A130 The Skeletal Histo-Taphonomy of Deep Coastal Marine Submersion and Exposure

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After attending this presentation, attendees will be aware of how pig carcasses, submersed in a cold marine water body, were affected at the microstructural level. Attendees will understand the experimental parameters and be able to recognize the specific "marine change" observed in bony microstructure.

This presentation will impact the forensic science community by explaining the effect of marine exposure to bone and illustrating how to identify associated taphonomic signatures that may be attributed as a result. This adds an important tier of new knowledge to a little-investigated area of forensic anthropology.

The microstructural preservation associated with marine exposure has been the subject of a small number of forensic studies. Work presented here represents the culmination of six deployments in a cold, deep coastal ocean body, the Salish Sea (in southwestern British Columbia and northwestern Washington), one of the world's busiest waterways. Pigs with weights between 16.3kg and 24.5kg, were freshly killed and placed in an experimental rig which deployed two pigs per deployment to the sea floor for an approximate period of six months. Lights and a High-Definition (HD) camera were turned on for a short period of time every 15 minutes per hour for the entire deployment period. Each deployment was at a different locale within the study area at differing times of the year.

Pigs proceeded to skeletonization in all cases, but this reduction did not proceed equally at each site in terms of time. Pigs were reduced within a period of days extending to months. Once recovered, pig bone was stored in seawater and transported within a 12-hour period to the laboratory where it was then washed with cold freshwater to flush out as much salt as possible, and allowed to air dry within the laboratory to stabilize. All pig bone recovered was jet black on recovery and within a 48-hour period would lose this coloration completely, becoming the white color considered normal for bone. The black color would partly be replaced by orange staining to the surface. During this time, bone was macroscopically screened using the ZEISS Stemi microscope. Bone that was untreated prior to freezing was also screened, and in no instance was there any evidence of biofilm. Washed mid-shaft femora and mid-shaft ribs, which had stabilized longer than four months, were prepared for light microscopy and three sequential transverse 80-micron sections were made for each bone using the Leica® microtome SP1600, mounted in **Digital Picture Exchange (**DPX) onto 35mm glass slides, and viewed on a ZEISS Axioscope.A1 using normal and circularly polarized light with a Light-Emitting Diode (LED) light source.

The results indicated that not all deployment environments rendered the marine tunneling observed in other studies; however, this tunneling was observed at different deployment sites and the tunneling dimensions were consistent with those observed by others as a characteristic constrained marine-change. Tunnels consistently had diameters of 5-7 microns and were peripheral to the outer cortex, were never seen on the medullary aspect, nor were they internal to the cortical osteonal systems. The observed orange staining was seen to minimally penetrate bone no deeper than 50-100 microns when present. Often this staining was associated with normal anatomical porosity and also with any postmortem tunneling present. No other microstructural change was observed in the pig bone and the bone had excellent internal preservation.

The results from this study indicate that the observed microstructural change is highly constrained in its morphology and the speed of this change occurred at some point during the six-month submersion period, most likely after soft tissue removal. Other studies have seen the penetrating depth of micro-tunneling extend more than 2mm into bone and dentine but, perhaps due to the short submersion period, such deep tunneling was never observed. Tunneling of other carbonaceous substrates has been speculated to be seasonally cyclical, with endoliths recolonizing as water conditions become favorable. Variation may also relate to rapid sedimentation where skeletal material becomes effectively covered, and this certainly happened with the experimental pigs; however, the change is not necessarily inevitable and further work is necessary to understand why this variation in tunnel depth exists with what is otherwise an important taphonomic indicator of marine submersion and exposure.

Marine, Bone, Taphonomy

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