H134 The Prodigal Child Returns: The Application of Forensic Taphonomic Analyses to Paleoanthropological Assemblages — Case Examples From the Malapa Hominin Deposit

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After attending this presentation, attendees will obtain knowledge on the application of whole-body forensic taphonomic analyses (focussing on subterranean weathering patterns, insect-bone modification, skeletal disarticulation patterns, and postmortem and post-fossilisation breakage patterns) of two exceptionally well-preserved early hominins. The data presented are used to inform forensic scientists as to the application of analyses of forensically typical, short-durational events into the deep geological past.

This presentation will impact the forensic science community by considering whether or not forensic taphonomy and anthropology can escape from the medicolegal confines of the recent past and provide new perspectives in paleoanthropology and archaeology. On the basis of recent work at Malapa, the answer has to be yes.

The co-option of taphonomy into the forensic sphere has been described by Dirkmaat and colleagues as "the most significant development [to] alter the field of forensic anthropology" in the last 20 years.[1] This paper will argue that forensic taphonomy is now well situated to return the favor by providing a framework with which to investigate the decompositional and formational histories of extremely ancient deposits. This study uses the example of recent analyses applied to a 1.98 million-year-old early hominin assemblage from Malapa, South Africa, the type site of *Australopithecus sediba*.[2]

Traditional approaches to taphonomic analyses focus on the application of uniformitarian assumptions in order to understand pattern, process, and mechanism in the past. Such studies were often established to answer or address research problems related to early hominid behaviors, such as use of fire or hunting versus scavenging niches. This early work represents a corpus of literature relating to aspects of necrology, biostratinomy, burial, and diagenesis of long-dead organisms. In contrast, the epistemological basis of forensic taphonomy is unique in that the field marks a shift in the temporal nature of taphonomic studies, away from longitudinal studies of complex time-averaged assemblages, to shorter postmortem time frames spanning days to years, with the emergence of the individual cadaver as a key unit of analysis.[3]

In the case of Malapa, two exceptionally well-preserved individuals were recovered from a 1.98 million-year-old karstic deposit in the Cradle of Humanity World Heritage Site, South Africa. MH1 is a juvenile male and MH2 an adult female. The hominins were analyzed initially using classical palaeo-taphonomic approaches, particularly with respect to the interpretation of patterns of peri-mortem breakage and burial rate. However, the later application of an explicit forensic analytical tool kit has seen a rapid re-evaluation of the history of the initial and later postmortem periods in particular. Forensic analyses focussed on macroscopic and microscopic evaluation of breakage patterns, bone surface modifying agents (matrix-based, physical, chemical, insect and invertebrate, mycological, and environmental), the interpretation of decomposition rate and environment based on skeletal part representation and spatial juxtaposition, and pattern of sedimentary loading based on postmortem and post-fossilisation damage in conjunction with fracture-plane analyses of calcified breccia. In particular, analyses of bone surface modification and breakage patterns using explicit biomechanical criteria (which are not conventionally applied in paleontological or archaeological analyses) has resulted in a parsimonious interpretation of the peri-mortem and later depositional history of the two hominin bodies; in particular, the differential pattern of weathering and surface modification between the two individuals suggests that their deposition may have been two separate events, or that micro-environmental conditions existed expressing differing patterns and possible rates of decomposition between the individuals. This study presents recent results, with the emphasis on data derived from macroscopic and microscopic analysis of surface modification and high-resolution spatial analysis of skeletal elements and their sedimentary context from micro-computed tomography and synchrotron imaging. Results indicate: (1) biomechanically-cogent patterns of peri-mortem trauma

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consistent with low-energy impact; (2) differential patterns of weathering, with MH2 ventrally-focused indicative of final disposition, and MH1 exhibiting a complex pattern of both dorsal and ventral weathering possibly indicative of aerial and sub-aerial processes; (3) widespread invertebrate modification of bone surfaces, including snail and termite damage; (4) contiguous postmortem fractures indicative of sediment-loading consistent with movement of encapsulating matrix; and, (5) spatial context of skeletal elements correlated with high-order rank disarticulation sequence, suggestive of mummification or rapid fixation within the cave system. The analysis of the Malapa assemblage is considered unique, in explicitly applying forensic taphonomic analyses to well-preserved fossilised remains in order to answer what may be considered conventional forensic questions.

References:

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