

Skeletal Processing

Table of Contents

1	INTRODUCTION	2
2	SCOPE	2
3	EQUIPMENT	2
4	PROCEDURE	2
4.1	Prior to Processing	2
4.2	Mechanical Debris Removal.....	3
4.3	Maceration.....	3
4.3.1	Cold Water Maceration	3
4.3.2	Warm Water Maceration.....	3
4.3.3	Enzyme Detergent Maceration.....	4
4.4	Fine Debris Removal	4
4.5	Debris Disposal	4
5	LIMITATIONS	4
6	SAFETY	5
7	REFERENCES	5
8	REVISION HISTORY	6

Skeletal Processing

1 INTRODUCTION

If remains are received for anthropological analysis with adhering non-skeletal debris (e.g., soft tissues, soil) that prevents direct observation of the bone surface, this debris may require removal using procedures referred to as “skeletal processing.” This document describes procedures for skeletal processing.

2 SCOPE

This document applies to Anthropology Examiners and Physical Scientists in the Trace Evidence Unit (TEU) who are involved in skeletal processing and related procedures.

3 EQUIPMENT

- Cheesecloth
- Detergent (e.g., Tergazyme or equivalent)
- General laboratory supplies
- Handheld tools (e.g., probe, scalpel, knife, tweezers, forceps)
- Hot plate (capable of bringing water below the boiling point)
- Nylon brush (e.g., toothbrush)
- Personal protective equipment (e.g., lab coat, gloves, eye protection)
- Screen
- Stainless steel vessel/receptacle (e.g., stock pot, tray)
- Water (e.g., tap water)

4 PROCEDURE

- A. The Forensic Anthropological Examinations procedure will be followed.
- B. The need for and extent of skeletal processing will be determined by an anthropology examiner depending on the condition of the remains, the nature of the debris, and the examinations requested.
- C. Not all of the following procedures may be required in all cases.
- D. Any skeletal processing procedures used will include consideration for avoiding (or limiting to the extent possible) any alterations to bone dimensions, deterioration, production of alterations, changes in bone structure, and commingling.
- E. Any alterations that occur during skeletal processing will be documented in the case notes.

4.1 Prior to Processing

- A. The contributor will be notified of the need for skeletal processing that will involve the removal of significant debris. The contributor will be requested to advise on the retention or disposal of debris removed, as well as the need for additional examinations on associated non-skeletal debris.
- B. Any associated non-skeletal debris that may require further examination (e.g., clothing, hairs, soil) will be recorded, removed, and packaged appropriately for further analysis by appropriate personnel.

- C. Photographs, including scale, will be taken prior to skeletal processing. Radiologic or other examinations may also occur prior to skeletal processing at the discretion of the examiner.

4.2 Mechanical Debris Removal

- A. Debris may be removed from the bones manually or using tools. Tools less likely to damage or leave marks on bone (e.g., those made of plastic or wood versus those made of metal) are preferred when practicable.
- B. In cases where bones are attached by tissues, dissection with scalpels or knives may be used to disarticulate the remains to facilitate examination or further processing.

4.3 Maceration

- A. Maceration involves the softening of debris by soaking in water.
- B. Remains will be placed into stainless steel vessels/receptacles filled with enough tap water to cover the remains (or relevant portions thereof). Assemblages of adjacent bones (such as hand bones) or small bone fragments can be placed within mesh or cheesecloth to avoid loss or commingling with bones from other body regions.
- C. During maceration, the receptacle and remains will be stored in a ventilated hood.
- D. The duration of maceration depends on the nature of the debris, the condition of the remains, and the addition of heat or detergents.

4.3.1 Cold Water Maceration

- A. Maceration may involve the use of cold/room temperature water.
- B. Cold water maceration promotes slow soft tissue decomposition through bacterial action; this process can be time-consuming and malodorous but involves less potential risk to damaging skeletal remains.
- C. This approach is recommended in cases with fragile remains (e.g., fetal, infant, taphonomically compromised, fragmentary).
- D. Cold water maceration may also be used in cases where only water is necessary (e.g., dried soil that can be more easily removed when wet).

4.3.2 Warm Water Maceration

- A. Maceration may be facilitated by the application of heat which promotes the breakdown of debris.
- B. Heat application will be accomplished by placing the receptacle onto a hot plate and bringing the water to a temperature below 100°C/212°F (boiling point - this can be gauged using a thermometer or visually).
- C. This approach may be used in cases where skeletal material is in good condition.
- D. Water temperature and remains condition will be closely monitored during the application of heat.
- E. Excessive heat application (i.e., higher temperatures or prolonged exposure) may be detrimental to the skeletal material and/or downstream examinations such as DNA extraction.

4.3.3 Enzyme Detergent Maceration

- A. Maceration may be facilitated by the addition of an enzymatic detergent to the water which promotes the breakdown of organic debris.
- B. The amount of detergent added depends on the condition of the remains, the nature of the debris, and type of detergent used, but typically 1 to 2 tablespoons per gallon of Tergazyme or equivalent is sufficient.
- C. Excessive detergent (i.e., large quantities or prolonged exposure) may be detrimental to the skeletal material.

4.4 **Fine Debris Removal**

- A. Following maceration, smaller portions of debris may be removed using handheld tools. This typically involves gently prying or dislodging debris from the bone using forceps, tweezers, or probes, and/or by gently scrubbing the bone surface with a nylon brush. Aggressive prying or scrubbing should be avoided.
- B. Fine debris removal is typically accompanied by running water to encourage debris loosening, and a screen with cheesecloth placed within the sink to catch bones and debris.
- C. If potentially probative debris (e.g., possible projectile fragment) is discovered during processing, it will be recorded, removed, and packaged appropriately for further analysis by appropriate personnel.
- D. Maceration and fine debris removal may be an iterative process (typically with new water used for each cycle) in order to remove all debris.
- E. Following fine debris removal, skeletal material will be placed onto paper or trays to dry slowly, without the use of heat or moving air. Padding should be used between the skeletal material and hard surfaces.

4.5 **Debris Disposal**

- A. Debris that is removed mechanically or through maceration and that is not retained for additional examinations or at the contributor's request will be disposed of in accordance with LD waste disposal procedures where applicable.
- B. Tissue will be placed into a biohazard waste receptacle. This may include mechanically removed bulk tissue, or smaller tissue portions retrieved from the cheesecloth/screen.
- C. It may not be possible to retrieve very fine debris such as dissolved tissues and small soil particles that result from skeletal processing.

5 **LIMITATIONS**

The need for and extent of skeletal processing is determined based on the condition of the remains, the nature of the debris, and the examinations requested. Skeletal processing procedures used include consideration for avoiding, or limiting to the extent possible, any alterations to bone dimensions, deterioration, production of alterations, changes in bone structure, and commingling.

Excessive heat application (i.e., higher temperatures or prolonged exposure) and excessive detergent (i.e., large quantities or prolonged exposure) may be detrimental to the skeletal material and/or downstream examinations such as DNA extraction.

It may not be possible to retrieve very fine debris such as dissolved tissues and small soil particles that result from skeletal processing.

6 SAFETY

- While working with physical evidence, laboratory personnel will wear at least the minimum appropriate protective attire (e.g., laboratory coat, safety glasses, protective gloves).
- Universal precautions will be followed.
- Exposure to physical, biological, and chemical hazards may be associated with the examination techniques performed. Safety procedures related to specific materials, instruments or equipment will be followed. Refer to the [FBI Laboratory Safety Manual](#) for guidance.

7 REFERENCES

ANTHRO-300: Forensic Anthropological Examinations (current version)

FBI Laboratory Safety Manual (current version)

8 REVISION HISTORY

Revision	Issued	Changes
00	08/02/2021	Original document issued.
01	01/28/2022	Formatting and language changes to conform to new template.