

Determining Skeletal or Non-skeletal Origin

1 Scope

As part of forensic anthropological examinations, it is sometimes necessary to determine whether the submitted evidence/material is skeletal including osseous (i.e., bone) or dental (i.e., tooth) in origin versus some other non-osseous or non-dental material. This document describes guidelines for determining whether material is consistent with originating from a bone or tooth by Anthropology Examiners within the Trace Evidence Unit (TEU).

2 Equipment/Materials/Reagents

- Stereobinocular microscope, magnification range approximately 2x to approximately 40x
- Sectioning/wafering saw (Isomet Precision Saw or equivalent)
- Digital radiography unit (NorthStar X-5000 X-radiography unit or Kubtek radiography unit, or equivalent)
- X-Ray Fluorescence Spectrometer (EDAX Eagle III XXL Micro X-Ray Fluorescence Spectrometer, or equivalent)
- National Institute of Standards and Technology (NIST) Hydroxyapatite Standard
- Personal protective equipment (e.g., lab coat, gloves, eye protection)

3 Standards and Controls

NIST Standard Reference Material[®] 2910a Calcium Hydroxyapatite

4 Sampling

Sub-samples of the submitted material may be examined at the discretion of the examiner. The individual sub-samples may not be representative of the entire specimen. Sub-samples are chosen based on the need to identify a particular component by a specific technique, and by its availability or presence.

5 Procedures

The Forensic Anthropological Examinations procedures will be followed. The determination of whether material is skeletal or non-skeletal can usually be achieved by visual examination if the specimens are sufficiently large and in good condition. Occasionally, specimens are very small and/or taphonomically compromised, precluding conclusions based on visual examination. In some cases, one of the following techniques may be sufficient, while in other cases, multiple techniques may be required to make a conclusion. Observations supporting conclusions will be recorded in the case notes.

5.1 Procedures for Determining Skeletal Versus Non-Skeletal

5.1.1 The material will be evaluated by macroscopic visual examination to assess the presence or absence of features or structures that characterize osseous and dental material to include overall size and morphology, landmarks, trabeculae, density, color, and reflectivity. The presence of features consistent with osseous or dental material supports the conclusion that the material is skeletal in origin.

5.1.2 The material may be evaluated by microscopic examination using a stereobinocular microscope to assess the presence or absence of features or structures that characterize skeletal material to include overall size and morphology, landmarks, trabeculae, and vascular systems. At the discretion of the examiner, this may involve preparing a thin section using a wafering saw following the Bone Histomorphology procedure. The presence of features consistent with skeletal material supports the conclusion that the material is skeletal in origin.

5.1.3 The material may be evaluated by radiographic examination using digital radiography following the Chemistry Unit, Metallurgy Digital Radiography procedure or other instrument-specific procedures to assess the presence or absence of features or structures that characterize skeletal material to include morphology, landmarks, and trabeculae. The presence of features consistent with osseous or dental material supports the conclusion that the material is skeletal in origin.

5.1.4 The material may be evaluated by X-ray fluorescence using an XRF spectrometer following the Chemistry Unit, Metallurgy procedure for Operation of the EDAX Eagle III XXL Micro X-Ray Fluorescence Spectrometer or other instrument-specific procedures of an equivalent XRF spectrometer to determine the elemental composition. Prior to analyzing the evidence, the NIST Hydroxyapatite Standard will be analyzed, and the results maintained in the case notes. The presence of significant calcium and phosphorus peaks supports the conclusion that the material is skeletal in origin.

5.2 Records

5.2.1 Case Notes

The case notes will include examinations used and all observations of traits and features used to determine skeletal versus non-skeletal origin. Where appropriate, this may include radiological images, photographs, and instrument printouts.

5.2.2 Reports

5.2.2.1 In the event that the material is determined to be skeletal in origin, this will be stated in the FBI *Laboratory Report* (7-1, 7-1 LIMS). For example: “*The material is consistent with skeletal origin*”. Osseous or dental origin may also be specified as appropriate.

5.2.2.2 In the event that the material is determined to be non-skeletal in origin, the report will state this. For example: “*The submitted item(s) is/are non-skeletal in origin. No further anthropological examinations were conducted.*”

5.2.2.3 In the event that the examination is inconclusive, the report will state this. For example: *“The submitted item(s) is/are of undetermined origin. No further anthropological examinations were conducted.”*

6 Calculations

Not applicable.

7 Measurement Uncertainty

Not applicable.

8 Limitations

The conclusions that can be reached from anthropological examinations to determine skeletal or non-skeletal origin are dependent on the condition and completeness of the submitted material. Results based on fragmentary or poorly preserved material may be inconclusive.

9 Safety

9.1 While working with physical evidence, laboratory personnel will wear at least the minimum appropriate protective attire (e.g., laboratory coat, eye protection, protective gloves).

9.2 Universal precautions will be followed.

9.3 Exposure to biological and radiological hazards may be associated with the examination techniques performed. Safety procedures related to specific instruments or equipment (e.g., wafering saws, X-ray units) will be followed. Refer to the FBI Laboratory Safety Manual for guidance.

10 References

- Forensic Anthropological Examinations, Trace Evidence Procedures Manual (current version)
- Digital Radiography, Chemistry Unit, Metallurgy (current version)
- Operation of the EDAX Eagle III XXL Micro X-Ray Fluorescence Spectrometer, Chemistry Unit, Metallurgy (current version)
- Scientific Working Group for Forensic Anthropology guidelines for Determination of Medicolegal Significance from Suspected Osseous and

Dental Remains (current version)

- Bone Histomorphology, Trace Evidence Procedures Manual (current version)
- FBI Laboratory Safety Manual (current version)

Rev. #	Issue Date	History
2	02/07/2018	Updated title from osseous or dental to skeletal or non-skeletal and throughout document as appropriate. Updated throughout removing references to TEU where appropriate; added forensic anthropologists to the Scope in Section 1. Updated Section 2. Added 'or Sample Selection' to Section 4 header. Clarified language in Section 5 Updated title of document referenced in Section 5.1.2. In Section 5.1.4, removed citation for article. Section 5.2 header changed to Records and added section 5.2.1. Added heading for Section 5.2.2 and updated wording in Sections 5.2.2.1 to state that osseous or dental origin may also be specified as appropriate.
3	02/10/2020	Updated references in Section 10. 'Sample Selection' removed from Section 4 title. Updated wording used in Sections 5, 5.1, 5.1.2, 5.1.3, and 5.1.4. Changed 'forensic anthropologist' to 'Anthropology Examiner' in Scope and 'examiner' throughout.

Approval

Redacted - Signatures on File

Trace Evidence Unit
Chief

Date: 02/07/2020

Anthropology Technical
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Date: 02/07/2020