H48 Estimating the Postmortem Interval from the Pattern of Staining on Skeletal Remains

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After attending this presentation, attendees will understand the value of bone staining in estimating time-since-death from skeletal remains, the necessary procedures for the successful application of this method, and the types of predictions that can be made regarding soil and environmental characteristics, soft tissue concentration, and time-since-death.

This presentation will impact the forensic science community by providing a new method for identifying the causal factors that affect bone staining to provide an estimate of time-since-death in medicolegal death investigations.

Taphonomic analyzes have become fundamental aspects in forensic anthropological investigations, especially with reference to the estimation of time-since-death for medicolegal and identification purposes. This study examines the causes and sequence of one such taphonomic process, bone staining. While staining has been reported in the literature (Calce and Rogers; Huculak and Rogers; Jaggers and Rogers; Sauer), detailed quantitative data on its causes and sequence are limited.[1-4] Therefore, the patterning, timing, and properties of bone stains were analyzed to determine if estimates of the postmortem interval could be accomplished. The appearance and progression of bone staining were examined utilizing 45 fleshed and defleshed juvenile pig long bones that were placed in a burial context at the Forensic Anthropology Research Facility at Texas State University-San Marcos. Half of the sample retained a large amount of tissue (fleshed group), while the other half was processed to remove as much tissue as possible (defleshed group). The remains were buried and then collected at one-week intervals over a period of four months and extensively photographed. Soil samples were also taken at deposition and collection times and analyzed for changes in pH, nitrogen, phosphorous, and potassium levels across these two time points. Additionally, ambient temperature, humidity, and soil temperature were included to account for any influence of environmental factors on the staining process. A Miniscan XE Plus© color scanner from Hunter Laboratories was utilized to quantitatively and objectively measure the color of the stains present on the bones.

It was determined that staining occurred as early as two weeks post-deposition. Statistical analysis of the data revealed that differences existed between the fleshed and defleshed remains in soil chemistry, color, and environmental variables. Specifically, pH and nitrogen levels increased only in the fleshed group due to decomposition and the chemical byproducts associated with that process (Carter and Tibbett 2008; Hopkins, Wiltshire and Turner 2000; Rodriguez and Bass 1985) and not the soil environment.[5-7] The color analyses demonstrated that the fleshed remains exhibited darker, redder, and yellower coloration than those in the defleshed group. In the defleshed group, the surrounding environment, including the soil, ambient temperature, and humidity levels were responsible for the coloration seen on those remains. The correlational data between color and the environmental variables indicated that temperature (both soil and ambient) and humidity levels had more of an influence on the defleshed remains than on the fleshed ones. It is hypothesized that the lack of copious amounts of tissue allowed the soil to interact more directly with these bone compared to the fleshed remains, where decomposition was the primary staining agent.

This study demonstrated that an understanding of the process of bone staining and the agents responsible for its occurrence is critical for establishing a depositional and chronological sequence. Even though time-since-death could not be estimated past two weeks, these results highlight the fact that taphonomic processes, such as bone staining are not limited to single causes, but result from a multitude of sources. While in its infancy, bone staining research has the potential to make important contributions to both forensic anthropology and other medicolegal professions. For medical examiners, death investigators, and forensic anthropologists, awareness of the potential causes, especially decomposition, climate, and depositional context can provide some information regarding the circumstances of an individual's death. Future research may be able to expand on these results to extend time-since-death estimates from two weeks to whole seasons.

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