

## **Methods for Estimating a Postmortem Interval (PMI) and Taphonomic Observations**

### **1.0 Principle, Spirit and Intent**

Taphonomy focuses on understanding and documenting the various postmortem processes associated with the decomposition of a corpse as well as those processes that interact with hard tissue as bone becomes incorporated into the environment. Thus, these processes are the perimortem and postmortem forces that ultimately include the nature of the evidence. Taphonomy is the study of those processes as a corpse moves from the biosphere into the lithosphere or hydrosphere; that is, they move from a living system into a terrestrial or aquatic environment. In a more practical sense, taphonomy can be used in several different ways: establish a postmortem interval (PMI), differentiate trauma from postmortem damage, locate clandestine graves, and identify remains. This document focuses on recovery observations of PMI, which is a central task of forensic taphonomy as well as examination observations and recording of taphonomic processes. Often the effects of taphonomic processes can be observed during examination.

An accurate estimation of PMI is critical to any death investigation and is most likely to occur during the recovery phase. A corpse is subject to a continuum of complex biotic and abiotic taphonomic processes, indicating that there is no single method for estimating PMI for all conditions and environments. Therefore, best practice is a multidisciplinary approach to produce the most accurate estimation of the PMI, where forensic anthropologists can contribute to a PMI estimate anytime within this continuum.

### **2.0 Purpose and Scope**

These guidelines recommend best practices for estimating the PMI from observations and analyses of the corpse and context as well as broad categories of post-recovery analysis and examination. Forensic anthropologists should implement these guidelines to the fullest extent possible. In the absence of specific guidelines or procedures, the principle, spirit and intent should be met.

To achieve a broader picture of taphonomic influences on remains, field observations must be coupled with the recognition and observation of taphonomic indicators during examination. These post-recovery observations are important for a variety of reasons:

- Providing circumstantial evidence for estimating the time and circumstance of death.
- Identifying postmortem conditions that may facilitate or complete identification and/or the determination of cause and manner of death.
- Systematically identifying factors that influence the preservation or decomposition of human remains and other evidence.

### 3.0 Best Approaches

PMI estimates should be based on the forensic anthropologist's knowledge of cadaver decomposition processes and the taphonomic effects of the surrounding environment. Observations should be interpreted to provide estimates that are nonbiased, objective, and based on direct observations of the corpse and the parameters of the surrounding ecology.

The forensic anthropologist should describe the condition of a corpse, and reference should be made to its stage of decomposition and/or its total body score. There are a variety of descriptive decomposition stages available for different environments. In addition a scoring system has been used to quantify the decomposition of adult human corpses. For accurate estimation, the anthropologist should select the most appropriate methods based on a combination of experience and the most similar environment.

Anthropologists should keep in mind that transition from one stage to the next is heavily influenced by a number of different factors that may accelerate or retard the transition between stages. Best practice recommends that the anthropologist should describe the observed factors that influence the rates of decomposition.

To that end, the anthropologist should document the context in which the corpse is recovered, which includes, but is not limited to:

- Age, sex, weight estimations
- Physical condition of the remains including clothing.
- Ecological and soil parameters
  - Outdoor terrestrial
    - Burial substrate, burial depth, ecosystem(pasture, park, wooded),
    - Soils: type, texture, moisture content, chemistry (C, N, P, pH, conductivity, etc.)
    - Shade, sun, elevation, temperature (collect temperature from nearest weather station for period believed to cover the PMI). Correlate with recovered hourly or daily temperatures for next 5 days to correct weather station temperature readings.
    - Insect and scavenger activity
  - Indoor terrestrial
    - Location: (e.g. barn, house (carpeted or hard floor), car, etc.)
    - Temperature
    - Insect and scavenger activity
  - Aquatic (e.g. creek, marsh, swamp, river, lake, ocean, etc.)
    - water pH, temperature, depth
    - potential decomposer population

Since many parameters that contribute to taphonomy fall outside a forensic anthropologist's expertise, best practice dictates collaboration, when possible, with practitioners of the following forensic disciplines:

- Biochemistry
- Botany
- Entomology
- Geoscience/soil science
- Meteorology
- Palynology
- Pathology/medical examiner

The goal of this collaboration is to recognize that each discipline within forensic taphonomy can provide its own separate estimate of PMI. Also, the anthropologist should be familiar with the recommended collection and preservation of the appropriate evidence at the scene necessary for the analytical technique(s) to be performed. For example, an anthropologist should collect remains after an entomologist has had the opportunity to search for puparia and before a soil scientist collects soils for chemical analysis.

Taphonomic processes have a wide range of observable effects on evidence. While the below list is not all encompassing, these represent some of the broader and more common taphonomic effects observed during an examination setting:

- Thermal damage.
  - Soot or smoke marking and other effects
  - Calcined bones or teeth
  - Melted or burned non-biological evidence
- Animal damage and effects.
  - Rodent or other types of gnawing or chewing
  - Aquatic damage (coral, gnawing by vertebrates/invertebrates, etc.)
  - Trampling
  - Boring or other insect activity
  - Bone scattering
- Gravity
  - Rolling or sorting of remains by shape and size related to topographic slope
- Weathering
  - Physical weathering and rolling
  - Chemical weathering (soil, surface)

#### **4.0 Unacceptable Practices**

It should be considered unacceptable practice for an anthropologist to make a PMI estimate without understanding the context of the death scene. Practitioners should not report overly precise PMI estimates without providing proper documentation of the variation/error involved. Additionally, it is unacceptable to make taphonomic observations without proper training.

## **5.0 Other Considerations**

Differentiate trauma from damage  
Medicolegal significance  
Research standards  
Data standards within forensic taphonomy