased. If requested to address issues of bone surface modification (exfoliation, gnawing, burning, staining, root-etching, and sun-bleaching), broken and fractured bones, missing elements, scattered elements, and a wide range of other topics, the forensic anthropologist generally looked to research conducted in other disciplines including fossil hominid taphonomy, paleopathology, and bioarchaeology. The key component linking the subdisciplines was that context was carefully noted in all cases through archaeological recovery methods. Given that limited or no notation of the original context (aside from a few pictures provided by law enforcement) was usually associated with the bones in forensic cases, determinations of time since death and specific reasons for scattered, missing, and damaged bones was left to "educated guesses," based on "years-of-experience" justifications.

In the 1980s a small core of forensic anthropologists, most of whom were trained in archaeological sciences, recognized that this gap in producing a scientific product was similar to the state of the discipline of paleontology in the 1940s, and paleoanthropology in the 1970s; that is, trying to address questions regarding the whys, whens, and hows of the patterns of skeletal remnants of individuals without contextual grounding. The forensic anthropologists saw very analogous situations and attempted to address similar questions by turning to a taphonomic perspective and roughly constructed a subdiscipline that was simply termed *forensic taphonomy*.

The succinct definition of forensic taphonomy provided by Haglund and Sorg (1997) serves well: "the study of postmortem processes which affect (1) the preservation, observation, or recovery of dead organisms, (2) the reconstruction of their biology or ecology, or (3) the reconstruction of the circumstances of their death" (1997: 13). Forensic taphonomy can then be understood as a backward process attempting to use other previous actualistic research and case studies to inform us about the causes of modification noted on the remains. However, forensic taphonomy embraces the central principles of taphonomy with minor modifications, that account for important observations in a forensic setting. Paleontological taphonomy focuses on what happens to the remains after burial and most of the discussion is related to how bones fare in the process of being buried, and, ultimately, conversion to mineral matrices. Forensic taphonomy focuses on what happens to the body immediately after death until recovery. This includes the study of the patterns and rates of soft-tissue decomposition including factors played by insect activity, bacteria, etc., the effects of animals on the remains in terms of scattering, damaging, and removing elements, the effects of plants on the remains, and even the effects of soil conditions, plant cover, shade factors, and temperature regimes. Forensic cases involving the recently deceased provide the best laboratory to study these changes and not paleontology.

In addition, it should be noted that recovery refers not only to the excavation of the remains but also to postrecovery transport, autopsy examination, and any other forensic examination up until the remains arrive in the forensic anthropology laboratory. Thus any modifications of the remains during the recovery and transport to the laboratory should be considered as taphonomic events, as should any modifications occurring during laboratory analyses, such as processing, reconstructing, and labeling of the remains. Forensic taphonomy thus incorporates *all* modifications to the remains after death.

Today we can recognize two primary foci of taphonomic reconstructions as they relate to human decedents associated with suspicious deaths: (i) providing a scientifically based determination of time since death and (ii) determining whether there is postdeath human altering of the remains at the scene.

Time-since-death estimates require a very strong multidisciplinary effort. Forensic entomology and the study of the insect-fauna associated with the decomposing remains often provide the best determination of a postmortem interval, in terms of precision and accuracy, when dealing with advanced stages of decomposition. Forensic botany comes into play when dealing with tree shade issues, understory conditions, plant recovery, root growth, decay rates of plants found buried in association with the remains, and soil composition and pH levels, as they all influence bone quality via diagenesis and temperature regimes. The concept of degree-days (more thoroughly discussed in Megyesi et al. 2005) is useful in providing more accurate estimates of a postmortem interval as they impact the life cycles of insects attracted to the mini ecosystem of a decomposing body as well as general soft-tissue decomposition. Geographic information systems (GIS) are also beginning to be used in forensic recovery in a multitude of ways, not just for providing maps of the scene, but also for generating models for body deposition (Manhein et al. 2006). The potential utility of GIS in forensic applications is just beginning, with the ability to incorporate detailed information on scene setting into the taphonomic analysis. GIS applications can provide data on tree cover, roads, water sources, topographic information, and a wide range of additional useful information, thus increasing the ability to understand taphonomic factors which may be affecting the remains. Finally, it is useful to include information on the fauna in the area, especially relative to carnivores, scavengers, rodents, and any taphonomic agents whose activities might have an impact on the body.

Issues related to postdepositional movement and the condition of the remains are included in taphonomic analyses in an effort to determine (i) why skeletal remains are not in their original anatomical position, and who or what is responsible, and (ii) whether modifications of the remains are due to trauma or taphonomic damage, and when this modification to the remains occurred (i.e., during the perimortem or postmortem interval). Here the ultimate goal is, through a process of elimination, to determine the role of humans or other agents in moving/removing portions of the remains and otherwise modifying the condition of the remains at the time of original deposition. In a sense, forensic taphonomists are asking the question: What occurred between the original deposition and recovery to create the current condition and arrangement of the remains?

After decomposition begins, remains may be displaced from their original anatomical position through a number of disruptive factors including movement by creatures (large scale) or movement by other natural agents (small scale) such as soil bioturbation, soil cryoturbation, plant root envelopment, worm activity, and diagenesis. Nonhuman modification of the remains results from carnivore, rodent, vulture and other scavenger interaction that may leave diagnostic marks on the bones (Haglund 1997a, 1997b). When confronted with isolated skeletal elements or partial sets of remains, determining possible causes for differential recovery of remains begins with macroscopic and microscopic (though only via limited magnification) examination of bone surfaces. Carnivore chewing, rodent gnawing, or evidence of dismemberment through saw or knife cuts, provide the most diagnostic features.

Scattered human remains are also common and interpretations are best approached following a proper archaeological recovery through the examination of landscape topography and environmental conditions (e.g., fluvial activity). The best way to document the context of remains at a scene during recovery is through archaeological methodology, description, and analysis; generating a *detailed map* with supplementary photographs and notes works well (Chapter 2, this volume). Contextual evidence is lost if archaeological recovery is not followed, which results in incomplete collection of the information necessary for an accurate taphonomic reconstruction and skeletal analysis.

The final goal of forensic taphonomic analysis is to identify all taphonomic agents potentially impinging upon the human remains in order to focus on those related to human intervention, which establishes forensic significance. Only after postmortem factors are explained can the perimortem events be reconstructed.

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