A78 Experimental Lacustrine Taphonomy: Decompositional Changes in Freshwater Lake-Submerged Skeletal Remains

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Learning Overview: After attending this presentation, attendees will better understand how *Ovis aries* (domestic sheep) bones will change at the macroscopic and microscopic level when submerged in freshwater lakes.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating what aquatic taphonomic signifiers can be expected of freshwater submergence of cortical bone discs in the Pacific Northwest and how findings can be used to compare with other submergence contexts, ecological zones, and geographic regions.

Although submergence studies have identified changes to skeletal remains that help distinguish aquatic decompositional environments from those involving terrestrial exposure, few studies have distinguished whether freshwater contexts would result in different diagenetic changes than that of marine water. Existing literature in this area has also inconsistently reported the presence of sediment-induced abrasion, disarticulation, dissolution, encrustation, fragmentation, spatial orientation, bioerosional tunneling, mechanical weathering, fluvial erosion, and scavenging marks, which suggests that taphonomic signifiers may be bound to ecological zones. Being able to identify taphonomic signifiers associated with freshwater lakes is also of forensic interest because it may help detect postmortem secondary movement and elapsed time since entering the water. The goal of this study was to create a baseline of decompositional changes in freshwater submerged skeletal remains and to explore whether these changes can be attributed to elapsed time, seasonality, and/or specific depositional environments across a freshwater lake.

This aquatic field experiment involved deploying sectioned sub-adult *Ovis aries* (domestic sheep) femoral bone discs (n=130) across ten sites across Marion Lake, BC, Canada, to study the effects of freshwater submergence on cortical bone preservation. Control samples were secured in the Centre for Forensic Research, Simon Fraser University, Canada. Experimental specimens were recovered consecutively over a 16-month period from 2016–2017 and analyzed macroscopically for structural (artifact, abrasion, cracking, bioerosion) and color change using a Zeiss Stemi macroscope. Atmospheric, lake surface, and core temperature were also monitored, along with precipitation, water pH, cage movement, and elemental profiling of silt composition using Focused Ion Beam/ Scanning Electron Microscopy (FIB/SEM) and Energy Dispersive Analysis X-Ray (EDAX).

Results revealed a significant relationship between several taphonomic signifiers and the location of submergence and elapsed time of submergence. Periosteal abrasion was found to be significantly related to the length of the submergence period. This suggests that the longer the sample stayed underwater, the more abrasive wear took place due to natural hydrodynamic characteristics of a mountainous coastal lake. Where samples were placed across Marion Lake had no effect on whether cracking would occur. Instead, the length of time a sample was submerged was yet again the most important factor in determining whether cracking on both the periosteum and transverse block face would occur. It was hypothesized that cracking would follow weaker boundaries of existing lamellar alignment, but findings reveal that cracks were tracking the periosteal surface inward, as well as radiating outward from cutting cones. Darkening of bone tissue from white to brown was found, along with blue and green staining on the surface of samples. The location of the cages was linked to the appearance of periosteal abrasion and encrustation, and distinctive damage to the periosteal surface was observed. Saw marks and bone lipping in submerged samples were also obscured or obliterated over time. This loss of pre-deployment artifacts suggests that intentional human-induced disarticulation of bones might be obscured over time. None of the control samples maintained in the laboratory exhibited any of the changes observed in experimentally submerged samples. The results of this experimental study on lake-submerged bone documented taphonomic changes that take place when submerged in freshwater lakes within the Pacific Coastal Western Hemlock Zone.

Taphonomy, Forensic Anthropology, Freshwater Decomposition

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