# Supplemental Document 1. Description of the criteria presumed diagnostic of bone grease processing.

This document provides detailed information about the criteria discussed in the accompanying paper (see Figures 2, 7–8 in that paper for illustrations of the criteria). These criteria (N=55), which are presented starting with the proximal humerus, are identified in bold. Note that the document also contains data for less common forms of damage that are not discussed in the paper.ANE is the Actual Number of Elements. Landmarks are described followed the nomenclature in Barone (1999).

**Humerus**(ANE=20)

Proximal epiphysis: humeral head (*Caput humeri*)

Many humeral heads show crushing marks on the lateral and/or postero-medial side(s) (NISP=25, MNE=15, **C1-H**). Less frequently, the top of the humeral head show crushing marks and/or evidence that the articular surface has collapsed (NISP=10, MNE=9).

Proximal epiphysis: Greater tubercle (*Tuberculum majus*)

Crushing marks are relatively common on the greater tubercle (NISP=17, MNE=11, **C2-H**).

Distal shaft: Fork above the olecranon fossa (*Fossa olecrani*)

All the specimens show two asymmetrical “prongs,” one of which is the proximal section of the epicondylar crest (*Crista epicondyli lateralis*,NISP=8, MNE=8, **M1-H**).

Distal shaft: Epicondylar crest (*Crista epicondyli lateralis*)

The fragments all show a significant portion of the lateral surface of the epicondylar crest (NISP=9, MNE=9, **M2-H**). Distally, the specimens are fractured at the juncture with the *Capitulum*.

Distal epiphysis: The olecranon fossa (*Fossa olecrani*) and the concave articular surface (cranial portion of the “gorge médiane”) immediately distal to it.

Fragments that were identified for this landmark generally show most of the articular surface (NISP=12, MNE=12, **M3-H**).

Distal epiphysis: Coronoid fossa (*Fossa coronoidea*) and cranial aspect of the trochlea

All fragments show the central depression immediately proximal to the anterior portion of the trochlea; the medial and lateral surfaces are missing (NISP=12, MNE=7, **M4-H**).

Distal epiphysis: *Capitulum* *humeri*

The *Capitulum* *humeri* is represented by fragments containing at least a portion of the articular surface (NISP=20, MNE=18, **M5-H**). The fragments also show a medio-lateral fracture plane coinciding with, or found adjacent to, the attachment surface for the digital extensor muscle. Only two *Capitula* are complete (NISP=2, MNE=2). In the medio-lateral plane, fragments typically only extend over a third to a half of the distal humerus. Crushing marks commonly occur on the lateral edge (NISP=8, MNE=8, **C3-H**), and tear marks on the lateral side (NISP=11, MNE=10, **T1-H**) or anterior aspect (NISP=4, MNE=3), of the *Capitulum*. However, the presence of saw marks produced during butchery on some specimens (NISP=9, MNE=8) may have prevented the recognition of these marks.

Distal epiphysis: Medial half of the trochlea (*Trochlea humeri*)

Fragments show a sagittal fracture that isolates the medial side of the trochlea. In transverse plane, fragments are fractured at the juncture with, or adjacent to, the fossa for the flexor carpi ulnaris muscle(*flexor carpi radialis*, NISP=15, MNE=15, **M6-H**). Crushing marks occur on the anterior and/or posterior aspect(s) of the medial trochlea, particularly along the medial edge (NISP=12, MNE=12, **C4-H**).

**Radius** (ANE=20)

Proximal epiphysis: Medial portion of the *Fovea capitis radii*

The sample is dominated by fragments with at least two fracture planes occurring within the medial glenoid cavity. The fractures tend to be straight and are generally intersecting at an angle ranging between 60–120° (NISP=33, MNE=12, **M1-R**).

Proximal epiphysis: Lateral portion of the *Fovea capitis radii*

On a large number of specimens, the lateral articular surface is relatively complete and isolated from the other *Fovea capitis radii* fragments (NISP=12, MNE=12, **M2-R**).

Distal epiphysis: Posterior articular surface of the radial styloid process (*Processus styloideus radii*)

On most fragments, the posterior portion of the articular surface of the radial styloid process is preserved whole or nearly whole. The specimens generally include the two crests that delimit the articulation with the scaphoid (NISP=15, MNE=15, **M3-R**). In addition, all the fragments that we identified for this landmark show a fracture plane coinciding with, or immediately lateral to, the crest that delimits the articulation with the scaphoid and lunatum. Tear marks were observed on a large number of specimens, typically on the crests (NISP=13, MNE=13, **T1-R**).

Distal epiphysis: Articular surface for the ulna on the distal radius

There is a tendency among the fragments from this bone region to show at least a portion of the contact surface with the ulnar styloid process and of the anterior section of the surface that articulates with the lunatum and triquetrum (NISP=12, MNE=12, **M4-R**).

**Ulna (ANE=20)**

Proximal: Caudal portion of the olecranon

Most fragments from the proximal section of the posterior aspect of the ulna lack the *Tuber olecrani* and have a roughly triangular shape, more or less akin to a bayonet (NISP=15, MNE=12, **M1-U**). Crushing marks are common on these specimens (NISP=14, MNE=13, **C1-U**).

Proximal: Anterior portion of the olecranon

Fragments from this region often have a squarish shape and show crushing marks (NISP=11, MNE=10, **C2-U**).

Proximal: Trochlear notch (*Incisura troclearis*)

Fragments from this bone region often show crushing marks (NISP=18, MNE=16, **C3-U**), tear marks (NISP=14, MNE=12, **T1-U**) or both forms of damage (NISP=14, MNE=12). Five additional specimens show a tearing lip (“languette d’arrachement”; NISP=5, MNE=3).

Shaft: Lateral coronoid process (*Processus coronoideus lateralis*)

The lateral coronoid process is generally broken off from the radius (NISP=17, MNE=16, **M2-U**). On the vast majority of the specimens, this region is preserved whole or nearly so (NISP=15, MNE=15). Crushing marks are relatively common on the coronoid process (NISP=9, MNE=9, **C4-U**).

Distal: Ulnar styloid process (*Processus styloideus ulnae*)

On most specimens, the ulnar styloid process is isolated from the radius (NISP=14, MNE=14, **M3-U**). The specimens are generally short and tend to be fractured where the ulna meets the transverse crest (*Crista transversa*) (NISP=15, MNE=15).

**Metacarpal** (ANE=24)

Distal epiphysis: Abaxial surface of the condyle

Most fragments show the complete abaxial condyle fractured along a sagittal plane. The intermediate ridge (“relief intermédiaire”), which separates the two condyles, is missing. This morphology (NISP=33, MNEcondyle=33, MNE=17, **M1-Mc**) is referred to here as a “condyle bayonet.” The edges of the abaxial condyle commonly present a squarish shape with crushing marks on the posterior and/or anterior aspect(s) (NISP=26, MNEcondyle=26; MNE=15, **C1-Mc**). Less frequently, crushing marks occur on the outline of the condyles (NISP=11, MNE=10, **C2-Mc**). Tear marks are frequent on the distal surface of the abaxial condyle, especially along the plane of fracture (NISP=18, MNEcondyle=18; MNE=12, **T1-Mc**). Tearing often leaves serrated outlines on the specimens. In term of overall shape, many fragments consist of a bayonet shaft fragment including the whole (NISP=28, MNEcondyle=28; MNE=16) or at least the proximal half of the abaxial condyle (NISP=27, MNEcondyle=27; MNE=16). A second, much rarer, type than the bayonet condyle consists of condyle portions that retain both the axial and abaxial surfaces. These fragments all show the complete abaxial condyle but only the distal half of the axial condyle (NISP=7, MNEcondyle=7; MNE=4).

Distal epiphysis: Distal half of the axial surface of the condyle

Also a remarkably strong criterion. Fragments take the shape of “half-moons” and correspond to the distal half of the axial condyle. The fracture plane is usually straight in sagittal section. Transversely, the fracture plane tends to be oblique and often ends with the intermediate ridge (“relief intermédiaire”) that separates the abaxial from the axial condyles (NISP=29, MNEcondyle=29; MNE=17, **M2-Mc**). Tear marks are not uncommon on half-moons (NISP=9, MNEcondyle=9; MNE=7, **T2-Mc**).

Distal epiphysis: Intertrochlear notch (*Incisura intertrochlearis*)

Most fragments include the distal portion of the fusion surface of the two metapodial halves and a small proximal section of the axial condyle (NISP=18, MNE=15, **M3-Mc**). Many of these specimens refit with half-moons. In some cases, the two surfaces remain fused on the fragments (NISP=12, MNE=12). Crushing marks were observed on the proximalmost surface of the condyles on the anterior and/or posterior aspect(s) (NISP=16, MNE=14, **C3-Mc**).

**Femur** (ANE=29[[1]](#footnote-1))

Proximal epiphysis: Femoral head (*Caput ossis femoris*)

Only eight femoral heads are complete or nearly complete. Of the former, seven presents crushing marks. Broken femur heads often show an anterio-posterior fracture plane coinciding with, or immediately lateral to, the *Fovea capitis* (MNE=19; NISP not calculated due to the difficulty of quantifying fractures on fragments). Fully fused epiphyses (NISP=7, MNE=7) frequently include additional fractures. Crushing marks occur at high frequency on the posterior and/or anterior aspect(s) of the specimens (posterior aspect only: MNE=23; anterior aspect only: MNE=24; both posterior and anterior aspects: NISP=45, MNE=26, **C1-F**). More rarely, crushing marks occur on the cranial aspect of the femoral head next to the *Fovea capitis* (NISP=6, MNE=5, see Figure 9 in the accompanying paper).

Proximal epiphysis: Proximo-lateral portion of the greater trochanter (*Trochanter major*)

Only one (unfused) greater trochanter is complete. Greater trochanter specimens commonly have the medial half missing (NISP=10 out of 18 cases, MNE=10 out of 18 cases, **M1-F**). Crushing marks are common on the anterior aspect of the greater trochanter (NISP=9 out of 11 cases, MNE=9 out of 11 cases, **C2-F**).

Distal epiphysis: Posterior portion of the axial aspect of the lateral condyle

The specimens all show at least the posterior half, if not most, of the fossa present on the axial aspect of the lateral condyle (NISP=26, MNE=25, **M2-F**). Most specimens have a plano-convex shape (NISP=23, MNE=23). Crushing marks frequently occur on the abaxial side of the lateral condyle (NISP=17, MNE=17, **C3-F**).

Distal epiphysis: Medial aspect of the medial condyle

Most specimens comprise the complete posterior palmar surface of the medial condyle and show a straight fracture coinciding with, or immediately posterior to, the *Epicondylus medialis* (NISP=18, MNE=18, **M3-F**). On several specimens, crushing marks occur on the medial articular surface of the medial condyle (NISP=15, MNE=15, **C4-F**).

Distal epiphysis: Latero-palmar region from *Fossa m. poplitei* to *Fossa extensora*

Posteriorly, fragments show fracture planes coinciding with, or immediately posterior to, the *Fossa m. poplitei*, and anteriorly, at, or immediately anterior to, the *Fossa extensora* (NISP=14, MNE=14, **M4-F**). Three specimens are not as fragmented. They probably represent an earlier stage of fragmentation, as they include a relative large portion of the trochlea. Crushing marks are sometimes present on the distal surface of the lateral condyle (NISP=4, MNE=4).

Distal epiphysis: Central palmar region of the medial side of the distal femur

A majority of specimens show the anteriormost palmar portion of the medial condyle as well as a portion of the posterior palmar surface of the trochlea (NISP=10, MNE=10, **M5-F**). Crushing marks are sometimes present on the medial surface of the medial condyle (NISP=5, MNE=5).

**Tibia** (ANE=21[[2]](#footnote-2))

Proximal epiphysis: *Sulcus extensorius* (extensor groove)

Most cases involve fragments in which the lateral portion of the cranio-lateral notch of the proximal extremity of the tibia (*Sulcus extensorius*) is approximately twice as long as the anterior portion (NISP=16, MNE=16, **M1-T**).

Distal epiphysis: Posterior portion of the lateral malleolus (*Malleolus lateralis*)

The lateral malleolus generally occur as fragments. Specimens are mostly from the posterior section of the lateral malleolus and exclude the articular surface immediately anterior to the *Incisura fibularis* (NISP=18, MNE=18, **M2-T**).

Distal epiphysis: Medial malleolus (*Malleolus medialis*)

On most specimens attributed to this region, the medial malleolus is isolated from the distal tibia and present an antero-posterior fracture plane that coincides with the medial groove of the *Cochlea tibiae*. The specimens also show the medial half of the articular surface of the medial malleolus (NISP=19, MNE=19, **M3-T**). In only three instances (NISP=3, MNE=3) does the fracture plane runs through the anterior eminence of the *Cochlea tibiae* (“tenon intermédiaire aux gorges”). Tear marks were observed on several medial malleoli (NISP=13, MNE=13, **T1-T**).

Distal epiphysis: Anterior eminence of the *Cochlea tibiae*

The majority of the fragments show the entire anterior eminence (NISP=14, MNE=14, **M4-T**). Fracture of the anterior eminence into two halves—a pattern observed on several specimens (NISP=11, MNE=6)—probably represents the next stage of fragmentation. The sides of the anterior eminence commonly exhibit tear marks (NISP=12, MNE=11, **T2-T**).

**Metatarsal** (ANE=21)

Patterns for the metatarsal are very similar to those for the metacarpal. Therefore, the same criteria prevail here.

Distal epiphysis: Abaxial surface of the condyle

Most fragments show the complete abaxial condyle fractured along a sagittal plane. The intermediate ridge (“relief intermédiaire”), which separates the two condyles, is missing. This morphology (NISP=26, MNEcondyle=26, MNE=14, **M1-Mt**) is referred to here as a “condyle bayonet.” The edges of the abaxial condyle commonly present a squarish shape with crushing marks on the posterior and/or anterior aspect(s) (NISP=24, MNEcondyle=24, MNE=13, **C1-Mt**). Less frequently, crushing marks occur on the outline of the condyles (NISP=14, MNE=12, **C2-Mt**). Tear marks are frequent on the distal surface of the abaxial condyle, especially along the plane of fracture (NISP=31, MNEcondyle=28, MNE=15, **T1-Mt**). Tearing often leaves serrated outlines on the specimens. In term of overall shape, many fragments consist of a bayonet shaft fragment including the whole (NISP=18, MNEcondyle=18, MNE=10) or at least the proximal half of the abaxial condyle (NISP=23, MNEcondyle=23, MNE=12). A second, much rarer, type than the bayonet condyle consists of condyle portions that retain both the axial and abaxial surfaces. These fragments are all distal halves of the condyles (NISP=6, MNEcondyle=6, MNE=5).

Distal epiphysis: Distal half of the axial surface of the condyle

Fragments take the shape of half-moons and correspond to the distal half of the axial condyle. The fracture plane is usually straight in sagittal section. Transversely, the fracture plane tends to be oblique and often ends with the intermediate ridge (“relief intermédiaire”) that separates the abaxial from the axial condyles (NISP=30, MNEcondyle=30, MNE=15, **M2-MT**). Tear marks are frequent on half-moons (NISP=19, MNEcondyle=19, MNE=10, **T2-Mt**).

Distal epiphysis: Intertrochlear notch (*Incisura intertrochlearis*)

Most fragments include the distal portion of the fusion surface of the two metapodial halves and a small proximal section of the axial condyle (NISP=19, MNE=11, **M3-Mt**). Many of these specimens refit with half-moons. In a few cases, the two surfaces remain fused on the fragments (NISP=6, MNE=6). Crushing marks were observed on the proximalmost surface of the condyles on the anterior and/or posterior aspect(s) (NISP=17, MNE=12, **C3-Mt**).

1. *note that one proximal femur and one distal femur were erroneously not fractured* [↑](#footnote-ref-1)
2. *one distal tibia was erroneously not fractured* [↑](#footnote-ref-2)