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Evaluation of Taphonomic Changes to Bone

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Abstract:

Analysis of taphonomic change to human skeletal remains helps forensic anthropologists to estimate the time since death and evaluate whether the discovery location was the actual crime scene. This study examines taphonomic changes in bone staining, abrasions, completeness, and aquatic life activity observed within forensic anthropology. When analyzing taphonomic effects, it is often necessary to interpret several overlapping changes. Individual taphonomic effects can be separated from each other and follow the rules of relative timing, allowing earlier or later effects to be determined. The rules are similar to those used in archaeological and geological stratigraphy, from which the basic concepts of superposition and other physical relationships arise. Taphonomic effects can result from a number of processes associated with early stages (death, decomposition, and removal of fresh remains) or later stages (staining of bone surfaces, bone decay, and leaching of dry remains). The relative ordering of taphonomic effects on a set of remains can be used to reconstruct their post-mortem history and distinguish human activity, including trauma, from scavengers and other biological factors.

Keywords: *Forensic anthropology, skeletal remains, taphonomic effects, bone staining, biological factors, etc.*

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Introduction

The study of taphonomic focuses on events that occur to any creature between the moment of its demise and its discovery **(Lyman and Lyman, 1994)**. Environmental, floral, and faunal phenomena as well as human intervention are examples of taphonomic factors. After death, taphonomic processes can change bone's appearance to the point where forensic investigators might not be able to spot evidence of criminal activity. For instance, the surface remains in fields with tall crops may accidentally be run over by farm equipment, resulting in crushing and sharp force trauma that could conceal previously present intentionally inflicted wounds. An identification during forensic investigations requires the accurate estimation of the time since death, the avoidance of injuries related to the death event (high-velocity gunshot, sharp force, or blunt force traumata), and the accurate assessment of in-life bone and dental changes. These factors can all be prevented by properly identifying after-death alterations to human remains **(Chen, *et al.*, 2011)**.

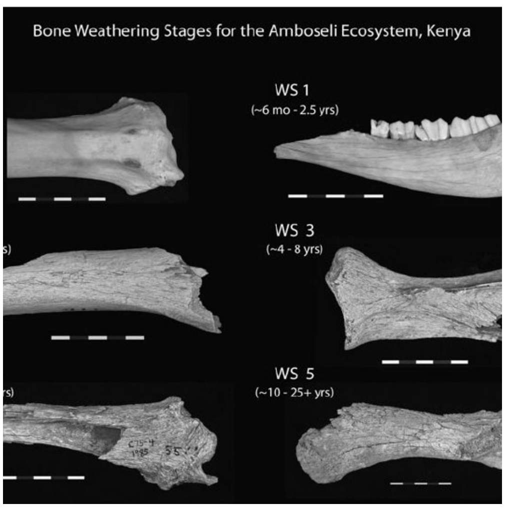

Figure No. 1 - 3 Bones showing the progressive weathering stages

One of the most significant ethnographic organic materials is bone, which man used for a variety of functions in daily life, including practical as well as technological, and aesthetic ones. Inorganic calcium hydroxyapatite makes up the first of two components that make up bone **(Angel, 2007)**, which makes up about 90% of its chemical makeup **(O'Connor *et al.*, 1984)**, and the organic portion, collagen, which makes up about 10% of its chemical makeup and is the principal building block of bone protein in the area where it is generated. The amino acids that make up collagen are arranged in interlocking chains **(Veis and Sabsay, 1987)**. Bone mineral or calcium hydroxyapatite (Ca10 (PO4)6 (OH) 2) is the inorganic component of human and animal bone **(Angel, 2007)**. Additionally, bone elements can be divided into two broad categories, which are macro elements (Ca, K, Mg, Na, O, and P) and microelements (C, Cu, Fe, Mg, Mn, Na, Se, Si, and Zn); the division of these two categories are based on concentrations in the skeletal parts **(Mkukuma *et al.*, 2004)**, Other elements commonly found in bones include Cl, Ni, and Sr, which can be categorized also as microelements **(Calonius and Visapää, 1965)**. Although the inorganic mineral content (ca. 65%), the water content (ca. 10%), and the organic content (ca. 30%) of bone has been observed to vary among vertebrate skeletons, the elemental classifications are valid **(Martin, 1999; Clarke, 2008; Feng, 2009)**.

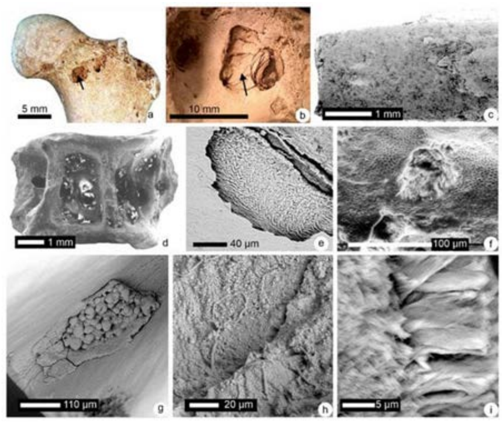

Figure No. 2 - Vertebrate Taphonomy and Diagenesis: Implications of Structural and Compositional Alterations of Phosphate Biominerals

Most archaeological sites are not free of archaeological remains, whether they are human or animal, and many studies depend on their good preservation because the environments in which the remains are located vary and different environments show signs of damage to the remains. In the case of bone damage, the damaging factors vary from humidity, heat, and circumstances. The burial, as well as the burial environment itself, the conditions of its oxidation and reduction, and the materials and components it contains because of the various processes of bone damage **(Child, 1995; Angel, 2007)** metabolic disorders: limitations to growth of and mineral deposition into the broiler skeleton after hatch and potential implications for leg problems. Density is generally considered to be one of the most significant variables affecting post-depositional bone survival **(Lyman and Lyman 1994; Blau, 2016)**. Numerous studies have explored bone density, with techniques including photon and X-ray densitometry **(Lyman, 1984; Bigi, *et al.*, 1992)** and water displacement **(Behrensmeyer, 1975; Binford and Bertram, 1977).**

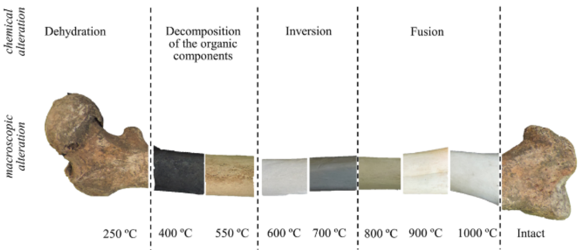

Figure No. 3 - Heat-induced Bone Diagenesis Probed by Vibrational Spectroscopy

Conclusion

Temperature, humidity levels, and other environmental conditions change the rate of decomposition and affect the nature of post-mortem changes. The results of this study show the importance of studying and documenting taphonomic changes at the environmental level and across seasons. Although many of the findings of this study are consistent with the published literature, there were clear differences in the timing and effects of taphonomic changes such as cracking and desiccation.

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