Solutions for Forensic Anthropology A Comprehensive Introduction 2nd Edition by Langley

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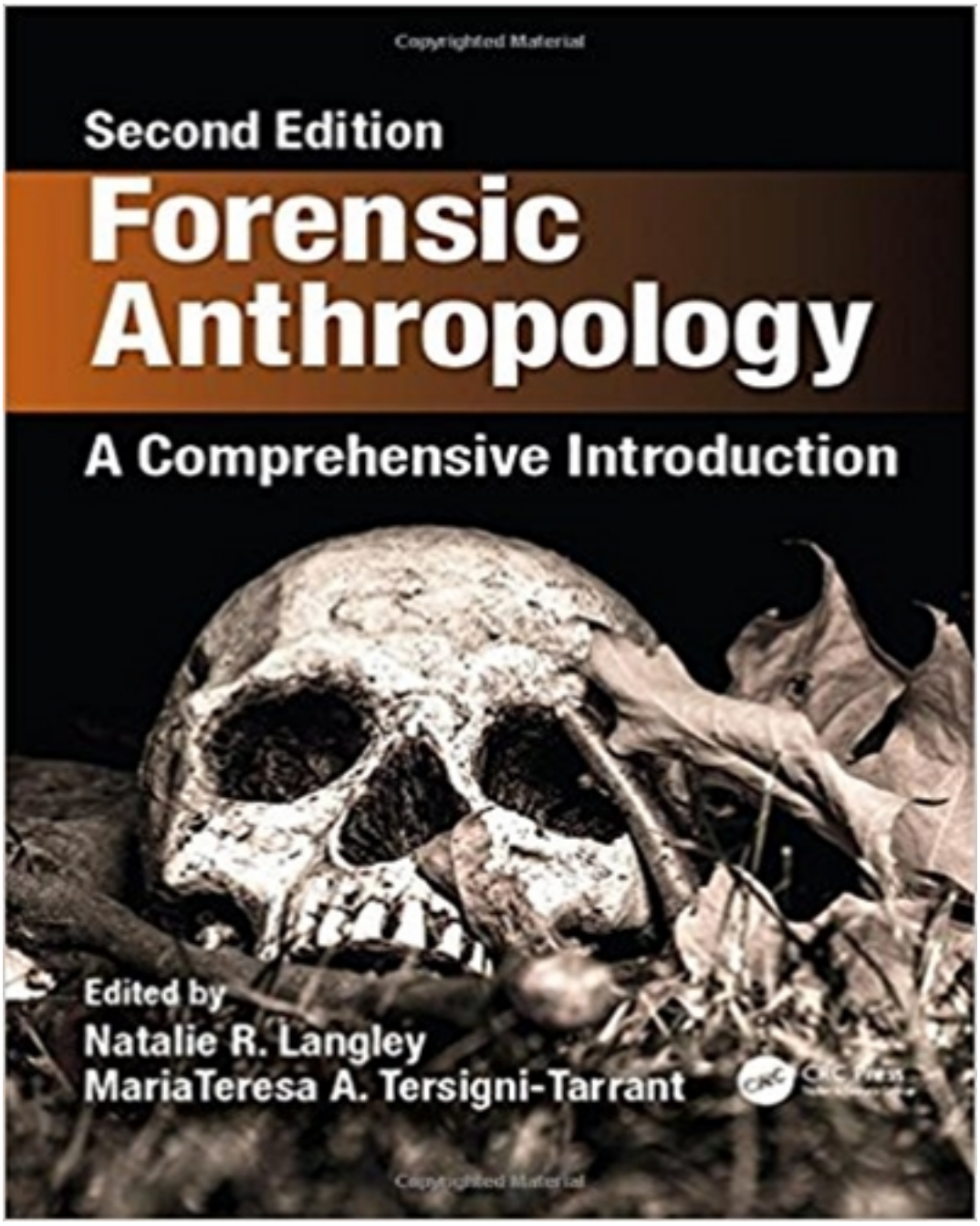


Solutions

SECTION 2 : TRANSITION ANALYSIS

The Transition Analysis Aging Method

INTRODUCTION

This manual covers how to record three skeletal features used to estimate age in adults with the Transition Analysis method and computer program: the pubic symphysis, iliac portion of the sacroiliac joint, and cranial sutures. Beginning in 1996, we developed new scoring systems for age-progressive changes in bony morphology and examined two known age-at-death skeletal collections (Terry and Coimbra) to estimate the age distribution associated with each of the newly defined stages. The program calculates estimated ages (maximum likelihoods) and confidence intervals for forensic and archaeological skeletons. Further explanation of the procedure can be found in Boldsen et al. (2002), and the results of a validation study in Milner and Boldsen (2012).

Not all skeletal traits have to be present to generate an age estimate. That is, the procedure was designed to accommodate the possibility that only a partial skeleton may be available for observation.

Trait location

It is essential to score only what is happening in the location specified in each of the descriptions, and not be influenced by the appearance of the anatomical unit as a whole. That is because the ages of transition for the young to old stages pertain to specific parts of the anatomical units under consideration. Inattention to adhering to the scoring locations will produce nonsensical results.

Ambiguous skeletal features

On occasion it is difficult or impossible to distinguish between sequential stages in a particular anatomical feature. That can be a result of a pathological process or postmortem erosion. There is still information, however, in such characters, as long as something is visible. You should record whatever is observable, using two or more stage designations, as appropriate (e.g., Stages 3-4). Doing so allows one to take full advantage of the meager information available in the damaged bony structure. For example, a partly observable pubic symphysis ventral margin that has at least 1 cm of rim visible would be scored as *Rim* (6) and *Breakdown* (7). A 6-7 score acknowledges that a rim is present, so an earlier stage is not appropriate. However, there might have been sufficient antemortem marginal erosion to be classified as *Breakdown* (7) in the part of the bone that is missing. The 6-7 designation indicates the individual was at least in Stage 6, and might have been in the next higher one (i.e., Stage 7), but we will never know.

When a particular component cannot be observed it should be coded as unscorable. Usually such situations arise when there is postmortem damage, but can happen as a result of antemortem alterations to normal skeletal structures, as well. For example, large parity pits can eat deeply into the dorsal portion of the pubic symphysis of females, eliminating features that otherwise could be scored.

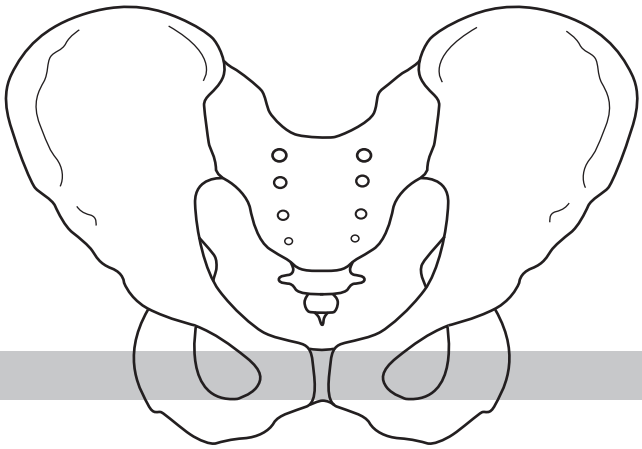
Figures and Illustrations

Images are from France Casting pubic symphysis casts and bones from several institutions and are coded as follows in the Figures:

- **FC** - France Casting male and female Suchey-Brooks stages (12 each), and male and female instructional casts
- **MC** - Forensic cases from Mercyhurst College
- **T** - Terry Anatomical Collection, Smithsonian Institution
- **B** - William M. Bass Donated Collection, University of Tennessee
- **P** - University of Pretoria
- **NF** - Norris Farms Collection, Illinois State Museum

Each photograph is accompanied by stage name and numerical designation for the stage; the part of interest, if relevant; and specimen designation.

Some images are reversed to make it easier to compare one specimen to the next. For pubis symphysis images, the left side of the image is dorsal, and the right side is ventral. Multiple examples of stages illustrate the variation one might encounter when examining skeletons.



Pubic Symphysis

Five separate components are examined for the pubic symphysis:

I. **Symphyseal Relief**
II. **Dorsal Symphyseal Texture**
III. **Superior Protuberance**
IV. **Ventral Symphyseal Margin**
V. **Dorsal Symphyseal Margin**

The various features are based on previous descriptions of bony changes in the pubic bone, especially those of Todd (1920) and McKern and Stewart (1957), supplemented by observations of numerous North American and Danish archaeological skeletons. Many terms used here are derived from this earlier work.

Users of Transition Analysis can gain experience with the changes that take place in the pubic symphysis by closely examining the excellent casts in the McKern-Stewart and Suchey-Brooks pubic bone sets. For sake of convenience, the several parts of the roughly oval symphyseal face are described as superior, inferior, ventral (anterior), and dorsal (posterior), even though such terms are not entirely accurate when the bone is oriented in proper anatomical position.

Opposing pubic bones tend to resemble one another, but they often differ in specific details. Therefore, the left and right sides are scored separately to accommodate that variation.

I. Symphyseal Relief

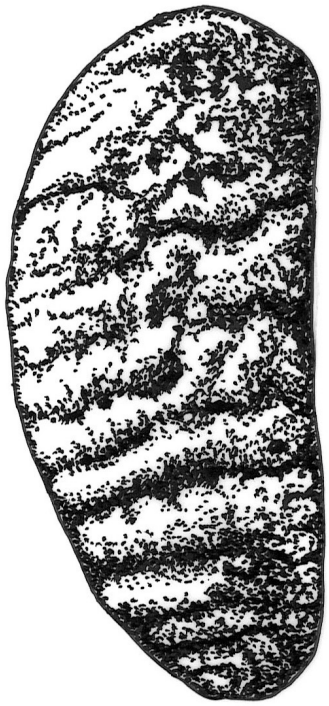


Fig. 2.1 ***Symphyseal Relief*** *(Note: dorsal is on the left side, ventral on the right in all pubic symphysis figures)*

LOCATION

The terms for this feature generally follow those of McKern and Stewart (1957). Although the entire face should be considered, the billowing is typically most clearly seen in the dorsal half of the symphyseal face (Figure 2.1). In fact, low ridges of bone, the billowing, can be entirely absent from the ventral symphyseal face, beginning as early as the ventral beveling stage.

CHARACTERISTICS [STAGES]

1. Sharp billowing
2. Soft, deep billowing
3. Soft, shallow billowing
4. Residual billowing
5. Flat
6. Irregular

DEFINITIONS

1. *Sharp billowing*: Sharply crested ridges of bone cover at least half of the surface (Figure 2.2). Deep and distinct furrows that extend completely across the symphyseal face separate well-defined ridges. The deepest furrows cut into the ventral and dorsal margins of the symphyseal face, often interrupting the edge of the bone and giving it a jagged appearance. *Sharp Billowing* has only been seen in teenagers and very young adults.

2. *Soft, deep billowing*: Softly crested to low billows separated by deep furrows extend across at least half of the surface (Figure 2.3), typically the dorsal half (demiface). The furrows do not appear as if they have been filled in with bone. The depth between high and low points of adjacent ridges and furrows is 2 mm or more.

3. *Soft, shallow billowing*: Low but clearly visible and discrete billows separated by shallow furrows are present on at least half of the dorsal demiface (Figure 2.4). The remnants of an earlier ridge and furrow system dominate the dorsal demiface, and the furrows look as if they have been filled partially with bone. Billows occupy most or all of the dorsal demiface, and in some individuals they extend anteriorly to reach the ventral margin.

4. *Residual billowing*: Billows are barely visible, being only slightly elevated above the symphyseal face (Figure 2.5). They tend to blend into one another to form low and indistinct raised areas that lack clearly defined furrows between them. The slightly raised areas occupy only part of the symphyseal face, typically about one-third of the middle to inferior portions of the dorsal demiface. Individual billows usually cross only part of the symphyseal face, typically less than one-half its width, being concentrated on the dorsal demiface. There must be two or more adjacent raised areas corresponding to billows to qualify as *Residual Billowing*. A single isolated bony elevation is not sufficient to be classified as *Residual Billowing*; instead, such specimens are considered *Flat* (see Stage 5 below).

Figure 2.2. ***Sharp billowing of the symphyseal surface*** *[1] (AZ 175).*

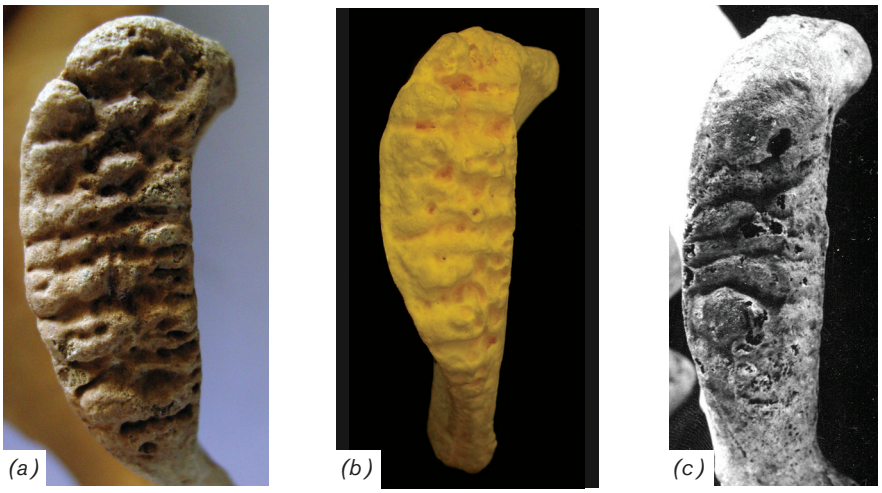


Figure 2.3. ***(a) Soft, deep billowing*** *[2] (P 6192, image reversed),* ***(b) Soft, deep billowing*** *[2] (FC F-I-1), and* ***(c) Soft, deep billowing*** *[2] (T 222R, image reversed).*

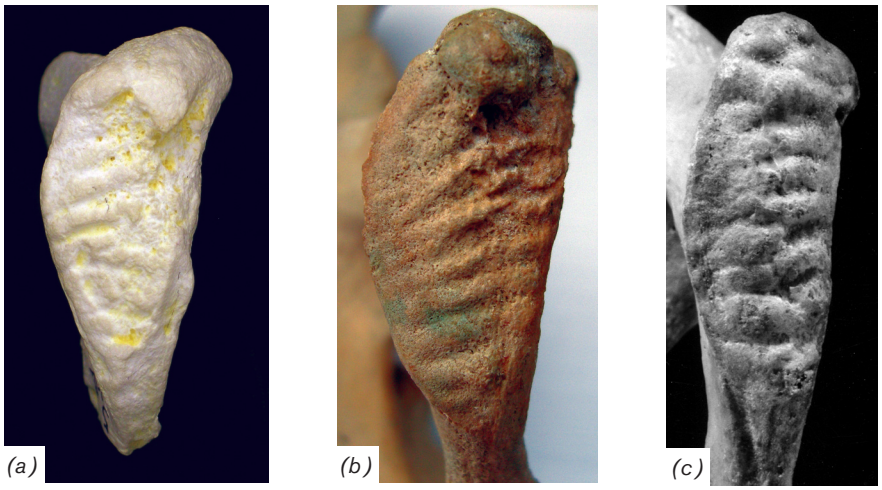


Figure 2.4. ***(a) Soft, shallow billowing*** *[3] (FC M-III-1),* ***(b) Soft, shallow billowing*** *[3] (P 5152, image reversed), and* ***(c) Soft, shallow billowing*** *[3], (T 385, image reversed).*

5. *Flat*: More than one-half of the symphyseal face within well-defined margins is flat or slightly recessed, and is often surrounded by a well-developed rim (Figure 2.6). Occasionally small, low pillows of bone give the otherwise flat surface a slightly bumpy appearance, but the symphyseal face does not conform to *Residual Billowing* (i.e., there is no more than one discrete and well-defined low raised area corresponding to what had been a more extensive series of billows). If there is a gap where the ventral rampart has failed to extend along the entire ventral edge of the pubis (a ventral hiatus), the surface within the gap does not receive a score.

6. *Irregular*: Pitting, which can be deep, covers more than one-half of the symphyseal face, giving it an irregular and disfigured appearance (Figure 2.7). The pits can be accompanied by small, sharp exostoses scattered across the face. Occasionally, in older individuals an otherwise flat face is thickly covered by low but typically sharp exostoses that give the symphyseal surface a markedly irregular appearance. Pitting in such specimens might be minor, but the bone is still classified as Irregular. Similar to the *Flat* category, the scored part of the symphyseal face does not include the ventral gap, if present. In Irregular specimens, the margins of the symphyseal face are typically defined by the *Rim* and *Breakdown* stages of the **Ventral and Dorsal Margin** components.

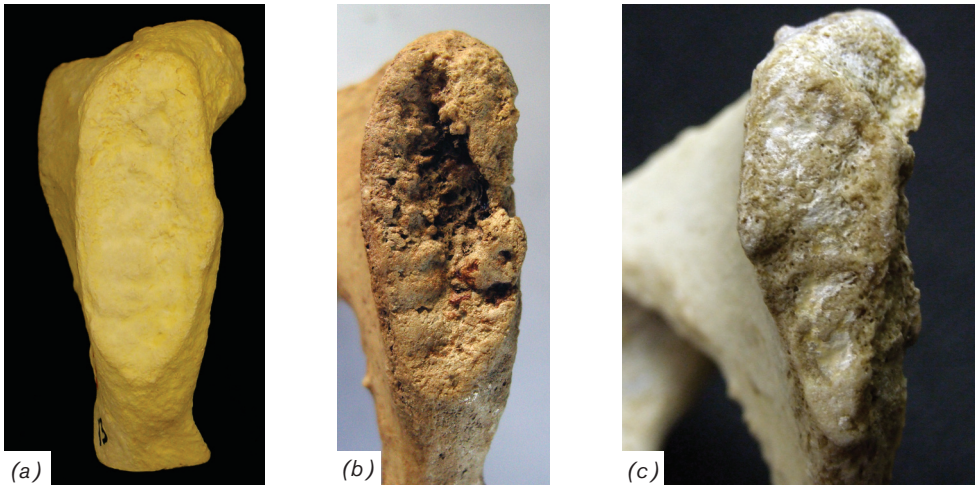


Figure 2.5. ***(a) Residual billowing*** *[4], inferior part (FC M-13),* ***(b) Residual billowing*** *[4], inferior part (P 6120, image reversed), and* ***(c) Residual billowing*** *[4], inferior part (MC 7-76).*

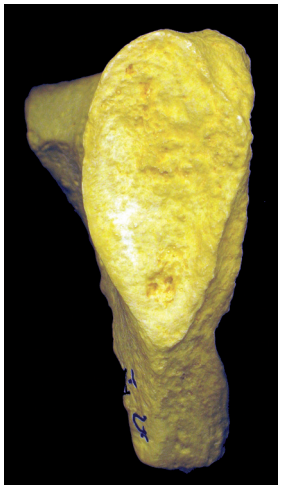


Figure 2.6. ***Flat*** *[5] (FC M-V-1).*

Figure 2.7. ***Irregular*** *[6] (FC F-12C).*

II. Dorsal Symphyseal Texture

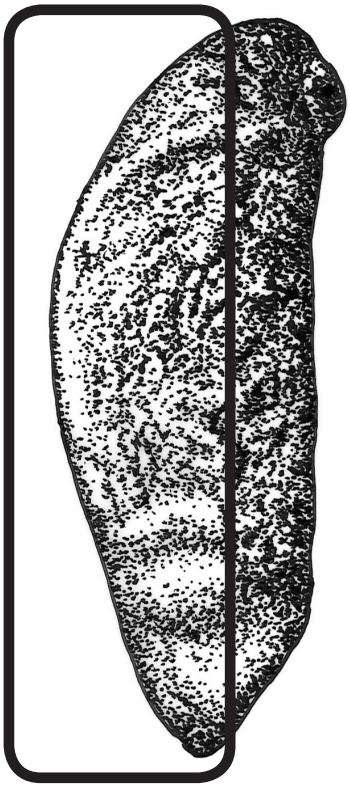


Figure 2.8. ***Dorsal Symphyseal Texture***

LOCATION

The dorsal portion of the surface is examined (Figure 2.8).

CHARACTERISTICS [STAGES]

1. **Smooth (fine-grained)**
2. **Coarse-grained**
3. **Microporosity**
4. **Macroporosity**

DEFINITIONS

1. *Smooth (fine-grained)*: Smooth to fine-grained bone extends across most, or all, of the dorsal demiface (Figure 2.9).
2. *Coarse-grained*: Coarse-textured bone covers over one-third of the dorsal demiface (Figure 2.10). The surface looks like packed fine sand, similar to medium-grained sandpaper. Americans may recognize it best as the surface of a sugar cube.
3. *Microporosity*: Porous bone covers over one-third of the dorsal demiface. It looks as if the surface was pierced by closely packed pinpricks (Figure 2.11).
4. *Macroporosity*: Deep pits cover over one-third of the dorsal demiface, giving it an irregular appearance (Figure 2.12). The pits are at least 0.5 mm in diameter, and generally are spaced close together. Sometimes the symphyseal surface is so irregular from pitting that it resembles the edge of a sponge. The surface looks like it was pierced by closely packed pinheads (the bulbous end of the same shirt or blouse pin in the previous description).

SCORING TIPS

In most instances it is difficult to identify the proper stage from photographs. So if the actual specimen is unavailable, it is generally best to score this feature as not observable.

The ventral part of the bone, when ventral beveling is present, is often pitted, giving it the appearance of microporosity. A porous ventral demiface should not be confused with what is happening in the dorsal demiface.

It is our impression that prehistoric Native American skeletons have microporosity more often and at an earlier age than medieval Scandinavians. More to the point, they differ from the modern Terry and Coimbra collection skeletons used to generate transition curves used when estimating age. Therefore, it is best not to rely heavily on this feature of the symphyseal face when examining Native American skeletons. In fact, it is prudent to record **Symphyseal Texture** stages for Native Americans, but treat them as missing data when estimating age with the computer program (i.e., do not enter the scores on the data entry page).

Figure 2.9. ***Smooth*** *[1] (FC M-I-1).*

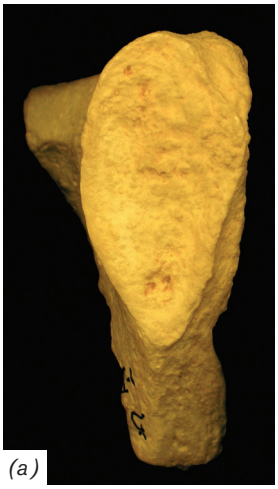


Figure 2.10. ***(a) Coarse grained*** *[2] (FC M-V-1) and* ***(b) Coarse grained*** *[2] (T 862).*

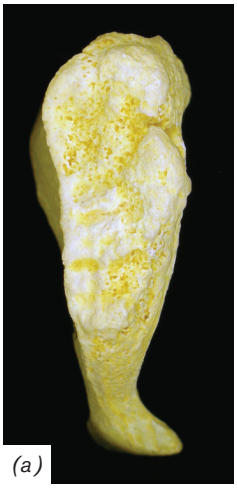


Figure 2.11.
(a) Microporosity *[3] (FC F-III-1),* ***(b) Microporosity*** *[3] (MC 6-69),* ***(c) Microporosity*** *[3] (MC 7-55, image reversed), and* ***(d) Microporosity*** *[3] (NF 19).*

Figure 2.12.
(a) Macroporosity *[4] (FC F-12C) and* ***(b) Macroporosity*** *[4] (NF 191).*

III. Superior Protuberance

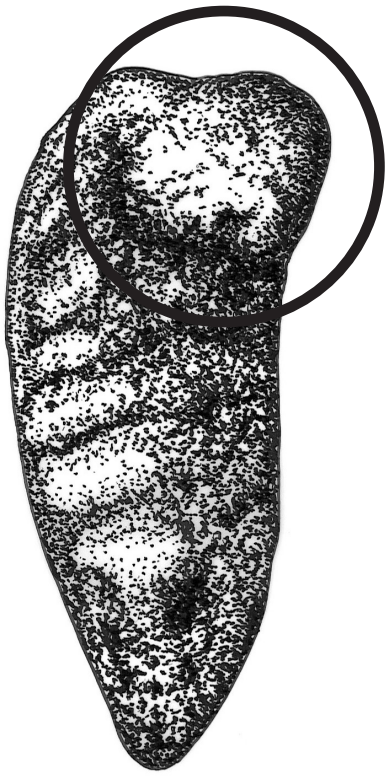


Figure 2.13. Superior Protuberance

LOCATION

The superior part of the symphyseal face is examined for a distinct knob of bone or, later, an elevated area (Figure 2.13).

CHARACTERISTICS [STAGES]

1. No protuberance
2. Early protuberance
3. Late protuberance
4. Integrated

DEFINITIONS

1. *No protuberance*: Deep to shallow billowing is present in the superior part of the symphyseal face (Figure 2.14). There are no signs of a bony protuberance. In young individuals, this part of the symphyseal face can be poorly differentiated from the non-articular portion of the pubis immediately lateral to the joint. This stage is on a symphyseal face characterized by a youthful ridge-and-valley surface.

2. *Early protuberance*: A distinct bony knob of variable dimensions with well-defined margins is visible in the superior part of the symphyseal face (Figure 2.15). It projects above the plane(s) defined by the immediately adjacent symphyseal face (i.e., the superior portions of the dorsal and ventral demifaces, where the latter can be characterized by ventral beveling). The surface of the bony protuberance is typically smooth to fine grained. In many specimens, the bony knob looks like a split pea stuck on the bone.

3. *Late protuberance*: The superior part of the symphyseal face is raised somewhat above the rest of the articulation surface (Figure 2.16). The elevated area is typically located mostly on the ventral side of the midline. The margins of the slightly raised area are poorly defined. These raised areas tend to look like a continuation of a relatively smooth symphyseal surface, except they slope slightly upward to meet the superior margin of the bone. Thus the *Late Protuberance* is more completely integrated with the rest of the symphyseal face than the distinctly knob-like *Early Protuberance*. *Late Protuberance* should not be confused with a narrow raised marginal rim that can border the cranial end of the symphyseal face in many specimens, especially females with narrow pubic symphyses. For a *Late Protuberance* to be scored as present, the slightly raised area must extend onto the symphyseal face; that is, it is not restricted to the rim alone. Occasionally, the superior part of the symphyseal face can be partly separated from the rest of the face by marked and extensive pitting of the middle symphyseal surface. Care must be taken not to confuse an isolated segment of the symphyseal face with a *Late Protuberance* stage. It is only *Late Protuberance* if the superior end of the symphyseal surface is elevated above the portions of the face not affected by the pitting.

4. *Integrated*: The symphyseal face's superior end displays no signs of a low bony elevation (Figure 2.17). The area where the protuberance was formerly present is fully integrated

with the rest of the symphyseal face. That is, the smooth to irregular (usually pitted) symphyseal face is essentially flat. This stage, the absence of a raised area, is distinguishable from Stage 1, *No Protuberance*, because the superior portion of the symphyseal face is flat, not the ridge-and-valley surface typical of the initial *No Protuberance* stage. The *Integrated* stage also frequently has a narrow elevated rim demarcating the superior symphyseal surface, which is a continuation of the ventral or dorsal rims.

SCORING TIPS

Do not confuse a narrow rim bordering the superior margin of the symphyseal face, which commonly occurs in the terminal *Integrated* stage, with the earlier *Late Protuberance* stage. The two stages are distinguishable because the *Late Protuberance* raised area extends onto the upper part of the symphyseal face. In the *Integrated* stage, a flat symphyseal face extends up to, and abuts, a narrow rim, which is commonly present.

Occasionally, a gap exists in the superior one-half of the ventral margin, but the ventral rampart is otherwise completely formed. In that case, the presence of a protuberance is often not scored as the appearance of the bone can be confusing.

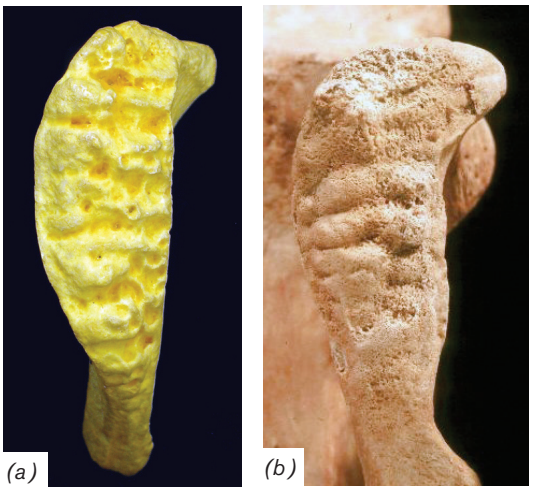


Figure 2.14. ***(a) No protuberance*** *[1] (FC F-I-1) and* ***(b) No protuberance*** *[1] (NF 44).*

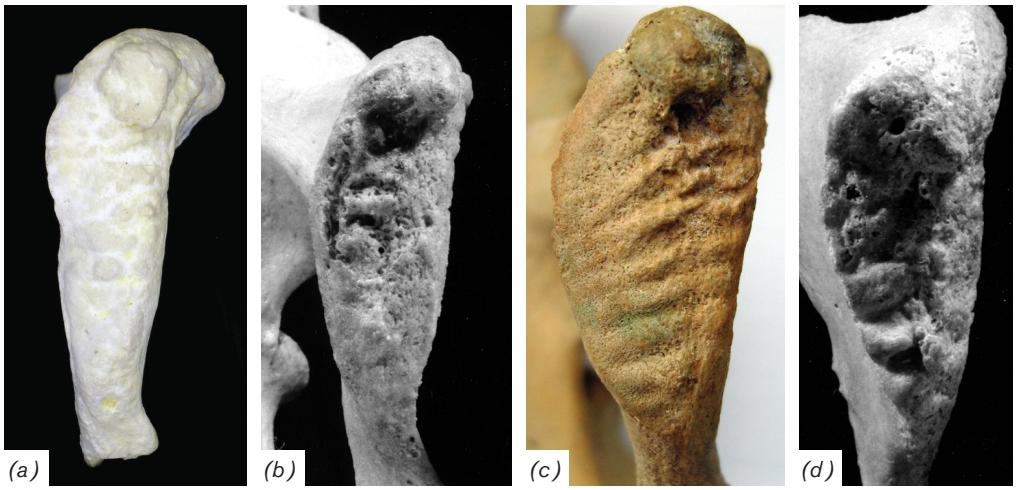


Figure 2.15. ***(a) Early protuberance*** *[2] (FC M-I-2),* ***(b) Early protuberance*** *[2] (T 465),* ***(c) Early protuberance*** *[2] (P 5152, image reversed), and* ***(d) Early protuberance*** *[2] (T 255, image reversed).*

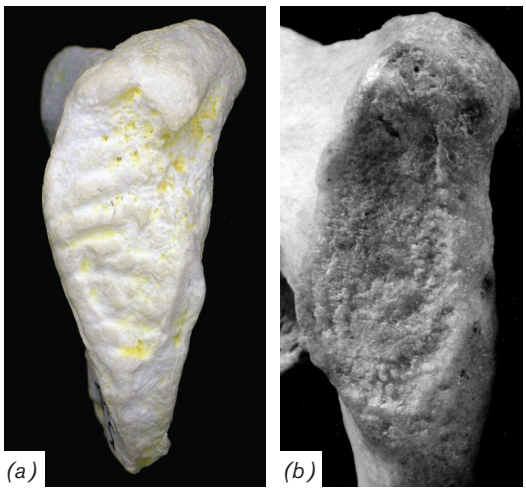


Figure 2.16. ***(a) Late protuberance*** *[3] (FC M-III-1) and* ***(b) Late protuberance*** *[3] (T 862).*

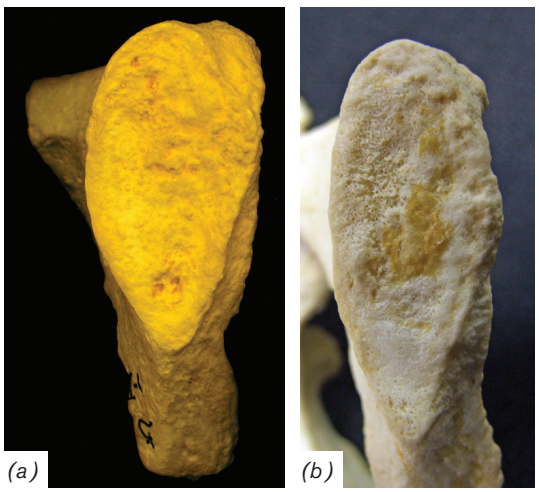


Figure 2.17. ***(a) Integrated*** *[4](FC M-V-1) and* ***(b) Integrated*** *[4] (MC 7-55).*

IV. Ventral Symphyseal Margin

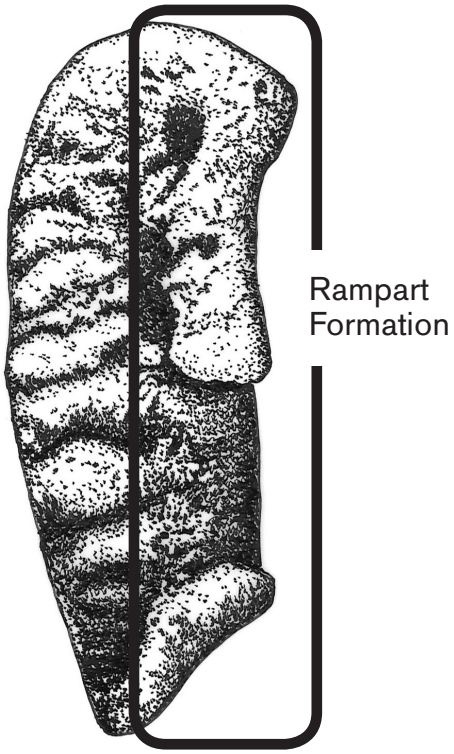


Figure 2.18. ***Ventral Symphyseal Margin***

LOCATION

The ventral margin of the pubic symphysis is scored separately from the rest of the bone (Figure 2.18).

CHARACTERISTICS [STAGES]

1. **Serrated**
2. **Beveled**
3. **Rampart formation**
4. **Rampart completion with anterior sulcus**
5. **Rampart completion without sulcus**
6. **Rim**
7. **Breakdown**

DEFINITIONS

1. *Serrated*: Ridges and furrows typical of *Sharp* or *Soft Deep Billowing* extend uninterrupted across the ventral part of the symphyseal face, producing a serrated or jagged ventral margin, especially when viewed from the front of the bone (Figure 2.19).

2. *Beveled*: Billows are flattened in the ventral half of the symphyseal face, a process that generally starts at the superior end (Figure 2.20). Flattening, or beveling, must extend along at least one-third of the ventral margin to be scored as present. There is often a reasonably well-defined margin where the beveled ventral portion meets the dorsal demiface immediately posterior to it.

3. *Rampart incomplete*: The ventral rampart, following McKern and Stewart (1957), refers to a distinct outgrowth of bone that ultimately forms the ventral aspect of the symphyseal face (Figure 2.21). The rampart extends from one or both ends of the symphysis, and it often resembles a roll of well-chewed gum stuck on the ventral edge of the symphyseal face. The rampart does not extend along the entire ventral edge, and often some elements of a youthful symphyseal surface can be followed uninterrupted to the ventral edge of the smphysis. In the superior part of the ventral margin, the rampart forms on the *Beveled* surface. In the inferior part of the margin, remnants of the original irregular surface can often be seen dipping below a partially formed rampart, which looks as if it was lying on a shallowly furrowed surface. An incomplete rampart frequently extends inferiorly from the bony protuberance defining the cranial end of the face, sometimes forming a bony elevation that resembles a comma, with the rampart being the tail.[1] A rampart can also extend superiorly from the inferior end of the symphysis. Bony extensions from the superior and inferior ends of the symphysis, if both are present, typically leave a gap in the middle one-third of the ventral margin. An early *Rampart Incomplete* stage can consist of one or more bony knobs, commonly located in the middle one-third of the ventral margin. The knobs can occur with, or without, the formation of a bony rampart extending from the superior and inferior ends of the symphysis. If the rampart is more than two-thirds complete but there is a gap in the superior part of it, you should consider the possibility

[1] *A well-developed bony protuberance at the cranial end of the face that lacks a distinct inferiorly projecting ventral rampart should not be coded as Ventral Rampart Formation; that is, the mere existence of a cranially located bony knob without bone being laid down along the ventral margin is not sufficient to score the ventral rampart as present.*

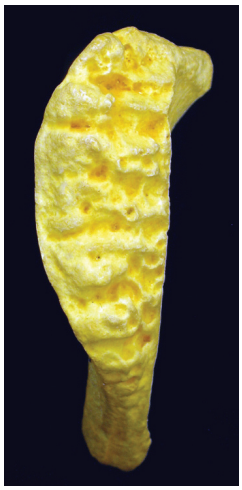


Figure 2.19. ***Serrated*** *[1] (FC F-I-1).*

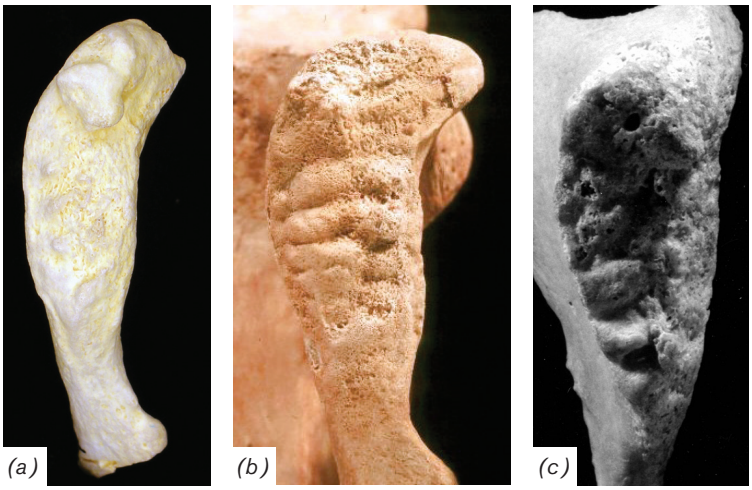


Figure 2.20. ***(a) Beveling*** *[2] (FC M-12),* ***(b) Beveling*** *[2] (NF 44), and* ***(c) Beveling*** *[2] (T 255, image reversed).*

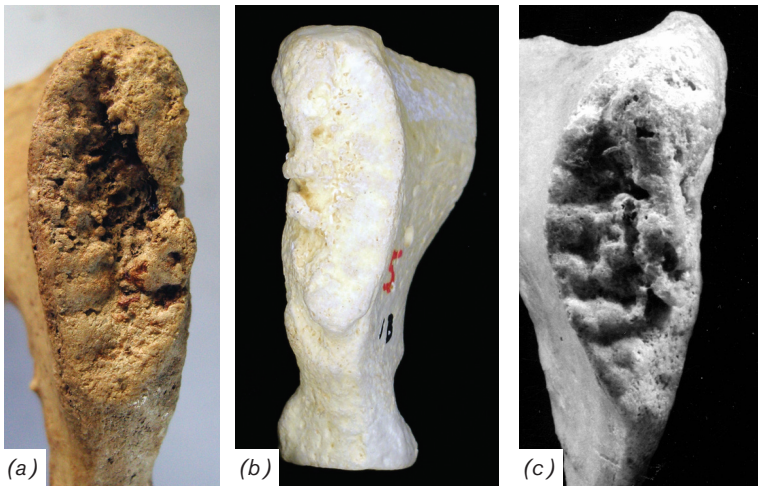


Figure 2.21. ***(a) Rampart formation*** *[3] (P 6120, image reversed),* ***(b) Rampart formation*** *[3] (FC M-1B, image reversed), and* ***(c) Rampart formation*** *[3] (T 255).*

that the specimen is in the *Rampart Complete with Anterior Sulcus* or *Rampart Complete without Sulcus* stages. Occasionally a rampart never completely forms along the ventral margin.

4. *Rampart Complete with Anterior Sulcus*: *Rampart Complete 4 and 5* are similar to one another. What distinguishes them is the appearance of the anterior surface of the bone immediately lateral to the symphyseal margin. In *Rampart Complete with Anterior Sulcus* [4], the ventral rampart is complete, but there is a shallow sulcus extending along much of the length of the ventral pubis immediately lateral to the symphysis (often more pronounced inferiorly). The groove is a residual feature related to rampart formation along the ventral margin. A reasonably flat symphyseal surface extends uninterrupted from the dorsal to ventral margins, so the face is unlike the somewhat furrowed appearance of many *Rampart Incomplete* specimens where there is a shallow groove just dorsal to an incomplete ventral rampart. Occasionally a gap exists in the ventral margin, usually in its superior half; the ventral rampart is otherwise completely formed. This stage is only occasionally found in most skeletal samples that have been examined. Typically the completed rampart is a *Stage 5, Rampart Complete without Sulcus*. The only difference between Stages 4 and 5 is the presence of the anterior sulcus in Stage 4.

5. *Rampart Complete without Sulcus*: The ventral rampart is

complete, and there is no shallow sulcus as described in *Rampart Complete 4*. A reasonably flat symphyseal surface extends uninterrupted from its dorsal to ventral margins, so the face is unlike the somewhat furrowed appearance of many *Rampart Incomplete* specimens where there is also a shallow groove just dorsal to the incomplete ventral rampart. Occasionally there is a gap in the superior half of the ventral margin, but the ventral rampart is otherwise complete (Figure 2.27a). These specimens should be classified as *Rampart Complete*. With regard to *Rampart Complete With and Without Anterior Sulcus (Stages 4 and 5)*, most specimens are in the later Stage 5.

6. *Rim*: A narrow, bony rim defining the ventral margin of the symphysis, perched on top of the ventral rampart, demarcates a usually flat or irregular face (Figure 2.22). The rim does not have to be complete, but it must be at least 1 cm long and readily visible as a raised ridge adjacent to a slightly recessed symphyseal face. The rim can be either a continuous ridge of bone or several segments, as long as 1 cm of an elevated border is present. The rim's crest can be low and rounded, or narrow and sharp. A ventral rim is always formed on top of a ventral rampart. Odd rim-like bone formations on gaps in a rampart or formed with no rampart at all are not scored as a ventral rim.
7. *Breakdown*: The ventral margin of the symphyseal face has begun to break down, as indicated by pitting and an erosion of the *Rim* (Figure 2.23). The breakdown of the ventral margin must exceed 1 cm (either in one spot, or when two or more areas of erosion are combined) to be scored as present. Care must be taken to distinguish antemortem degeneration – that is, true *Breakdown* – from postmortem damage. The latter, of course, can render the bone unscorable if it is extensive enough.

SCORING TIPS

In mature pubic symphyses there can be a gap in the ventral margin, as noted by McKern and Stewart (1957: 77, Fig. 40) who called it the "ventral hiatus (Figure 2.27a)". Gaps, when present, usually occur in the superior half of the pubic symphysis. In most instances, they are readily distinguishable from incomplete rampart formation because the remainder of the ventral rampart appears complete. That is, the ventral margin elsewhere has a rounded to angular edge, an anterior sulcus is typically absent, and a rim might have developed on the part of the rampart that is present. In addition, the symphyseal surface extends uninterrupted from the dorsal to ventral margins, and it is often flat. The appearance of the symphyseal face contrasts sharply with what is present in the typical *Rampart Incomplete* stage. In the earlier *Rampart Incomplete 4* stage, a shallow depression is often present immediately dorsal to the newly formed and still rather narrow rampart, and much of the rest of the symphyseal face is marked by remnants of the original ridges and furrows.

Occasionally in the *Rim* or *Breakdown* stages, there is also a separate bony growth or collar, presumably ossified ligaments, adjacent to the ventral margin that is separated from the symphyseal face by a groove. It only occurs on old people, and it is more commonly found toward the superior end of the pubic symphysis. This bony structure is not scored and should not to be confused with what is happening on the symphyseal surface or its margin.

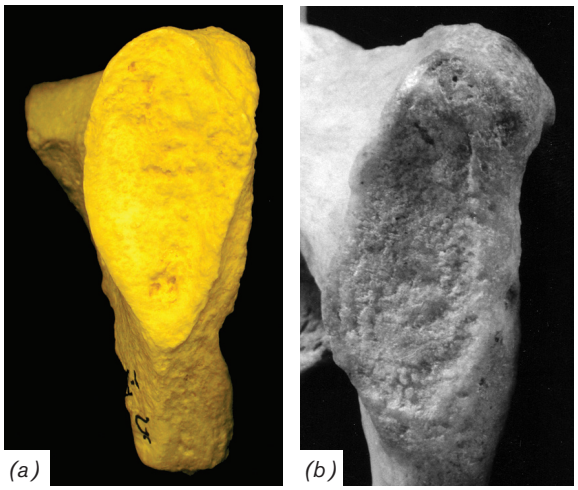


Figure 2.22. ***(a) Rim*** *[6] (FC M-V-1) and* ***(b) Rim*** *[6] (T 862).*

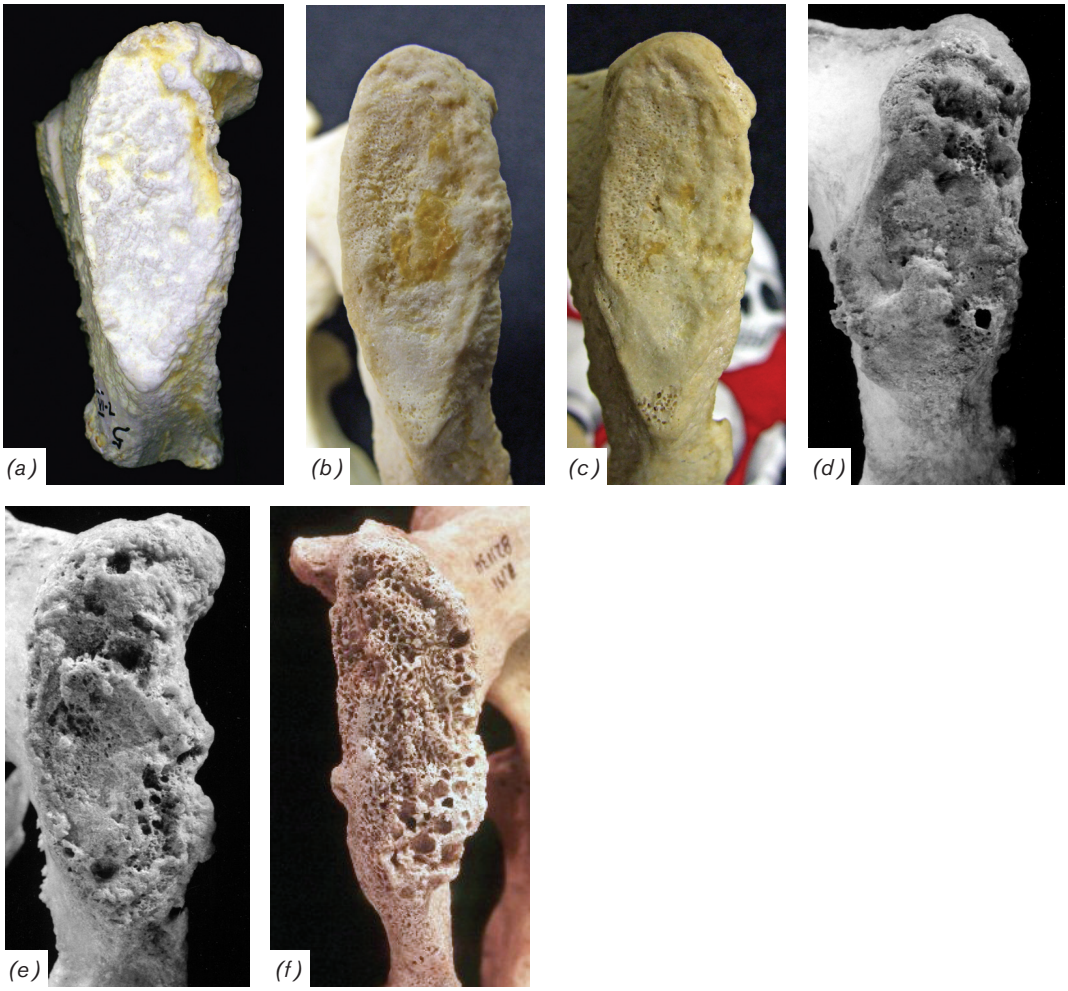


Figure 2.23. ***(a) Breakdown*** *[7] (FC M-VI-2),* ***(b) Breakdown*** *[7], breakdown superiorly and rim inferiorly (MC 7-55),* ***(c) Breakdown*** *[7], breakdown most of margin (MC 7-55, image reversed),* ***(d) Breakdown*** *[7] (T 500),* ***(e) Breakdown*** *[7] (T 1115), and* ***(f) Breakdown*** *[7] (NF 191).*

V. Dorsal Symphyseal Margin

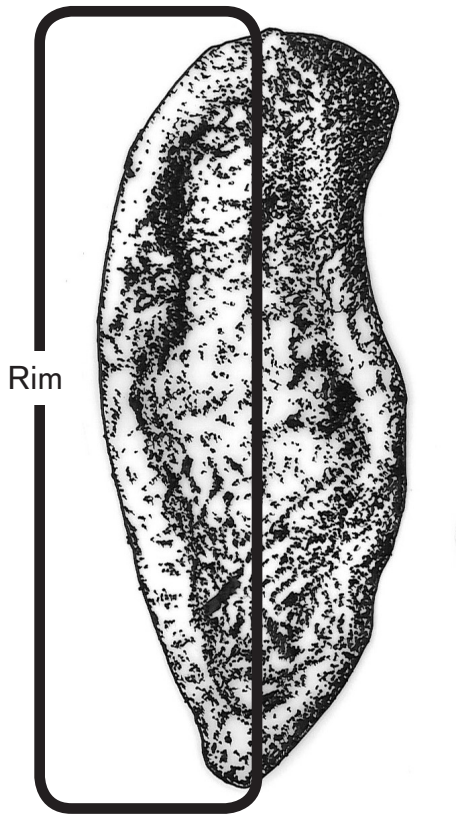


Figure 2.24. ***Dorsal Symphyseal Margin***

LOCATION

The dorsal part of the pubic symphysis is scored separately from the ventral margin (Figure 2.24). In females, dorsally located characteristics can be partly or entirely obscured by large postpartum, or parity, pits. Occasionally, such specimens cannot be scored properly.

CHARACTERISTICS [STAGES]

1. **Serrated**
2. **Flattening incomplete**
3. **Flattening complete**
4. **Rim**
5. **Breakdown**

DEFINITIONS

1. *Serrated*: The dorsal margin of the symphyseal face is irregular because ridges and furrows typical of pronounced billowing extend uninterrupted to the edge of the bone (Figure 2.25).

2. *Flattening incomplete*: A well-defined flattened area at least 1 cm long is present where the symphyseal face meets the dorsal margin (Figure 2.26). Flattening usually starts in the superior part of the dorsal demiface; the remainder of the margin has the ridge and valley configuration typical of a youthful symphyseal face. The undulating edge usually occurs in the inferior part of the symphyseal face. Note that billowing is also present on the dorsal demiface, and it typically produces an undulating edge to the pubic symphysis, although it is usually not as extreme as what is found in *Serrated* specimens.

3. *Flattening complete*: There is a rather obvious area of flattening that completely (or almost entirely) covers the symphyseal face where it meets the dorsal margin (Figure 2.27). This flattening seemingly occurs partly through a coalescence of billows. A small area at the inferior end of the dorsal margin occasionally retains an undulating appearance.

4. *Rim*: An elevated bony rim demarcates a flat or, infrequently, an irregular face (Figure 2.28). The rim projects slightly above the symphyseal face, and its crest can be blunt or sharp. The rim does not have to extend along the entire dorsal margin to be scored as present, but it must be at least 1 cm long. The 1 cm rule pertains to either a continuous rim or discontinuous segments that together sum to that length. A rim typically develops first along the superior part of the dorsal margin. It can, however, occur anywhere along the dorsal margin.

Figure 2.25.
***Serrated** [1] (FC F-I-1).*

Figure 2.26.
***Flattening incomplete** [2] (FC M-II-1).*

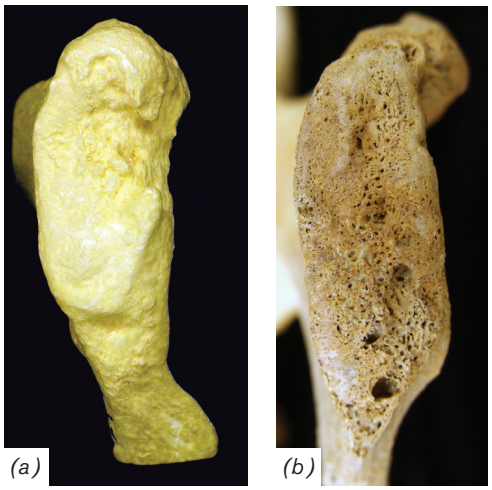


Figure 2.27.
***(a) Flattening complete** [3] (FC M-III-2) and*
***(b) Flattening complete** [3] (NF 229).*

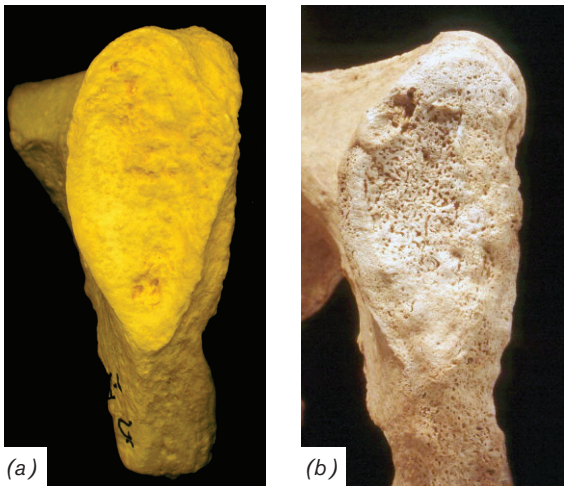


Figure 2.28.
***(a) Rim** [4] (FC M-V-1) and **(b) Rim** [4] (NF 19).*

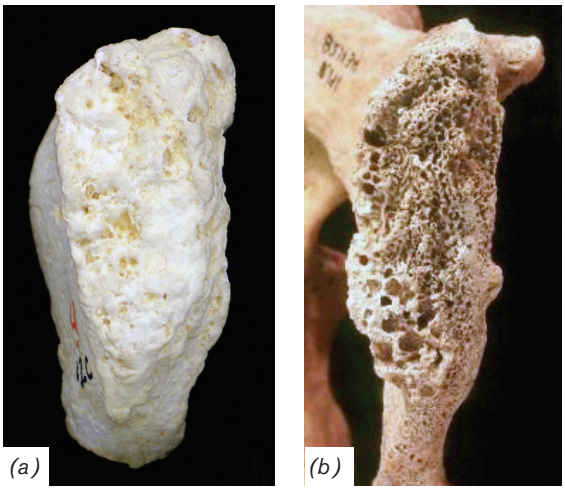
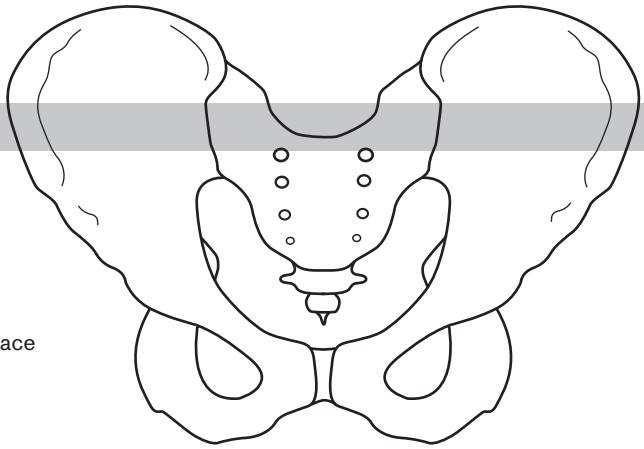


Figure 2.29.
***(a) Breakdown** [5] (FC F-12C) and*
***(b) Breakdown** [5] (NF 191)*

5. *Breakdown*: The dorsal margin where the Rim is located shows evidence of breakdown, specifically a pitting and erosion of the edge of the pubic symphysis (Figure 2.29). The breakdown must exceed 1 cm in length either in one spot or when two or more areas of erosion are combined. Care must be taken to differentiate antemortem degeneration of the margin from postmortem damage, which is of no concern. Antemortem destruction attributable to large parity pits in females that can undercut the dorsal margin is not considered breakdown in the sense of the term as used here. It might not be possible to score those specimens; when that occurs, the component is simply missing data.

Sacroiliac Joint



Two aspects of the sacroiliac joint on the ilium are examined (Figure 2.30):

1. the auricular (joint) surface
2. the ilium immediately posterior to the joint surface

Anatomical features and terms follow those of Lovejoy and colleagues (1985) where possible.

Nine separate components are examined for the iliac portion of the sacroiliac joint:

- **I. Superior Demiface Topography**
- **II. Inferior Demiface Topography**
- **III. Superior Surface Characteristics**
- **IV. Middle Surface Characteristics**
- **V. Inferior Surface Characteristics**
- **VI. Inferior Surface Texture**
- **VII. Superior Posterior Iliac Exostoses**
- **VIII. Inferior Posterior Iliac Exostoses**
- **IX. Posterior Exostoses**

I. Superior Demiface Topography

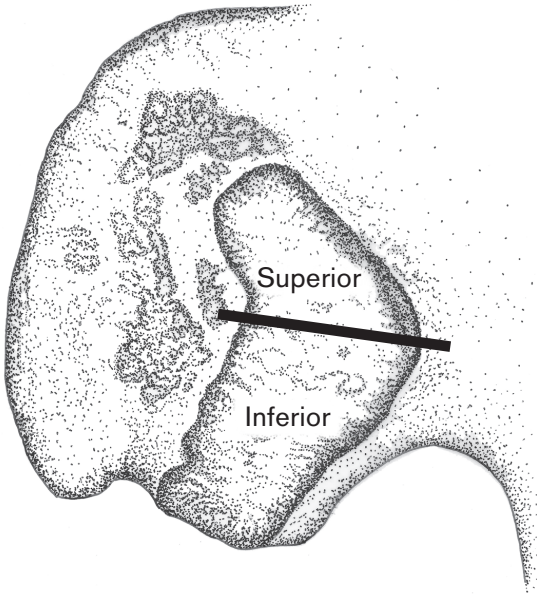


Figure 2.30 ***Superior Demiface Topography***

LOCATION

The superior demiface is examined. The two demifaces (superior and inferior) are divided by a line extending posteriorly from the most anterior point of the apex to the posterior joint margin.

CHARACTERISTICS [STAGES]

1. Undulating
2. Median elevation
3. Flat to Irregular

DEFINITIONS

1. *Undulating*: The surface is undulating in a superior to inferior direction. There is no centrally located and linear area of elevated bone (*Median Elevation*). When the entire articular surface is viewed in aggregate, the overall effect is of two or three low waves proceeding lengthwise along the joint (Figure 2.31).

2. *Median elevation*: In the middle to posterior part of the demiface there is a broad raised area where the joint surface is elevated slightly above the rest of the joint (Figure 2.32). The elevation is flanked anteriorly, posteriorly, or both by one or two long, low areas. The elevated area takes the form of an elongated ridge with the long axis paralleling the main orientation of the demiface. It is not unusual for the elevated area to be restricted to a noticeably raised area that does not extend the entire length of the demiface. When that occurs, the raised area is typically located in the inferior portion of the demiface. To be scored as present, the elevated area must extend along at least one-third of the joint surface's length.

3. *Flat to irregular*: The surface is essentially flat or recessed, a result of marginal lipping, or it is irregular from degeneration of the joint or the formation of low, pillow-like exostoses (Figure 2.33).

SCORING TIPS

These comments pertain to **Superior and Inferior Demiface Topography**. The first thing to do is to place your thumb such that it masks the superior demiface, and then score the inferior part of the joint. The characteristics of the inferior demiface are generally easier to see, and to score reliably, than the superior demiface, especially with regard to the *Median Elevation*. Then move your thumb so it masks much of the inferior part of the joint so you just look at the superior part. The purpose of this exercise is to prevent being influenced by what is happening in the part of the joint that is not being scored.

When deciding which of the stages is represented, it is easiest to determine if a *Median Elevation* is present first. It will be generally more pronounced on the inferior demiface. If it is not present, the surface is typically in the *Flat* to *Irregular* stage. The *Undulating* variant is almost always found on the ilia of young people in their teens or twenties. The **Superior Demiface** *Undulating* and *Median Elevation* features are more subdued and harder to distinguish than those of the **Inferior Demiface**.

Most specimens are either *Median Elevation* [2] or *Flat to Irregular* [3]. Occasionally in young adults a median elevation appears to be in the process of forming on an otherwise undulating surface. The median elevation is short and typically centrally located on the superior demiface (rarely this occurs on the inferior demiface). Because the median elevation, if present, is poorly defined, these specimens are best coded as 1-2.

Figure 2.31. ***Undulating*** *[1], inferior and superior (subtle) parts (P 5897).*

Figure 2.32. ***Median elevation*** *[2], superior part (MC 6-73).*

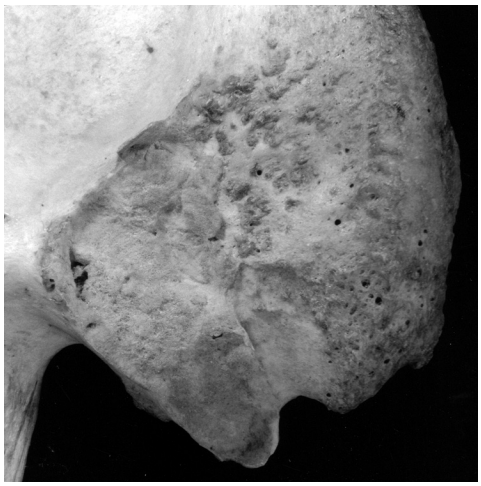


Figure 2.33. ***Flat*** *[3], superior and inferior parts (T 500).*

II. Inferior Demiface Topography

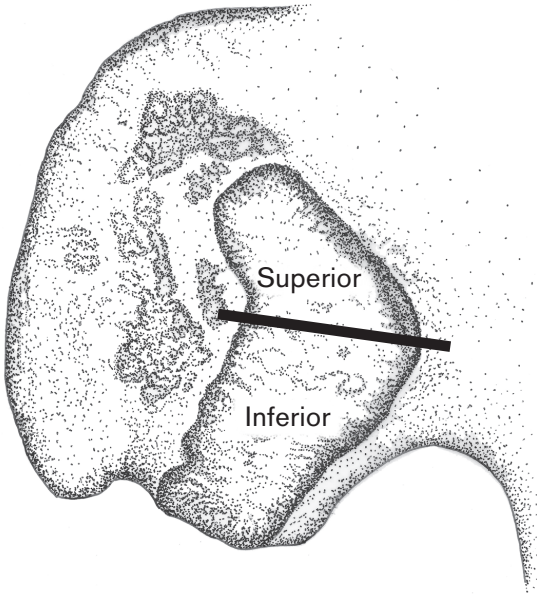


Figure 2.30. ***Superior Demiface Topography***

LOCATION

The inferior demiface is examined. The superior and inferior demifaces are divided by a line extending posteriorly from the most anterior point of the apex to the posterior border of the joint (see Figure 2.30).

CHARACTERISTICS [STAGES]

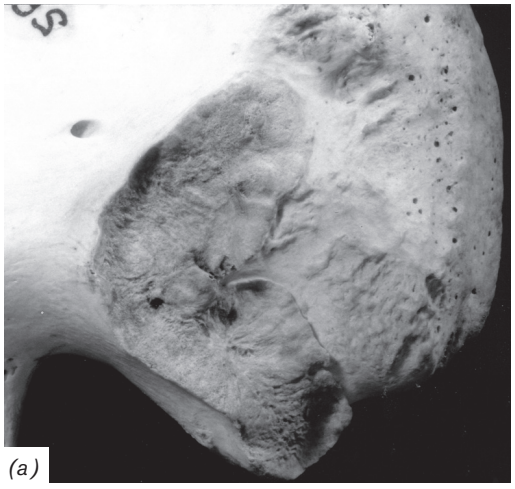
1. Undulating
2. Median elevation
3. Flat to Irregular

DEFINITIONS

1. *Undulating*: The surface is undulating in a superior to inferior direction (Figure 2.34). There is no centrally located linear area of elevated bone (*Median Elevation*). When the entire articular surface is viewed in aggregate, the overall effect is of two or three low waves proceeding lengthwise along the joint.

2. *Median elevation*: In the middle to posterior part of the demiface there is a broad raised area where the joint surface is elevated slightly above the rest of the joint (Figure 2.35). The elevation is flanked anteriorly, posteriorly, or both by one or two long, low areas. The elevated area takes the form of an elongated ridge with the long axis paralleling the main orientation of the demiface. It is not unusual for the elevated area to be restricted to a noticeably raised area that does not extend the entire length of the demiface. To be scored as present, the elevated area must extend along at least one-third of the joint surface's length

3. *Flat to irregular*: The surface is essentially flat or recessed, a result of marginal lipping, or it is irregular from degeneration of the joint or the formation of low, pillow-like exostoses (Figure 2.36).


(a)

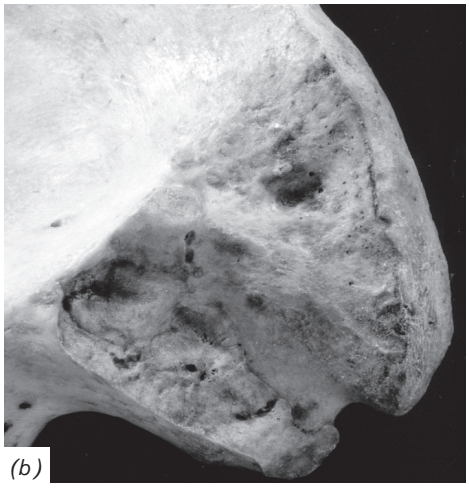

(b)

Figure 2.34.
(a) Undulating *[1], inferior part (T 269, image reversed),*
(b) Undulating *[1], inferior part (T 385, image reversed)*

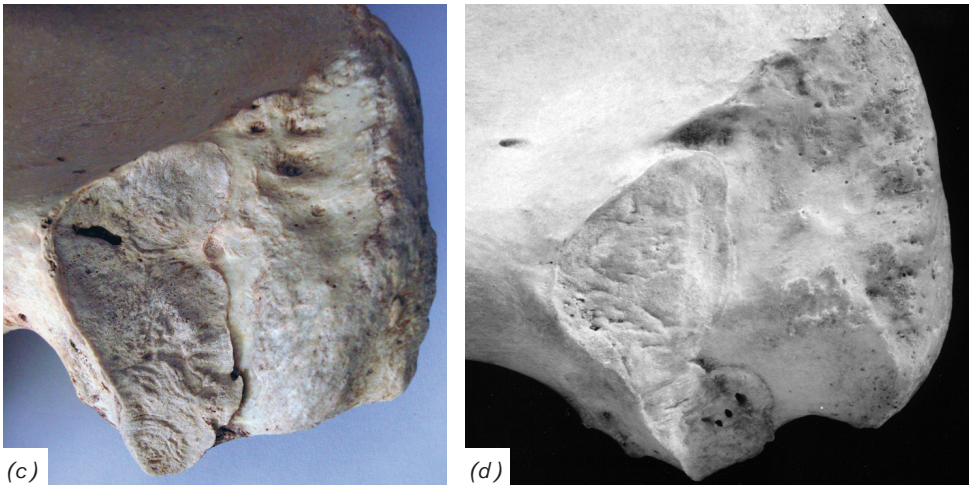


Figure 2.34. ***(c) Undulating*** *[1], inferior and superior (subtle) parts (P 5897), and* ***(d) Undulating*** *[1], inferior part (T 255).*

Figure 2.35.
Median elevation *[2], inferior part (T 274, image reversed).*

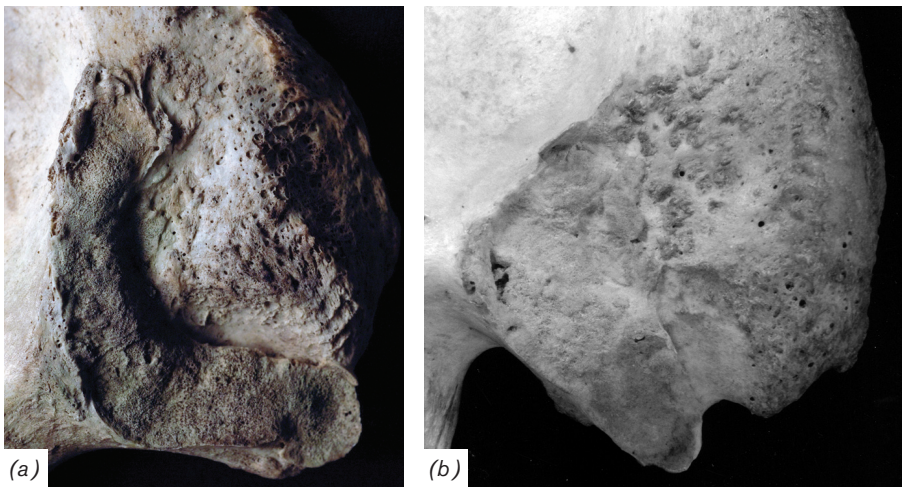


Figure 2.36.
(a) Flat *[3], inferior part (MC 6-73) and* ***(b) Flat*** *[3], superior and inferior parts (T 500).*

III. Superior Surface Characteristics

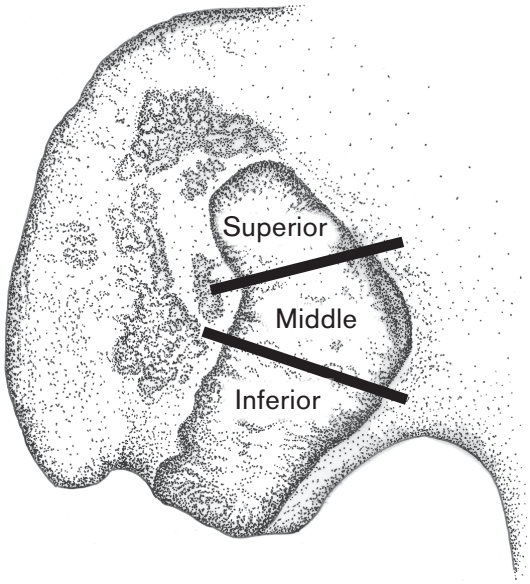


Figure 2.37. ***Superior Surface Characteristics***

LOCATION

The superior part of the face is examined. The joint surface is divided into superior, middle (apical), and inferior segments (Figure 2.37).

CHARACTERISTICS [STAGES]

1. **>2/3 covered by billows**
2. **1/3-2/3 covered by billows**
3. **<1/3 covered by billows**
4. **Flat (no billows)**
5. **Bumps**

DEFINITIONS

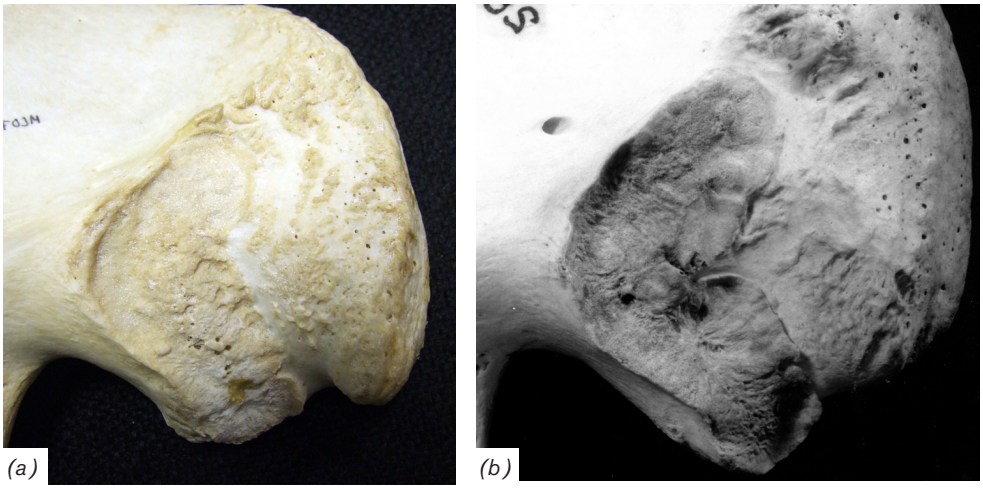
1. *Billows cover >2/3 of the surface*: Low, rounded ridges separated by furrows with have distinctly rounded bases are clearly identifiable (Figure 2.38). The ridge surfaces are curved from the depths of the furrows completely across their crests. Most or all of the billowing is oriented roughly anterior to posterior, and furrows can run across much of the face. Billowing covers most (>2/3) of the joint surface (i.e., it is a dominant element of the surface).
2. *Billows cover 1/3-2/3 of the surface*: About one-half of the surface is covered by billows.
3. *Billows cover <1/3 of the surface*: Billows are a noticeable, but minor, component of the joint surface. The rest of the surface is flat or bumpy.
4. *Flat* (no billows): The joint surface is flat (Figure 2.39).
5. *Bumps*: Most, or all, of the joint surface is covered by low, rounded bony exostoses, much like little irregular pillows (Figure 2.40). Part of the surface may be flat, but over one-half of it is bumpy. One is often reminded of lentils squished onto the joint surface. The bumps can be discrete low elevations or confluent, in which case the raised areas have irregular margins

Unscorable: If defects in the joint surface are so extensive they obscure much of the face, this characteristic is considered unscorable. The defects often take one of two forms. (1) Irregular and large pits can be present that are for the most part either separate or confluent with one another. The pits can be found anywhere on the joint face. (2) Alternatively, the defects are linear grooves that occur in isolation or as multiple nearby grooves. In either case, they can be up to a centimeter long, and they generally extend in a transverse direction. For the linear defects in particular, the smooth bone of the joint surface frequently laps over into the defect for a short distance. That is, the lips of these defects are covered by smooth-surfaced bone. The grooves are more commonly found in the middle part of the joint surface than toward the superior or inferior parts. They are not to be confused with some form of anomalously deep billows. Occasionally surface defects are sufficient to obscure the **Superior and Inferior Demiface Topography**, although they more often interfere with the proper scoring of the **Superior**, **Middle**, and **Inferior Surface Characteristics**.

SCORING TIPS

These comments pertain to the **Superior**, **Middle**, and **Inferior Surface Characteristics**. The best way to proceed is to first

Figure 2.38.
***Billows** [1-3], middle apical and inferior parts (T-1023).*



(a) *(b)*

Figure 2.39.
***(a) Flat** [4], superior part (MC 7-55, image reversed) and **(b) Flat** [4], superior part (T 269, image reversed).*

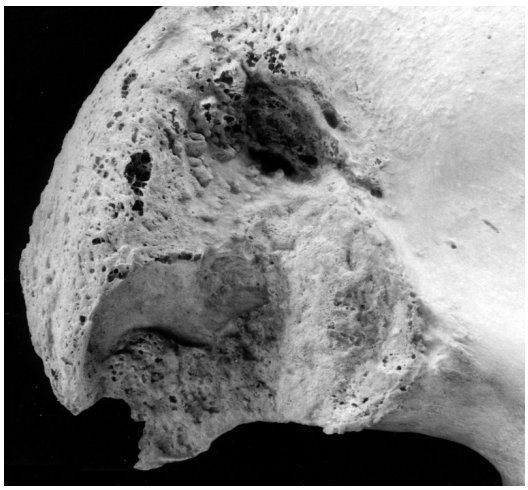


Figure 2.40.
***Bumps** [5] superior part (T-1103R, image reversed).*

bracket the part of the auricular surface that includes the apex with your two thumbs. That defines the middle, or apical, portion. Then move one thumb to define the inferior margin of the superior portion. Finally, use a thumb to define the superior margin of the inferior surface. This simple masking procedure will help counteract the tendency to be influenced by what is present on adjacent parts of the auricular surface.

When scoring the surface characteristics, it is generally easiest to look for billows first. If present, then determine how abundant they are: there are only a few of them, they cover roughly one-half of the surface, or they spread out across much of the surface. If billows are not present, then look for bumps. The low and irregular bumps do not display the generally transverse organization of the billows.

IV. Middle Surface Characteristics

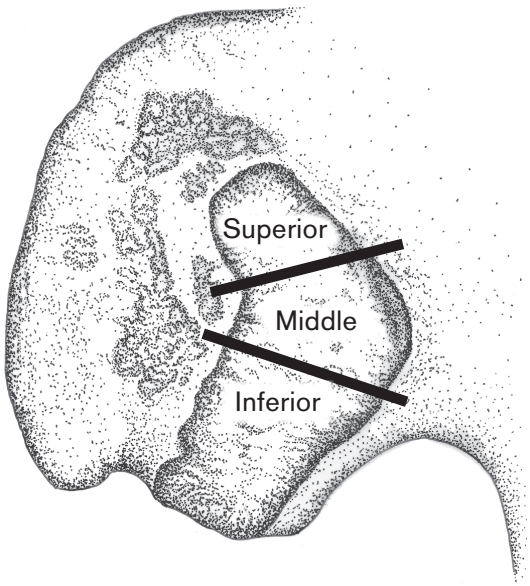


Figure 2.37. ***Superior Surface Characteristics***

LOCATION

The middle part of the face is examined (see Figure 2.37). This area corresponds to the portion of the joint surface that includes the so-called apex – the curved part of the boomerang-shaped auricular surface.

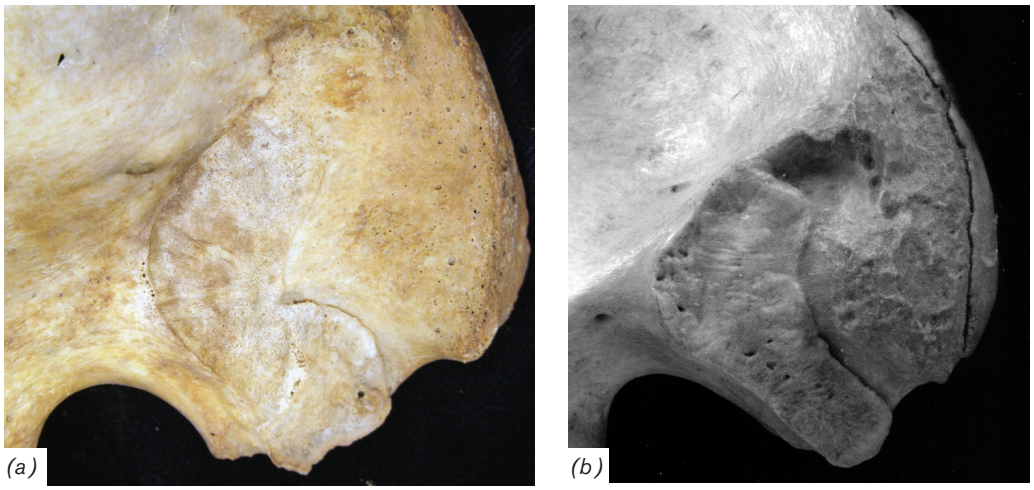
CHARACTERISTICS [STAGES]

1. **>2/3 covered by billows**
2. **1/3-2/3 covered by billows**
3. **<1/3 covered by billows**
4. **Flat (no billows)**
5. **Bumps**

DEFINITIONS

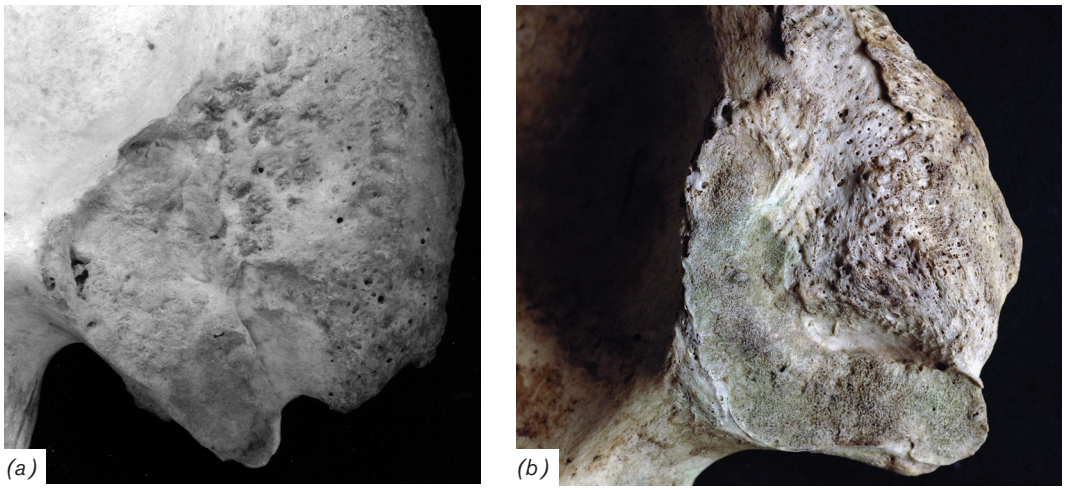
1. *Billows cover >2/3 of the surface*: Low, rounded ridges separated by furrows that have distinctly rounded bases are clearly identifiable (Figure 2.41). The ridge surfaces are curved from the depths of the furrows completely across their crests. Most or all of the billowing is oriented roughly anterior to posterior, and furrows can run across much of the face. Billowing covers most (>2/3) of the joint surface (i.e., it is a dominant element of the surface).
2. *Billows cover 1/3-2/3 of the surface*: About one-half of the surface is covered by billows.
3. *Billows cover <1/3 of the surface*: Billows are a noticeable, but minor, component of the joint surface. The rest of the surface is flat or bumpy
4. *Flat (no billows)*: The joint surface is flat (Figure 2.42).
5. *Bumps*: Most, or all, of the joint surface is covered by low, rounded bony exostoses, much like little irregular pillows (Figure 2.43). Part of the surface may be flat, but over one-half of it is bumpy. One is often reminded of lentils squished onto the joint surface. The bumps can be discrete low elevations or confluent, in which case the raised areas have irregular margins.

Unscorable: If defects in the joint surface are so extensive they obscure much of the face, this characteristic is considered unscorable. The defects often take one of two forms. (1) Irregular and large pits can be present that are for the most part either separate or confluent with one another. The pits can be found anywhere on the joint face. (2) Alternatively, the defects are linear grooves that occur in isolation or as multiple nearby grooves. In either case, they can be up to a centimeter long, and they generally extend in a transverse direction. For the linear defects in particular, it frequently appears as if the smooth bone of the joint surface laps over into the defect for a short distance. The grooves are more commonly found in the middle part of the joint surface than toward the superior or inferior ends. They are not to be considered a form of anomalously deep billows. Occasionally the surface defects are sufficient to obscure the **Superior and Inferior Demiface Topography**, although they more often interfere with the proper scoring of the **Superior**, **Middle**, and **Inferior Surface Characteristics**.



(a) (b)

Figure 2.41.
***(a) Billows** [1-3], middle/apical part (NF 225, image reversed) and **(b) Billows** [1-3], middle apical and inferior parts (T-1023).*



(a) (b)

Figure 2.42.
*(a) **Flat** [4], middle/apical and inferior parts (T-500) and (b) Flat [4] (MC 6-73).*

*Figure 2.43. **Bumps** [5] middle part (P 5750, image reversed).*

V. Inferior Surface Characteristics

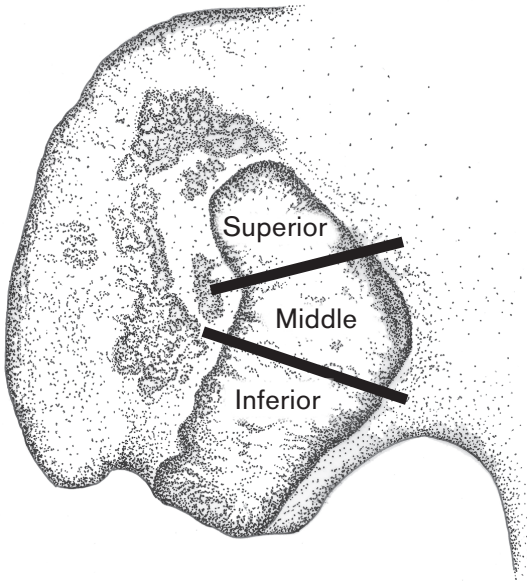


Figure 2.37. ***Superior Surface Characteristics***

LOCATION

The inferior part of the face is examined. On most ilia this is the largest part of the auricular surface as it is defined here (see Figure 2.37).

CHARACTERISTICS [STAGES]

1. >2/3 covered by billows
2. 1/3-2/3 covered by billows
3. <1/3 covered by billows
4. Flat (no billows)
5. Bumps

DEFINITIONS

1. *Billows cover >2/3 of the surface*: Low, rounded ridges separated by furrows with distinctly rounded bases are clearly identifiable (Figure 2.44). The ridge surfaces are curved from the depths of the furrows completely across their crests. Most or all of the billowing is oriented roughly anterior to posterior, and furrows can run across much of the face. Billowing covers most (>2/3) of the joint surface (i.e., it is a dominant element of the surface).
2. *Billows cover 1/3-2/3 of the surface*: About one-half of the surface is covered by billows.
3. *Billows cover <1/3 of the surface*: Billows are a noticeable, but minor, component of the joint surface. The rest of the surface is flat or bumpy.
4. *Flat (no billows)*: The joint surface is flat (Figure 2.45).
5. *Bumps*: Most, or all, of the joint surface is covered by low, rounded bony exostoses, much like little irregular pillows (Figure 2.46). Part of the surface may be flat, but over one-half of it is bumpy. One is often reminded of lentils squished onto the joint surface. The bumps can be discrete low elevations or confluent, in which case the raised areas have irregular margins.

Unscorable: If defects in the joint surface are so extensive they obscure much of the face, this characteristic is considered unscorable. The defects often take one of two forms. (1) Irregular and large pits can be present that are for the most part either separate or confluent with one another. The pits can be found anywhere on the joint face. (2) Alternatively, the defects are linear grooves that occur in isolation or as multiple nearby grooves. In either case, they can be up to a centimeter long, and they extend in a generally transverse direction. For the linear defects in particular, it frequently appears as if the smooth bone of the joint surface laps over into the defect for a short distance. The grooves are more commonly found in the middle part of the joint surface than toward the superior or inferior ends. They are not to be considered a form of anomalously deep billows. Occasionally the surface defects are sufficient to obscure the **Superior and Inferior Demiface Topography**, although they more often interfere with the proper scoring of the **Superior**, **Middle**, and **Inferior Surface Characteristics.**

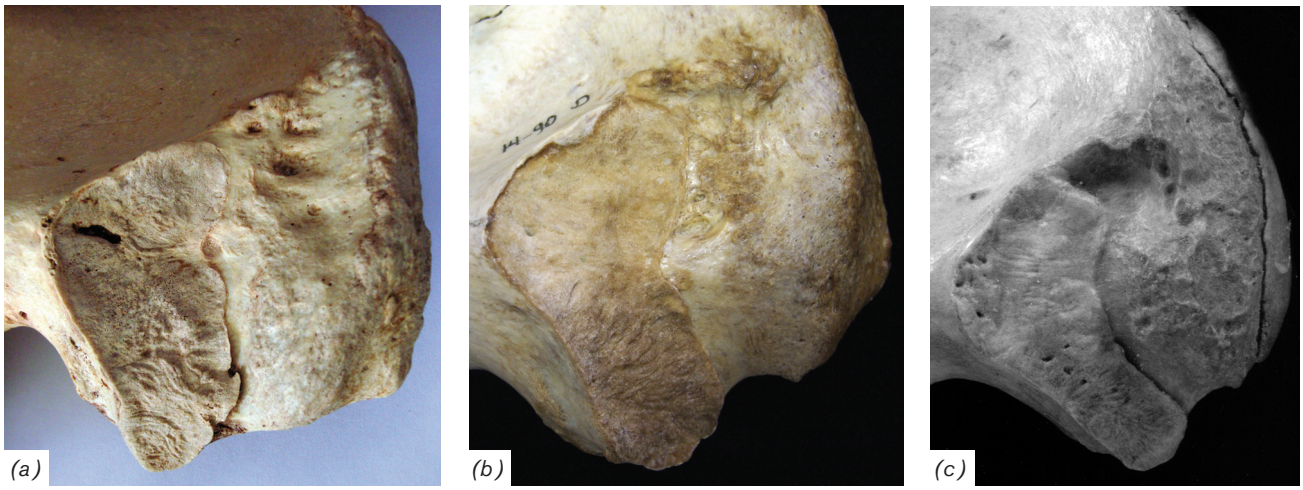


Figure 2.44.
***(a) Billows** [1-3], inferior part (P 5897), **(b) Billows** [1-3], inferior part (Bass 14-90), and **(c) Billows** [1-3], middle/apical and inferior parts (T-1023).*

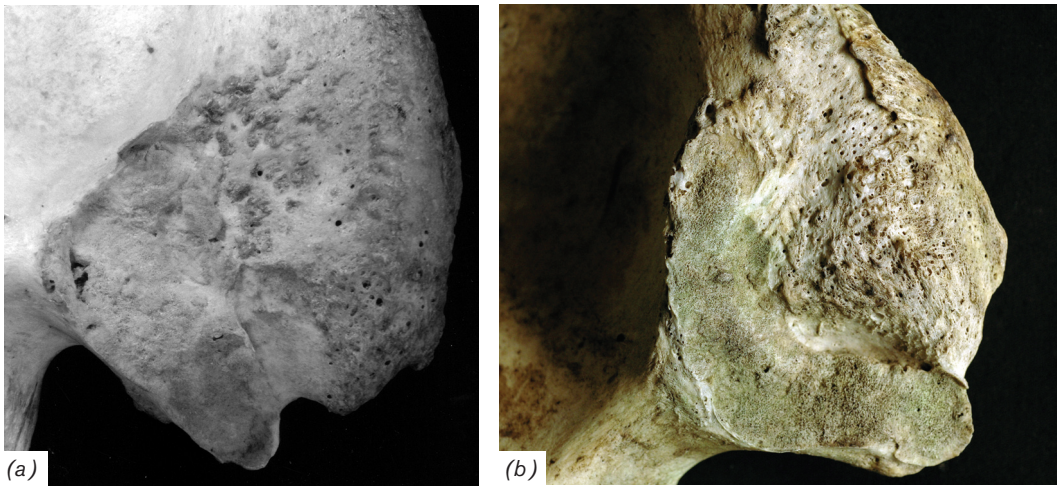


Figure 2.45.
***(a) Flat** [4], apical and inferior parts (T-500) and **(b) Flat** [4] (MC 6-73).*

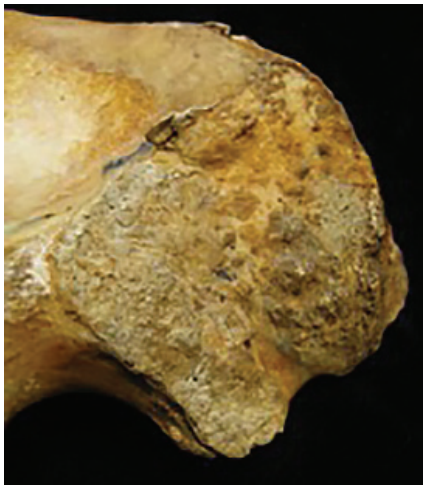


*Figure 2.46. **Bumps** [5] on inferior part (William M. Bass Collection).*

VI. Inferior Surface Texture

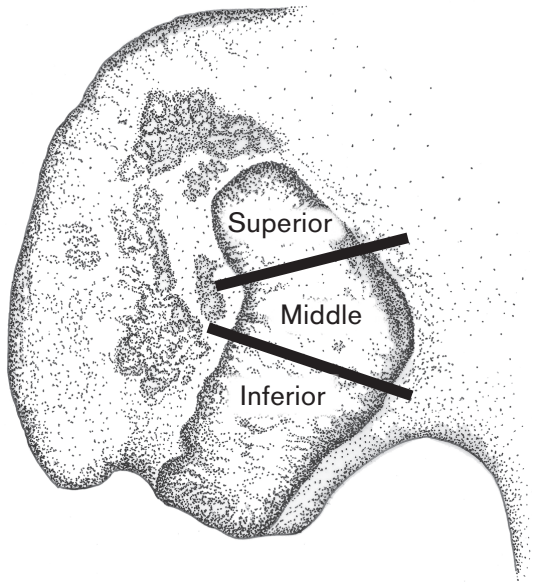


Figure 2.47. ***Inferior Surface Texture***

LOCATION

Only one part of the joint surface – the inferior area – is scored for texture (Figure 2.47). This part of the joint is 1 cm long, as measured in a superior to inferior direction. Occasionally there can be an elongated portion of the joint surface, often accompanied by marginal lipping, that extends well beyond the main body of the ilium. While it can occur in both sexes, it is more often seen in females. Do not score the auricular surface that extends beyond the margin of the ilium proper.

CHARACTERISTICS [STAGES]

1. **Smooth**
2. **Microporosity**
3. **Macroporosity**

DEFINITIONS

1. *Smooth*: Most, or all, of the joint surface appears to be smooth to slightly granular (Figure 2.48).
2. *Microporosity*: At least one-half of the surface has a porous appearance with apertures less than 0.5 mm in diameter (Figure 2.49). The symphyseal face looks as if it is covered by many closely spaced pinpricks.
3. *Macroporosity*: At least one-half of the surface is porous, with most or all of the apertures exceeding 0.5 mm in diameter (Figure 2.50). Here the surface looks as if it was penetrated by multiple closely spaced pinheads (the large end of the same shirt pin mentioned above).

Figure 2.48. ***Smooth*** *[1] (MC 6-69).*

Figure 2.49. ***Microporosity*** *[2] (MC 6-73).*

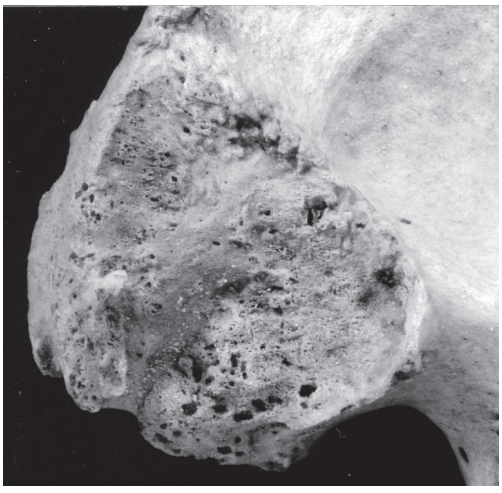


Figure 2.50. ***Macroporosity*** *[3] (T 1394, image reversed).*

VII. Superior Posterior Iliac Exostoses

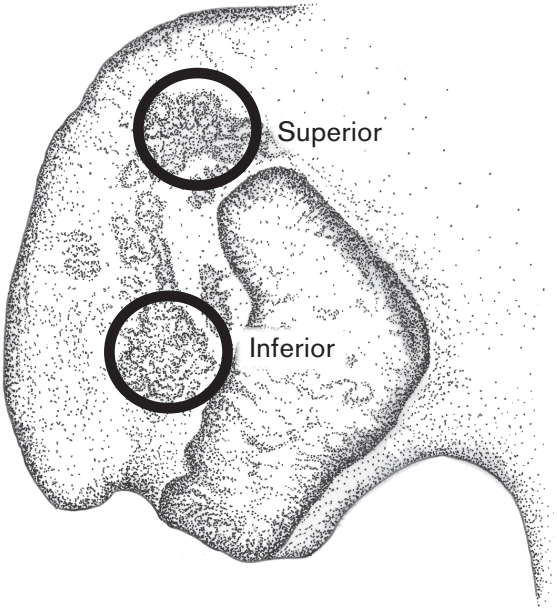


Figure 2.51. ***Superior Posterior Iliac Exostoses***

LOCATION

Superior posterior iliac exostoses are scored. This area refers to the superior part of the medial surface of the posterior ilium where ligaments attach (Figure 2.51). It is located superior to the sacroiliac joint surface; that is, to a line that passes from the anterior superior iliac spine, to the most superior point of the joint surface (the superior angle), and on through the posterior part of the ilium. In some individuals, the bone is distinctly raised in this area, so care must be taken to differentiate jagged (or high) exostoses from rounded or pointed ones perched on top of a raised elevation of bone.

CHARACTERISTICS [STAGES]

1. **Smooth**
2. **Rounded exostoses**
3. **Pointed exostoses**
4. **Jagged exostoses**
5. **Touching exostoses**
6. **Fusion**

DEFINITIONS

1. *Smooth*: The surface is often elevated in this area, but shows no evidence of discrete bony elevations (Figure 2.52). At most there are one or two isolated small exostoses.
2. *Rounded exostoses*: Definite raised areas of bone with rounded crests dominate the scoring area (Figure 2.53).
3. *Pointed exostoses*: Over one-half of the rough area where ligaments attach is dominated by sharply pointed, but short elevations of bone (Figure 2.54).
4. *Jagged exostoses*: The raised areas of bone have a jagged appearance where ligaments attach in life (Figure 2.55). These exostoses, which can have either round or sharp ends, are tall, extending several millimeters upward from the original bone surface.
5. *Touching exostoses or facet*: There is a distinct oval facet where the ilium and sacrum are in close justaposition, often 5 mm in diameter or more. This facet can occur either on top of a pronounced growth of bone or on an iliac surface that is relatively flat.
6. *Fusion*: The ilium and sacrum are fused by exostoses in this area.

SCORING TIPS

These comments pertain equally to the **Superior and Inferior Posterior Iliac Exostoses**. If the ilium is fused to the sacrum at the margins of the auricular surface (usually the superior-anterior margin), you should score the **Superior and Inferior Exostoses** as not observable. The effect of fusion on the posterior exostoses is unknown. The common adult condition is to have either *Rounded* or *Pointed Exostoses*. The *Smooth* variant is typically found on the ilia of very young adults. You will rarely see sharp *Jagged Exostoses.*

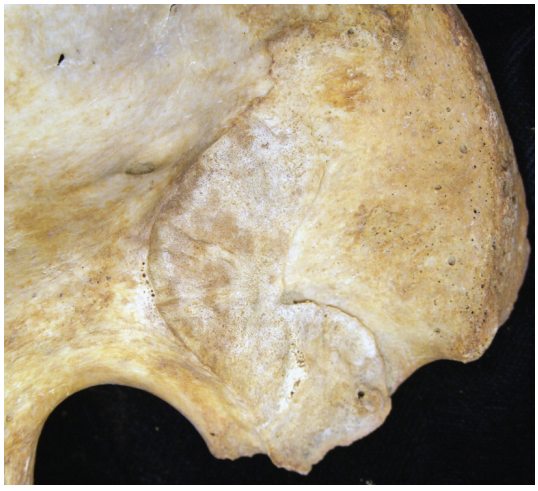


Figure 2.52. ***Smooth*** *[1] superior exostoses (NF 225, image reversed).*

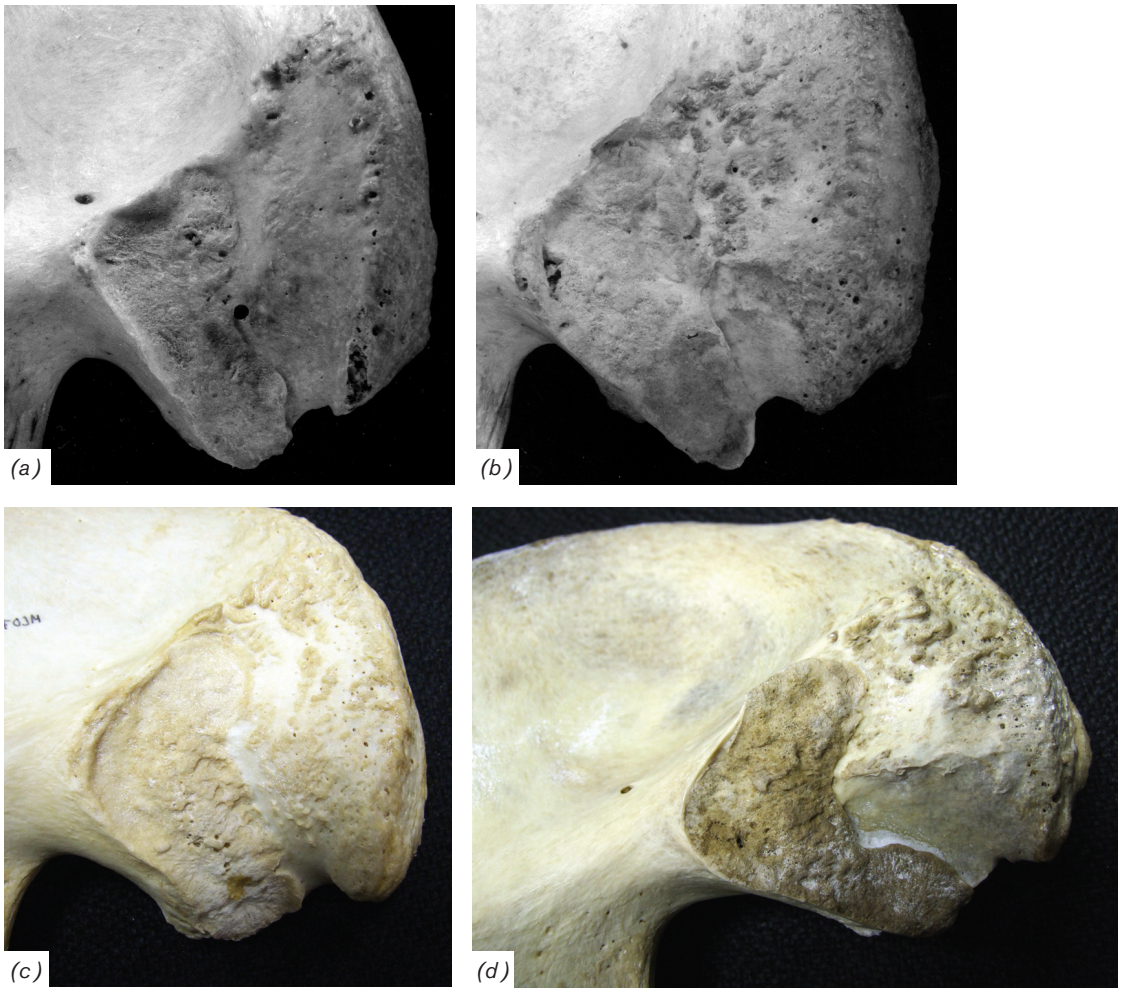


Figure 2.53.
***(a) Rounded** [2], superior (T 862), **(b) Rounded** [2], superior exostoses (T 500), **(c) Rounded** [2], superior and inferior exostoses (MC 7-55, image reversed), and **(d) Rounded** [2], superior (MC 7-76*

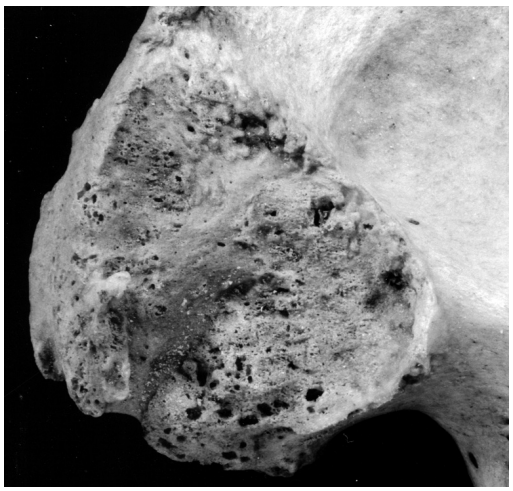


Figure 2.54.
***Pointed** [3], superior (T 1394, image reversed).*

*Figure 2.55. **Jagged.***

VIII. Inferior Posterior Iliac Exostoses

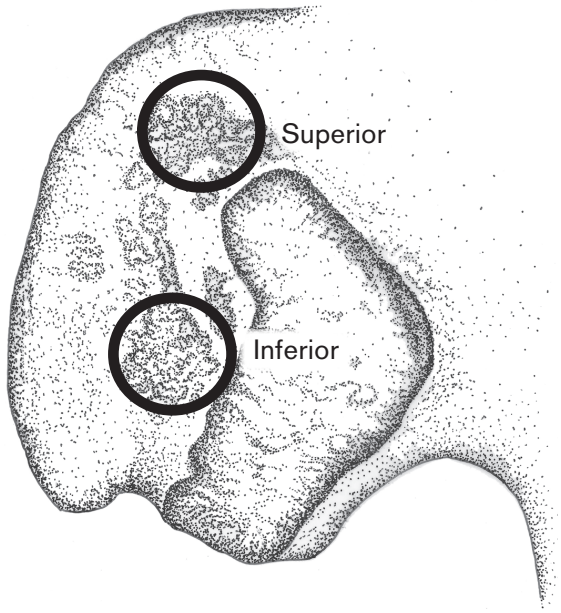


Figure 2.51. ***Superior Posterior Iliac Exostoses***

LOCATION

The inferior posterior iliac exostoses are scored. This area refers to the inferior part of the medial surface of the posterior ilium where ligaments attach (see Figure 2.51). It is located inferior to a line that passes from the anterior superior iliac spine, to the most superior point of the sacroiliac joint surface (the superior angle), and on through the posterior part of the ilium. This area is located immediately posterior to the middle of the sacroiliac joint; that is, it lies behind the most anteriorly projecting part of the posterior margin of the joint. In some individuals, the bone is distinctly raised in this area, so care must be taken to differentiate jagged (or high) exostoses from rounded or pointed ones perched on top of a raised elevation of bone.

CHARACTERISTICS [STAGES]

1. **Smooth**
2. **Rounded exostoses**
3. **Pointed exostoses**
4. **Jagged exostoses**
5. **Touching exostoses**
6. **Fusion**

DEFINITIONS

1. *Smooth*: The surface is often elevated in this area, but shows no evidence of discrete bony elevations (Figure 2.56). At most there are one or two isolated small exostoses.
2. *Rounded exostoses*: Definite raised areas of bone with rounded crests dominate the scoring area (Figure 2.57).
3. *Pointed exostoses*: Over one-half of the rough area where ligaments attach is dominated by sharply pointed but short elevations of bone (Figure 2.58).
4. *Jagged exostoses*: The raised areas of bone have a jagged appearance where ligaments attach in life. These exostoses, which can have either round or sharp ends, are tall, extending several millimeters upward from the original bone surface.
5. *Touching exostoses or facet*: There is a distinct oval facet where the ilium and sacrum are in close justaposition, often 5 mm in diameter or more (Figure 2.59). This facet can occur either on top of a pronounced growth of bone or on an iliac surface that is relatively flat.
6. *Fusion*: The ilium and sacrum are fused by exostoses in this area.

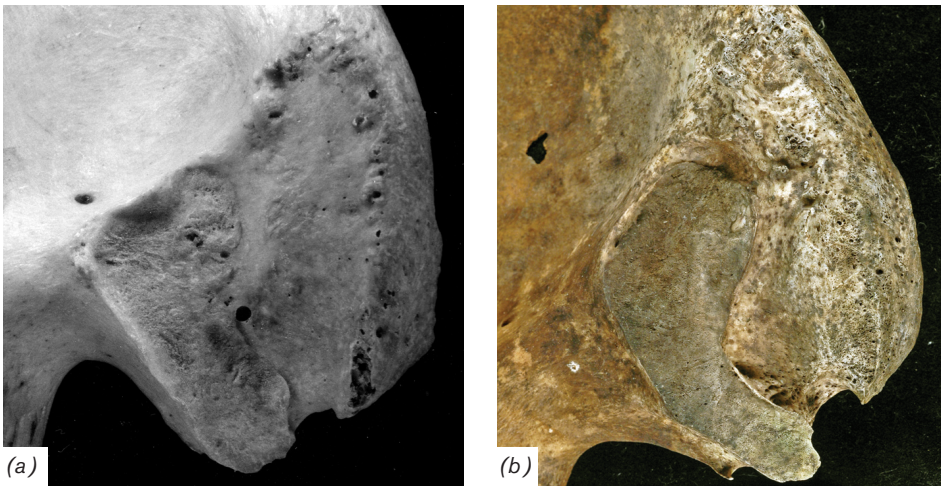


Figure 2.56. ***(a) Smooth*** *[1], inferior (T 862) and* ***(b) Smooth*** *[1], inferior exostoses (MC).*

Figure 2.57. ***Rounded*** *[2], superior and inferior exostoses (MC 7-55, image reversed).*

Figure 2.58. ***Pointed*** *[3], inferior, sometimes sharp ones can approximate linear ridges (MC 7-76).*

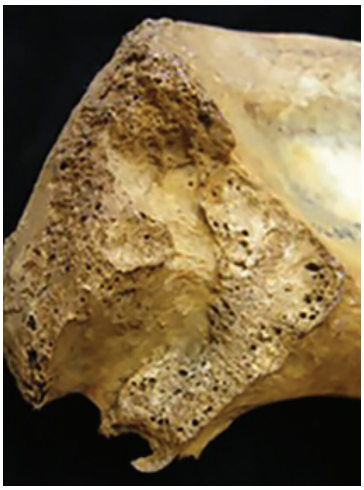


Figure 2.59. ***Facet*** *[5] on inferior portion (William M. Bass Collection)*

IX. Posterior Exostoses

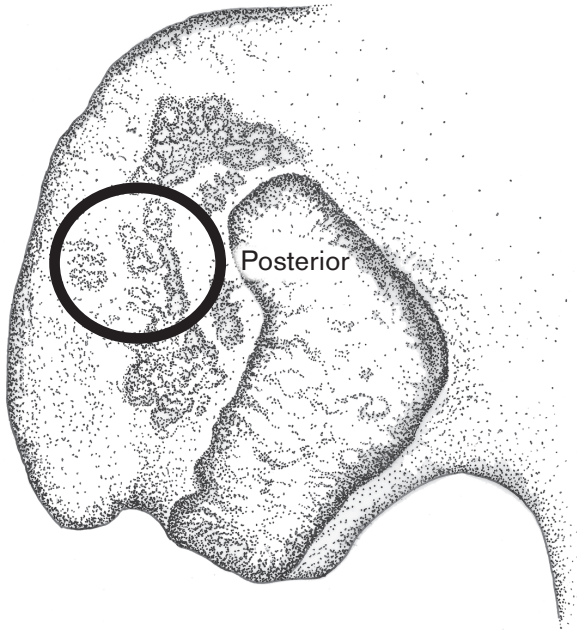


Figure 2.60. ***Posterior Exostoses***

LOCATION

The posterior iliac area between the **Superior and Inferior Posterior Iliac Exostoses** (defined above) is scored. These exostoses are found on the medial side of the ilium bordered posteriorly by the iliac crest, anteriorly by the sacroiliac joint surface, superiorly by a slightly raised area often surmounted by bony exostoses (**Superior Posterior Iliac Exostoses**), and inferiorly by a similar area (**Inferior Posterior Iliac Exostoses**) (Figure 2.60). Most individuals are *Smooth* as defined below. The feature is best considered an old-age trait.

CHARACTERISTICS [STAGES]

1. **Smooth (no exostoses)**
2. **Rounded exostoses**
3. **Pointed exostoses**

DEFINITIONS

1. *Smooth*: The area posterior to the sacroiliac joint is smooth, except for the two areas scored separately as **Superior and Inferior Posterior Iliac Exostoses** (Figure 2.61).
2. *Rounded exostoses*: Low, rounded exostoses (or spicules) cover the *entire* bone surface posterior to the sacroiliac joint, except for a ca. 0.5 cm band of smooth bone immediately adjacent to the posterior edge of the joint (Figure 2.62). The exostoses are normally lower than the **Superior and Inferior Posterior Iliac Exostoses**. The low exostoses give the normally smooth iliac surface a rough appearance. It looks as if the surface is covered by coarse (construction) sand.
3. *Pointed exostoses*: Low, pointed exostoses (or spicules) cover the *entire* bone surface posterior to the sacroiliac joint, except for a ca. 0.5 cm band of smooth bone immediately adjacent to the posterior edge of the joint. The exostoses are normally lower than the **Superior and Inferior Posterior Iliac Exostoses**. The sharp exostoses give the normally smooth iliac surface a rough appearance. It looks as if the surface is covered by coarse (construction) sand.

Not scorable: Superior part of sacroiliac joint surface cannot be scored because of significant abnormal pitting (Figure 2.63).

SCORING TIPS

By far the most common condition is *Smooth*, as it is defined here. Keep in mind that the *Smooth* category also includes surfaces with bony exostoses, which are typical of the 20s onward. Bones are only scored as *Rounded* or *Pointed* if the entire surface is covered with exostoses (the surface looks as if it is thickly covered by construction sand, and little, if any, of the original smooth surface remains visible). Furthermore, the ilium and sacrum can be fused in several places. If that occurs, you should score **Posterior Exostoses** as not observable, as the effect of fusion on this joint characteristic is unknown.

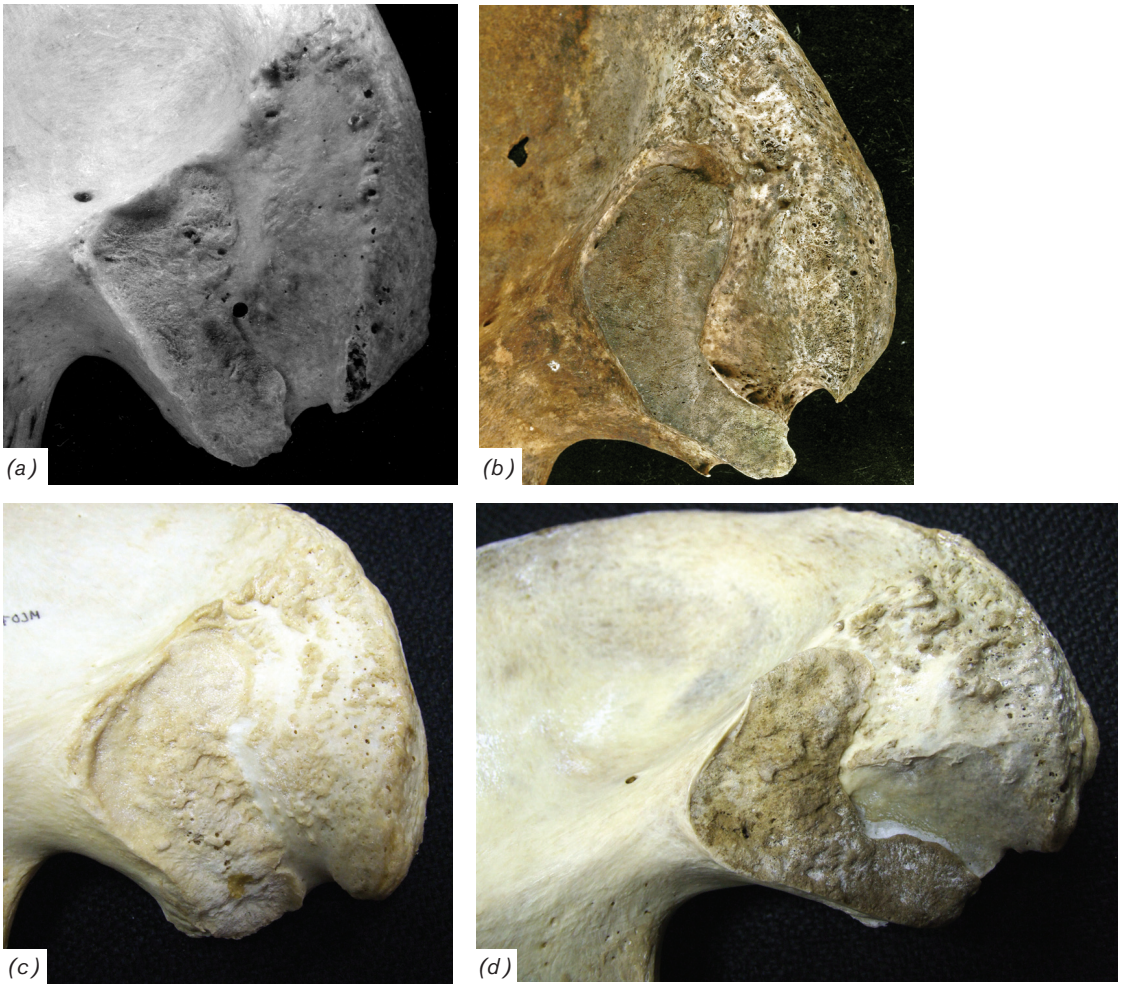


Figure 2.61.
(a) Smooth *[1] (T 862),* ***(b) Smooth*** *[1] (MC 6-69),* ***(c) Smooth*** *[1], while exostoses are present, significant areas of smooth bone remain (MC 7-55, image reversed), and* ***(d) Smooth*** *[1], while exostoses are present, significant areas of smooth bone remain (MC 7-76).*

Figure 2.62. ***Rounded*** *[2] (T 274, image reversed).*

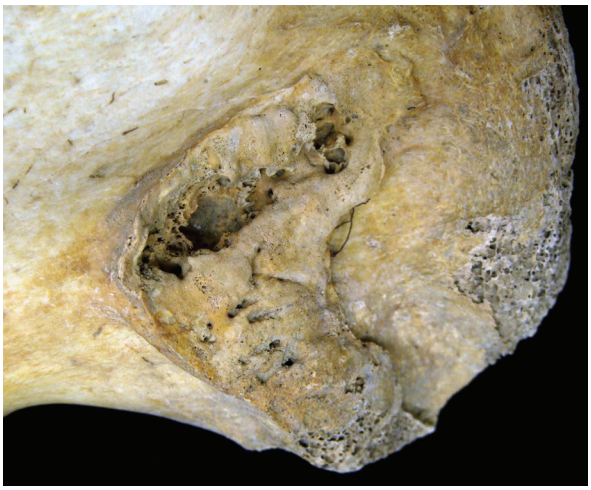
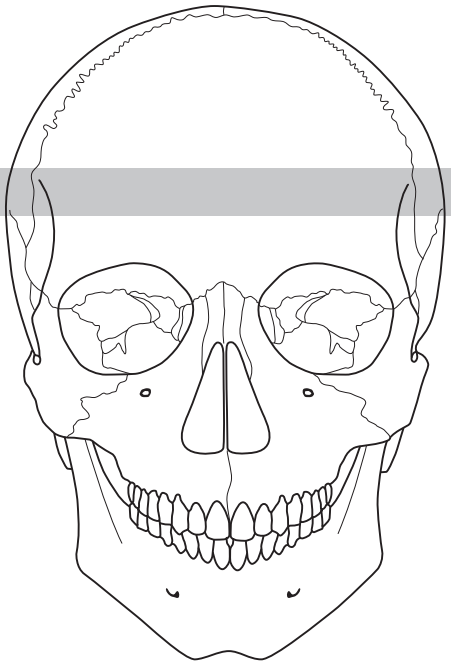


Figure 2.63. ***Sacroiliac joint****, not scorable (NF 229, image reversed).*



Cranial Sutures

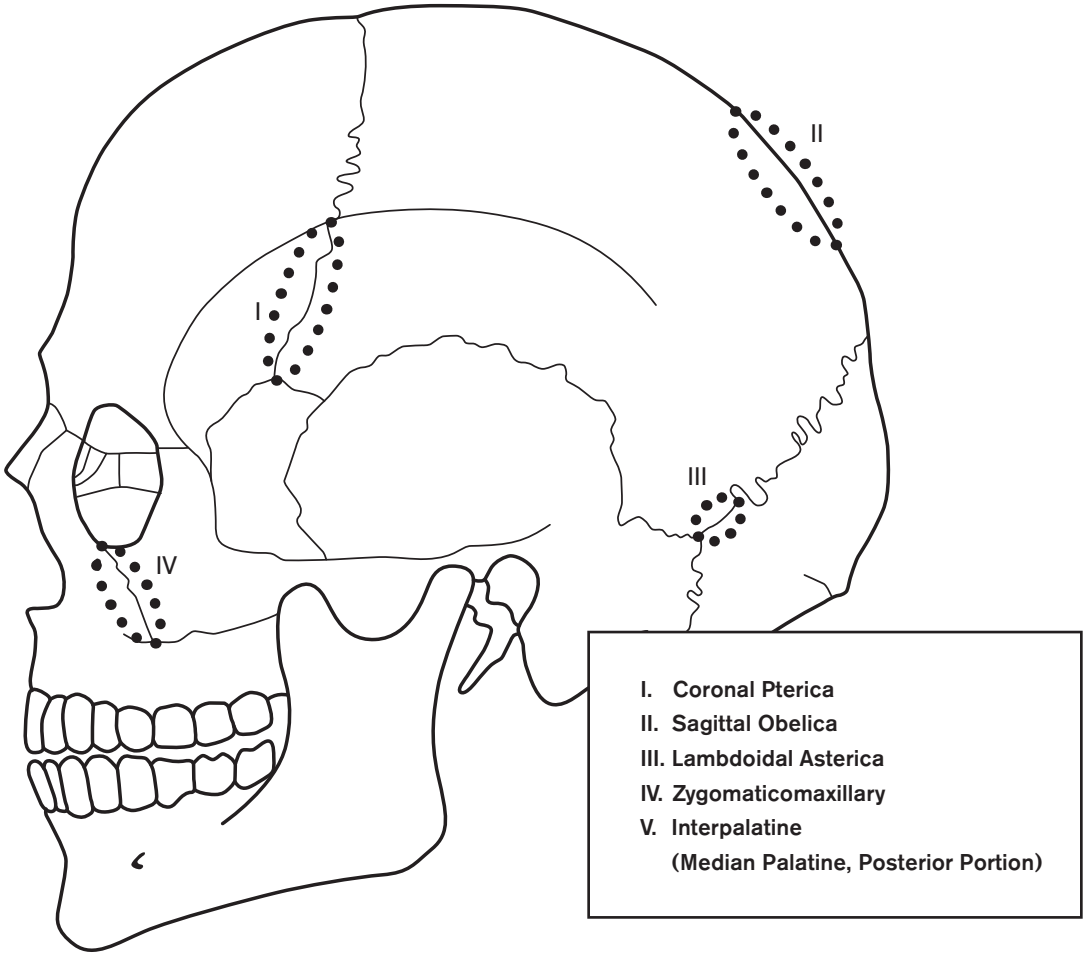
The suture closure scores are similar to what osteologists have used for over a century. Ectocranial suture closure is recorded because it is often difficult to examine the interiors of archaeological crania, which can be dirty. Suture segment names conform to those commonly used by osteologists. Palatal sutures are included because they have been shown to be of some use in age estimation, even though they are often damaged (Mann et al. 1987). Five sutures are scored:

I. **Coronal Pterica**
II. **Sagittal Obelica**
III. **Lambdoidal Asterica**
IV. **Zygomaticomaxillary**
V. **Interpalatine (Median Palatine, Posterior Portion)**

SCORING TIPS

For sake of completeness, it is a good practice to record closure of both the left and right coronal, lambdoidal, and zygomaticomaxillary sutures, if present. When entering data, it is possible to list scores for both sides if they are different. Although Transition Analysis is based on the left side, the inclusion of scores for both bilateral sutures is conservative because it, in effect, increases the age interval. Because sutures are notoriously poor indicators of age, wider intervals are not a bad outcome.

The first stage, *Open*, is perhaps best seen in **Lambdoidal Asterica**. It is a common score for that suture segment, especially in young adults, but it even occurs in middle-aged adults. The *Open* category is distinguished from *Juxtaposed* by a noticeable gap between the two adjoining bones. The width of this gap varies from one suture to another, although it is generally greatest at **Lambdoidal Asterica**. While there is no bony bridging of the suture in the *Juxtaposed* category, the two adjacent bones are only separated by a narrow line, just as if a line was drawn on the bone by a pencil with a thin lead.



I. Coronal Pterica

LOCATION

Score the most inferior section of the coronal suture, a relatively straight part without a meandering appearance. It typically extends from the temporal line inferiorly to the sphenoid.

II. Sagittal Obelica

LOCATION

Score the relatively straight part of the posterior sagittal suture near the parietal foramina. This ca. 3-4 cm long segment is in the vicinity of the parietal foramina.

III. Lambdoidal Asterica

LOCATION

The relatively straight part of the lambdoidal suture adjacent to asterion is scored.

IV. Zygomaticomaxillary

LOCATION

The entire length of the facial, or anterior, part of the zygomaticomaxillary suture is scored.

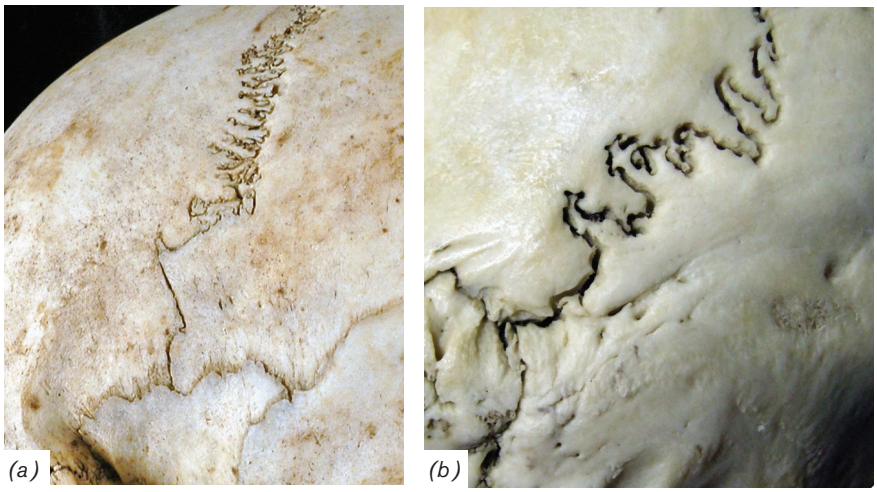


Figure 2.64. ***(a) Open*** *[1], Coronal Pterica (MC 6-69) and* ***(b) Open*** *[1], Lambdoidal Asterica (MC 7-76).*

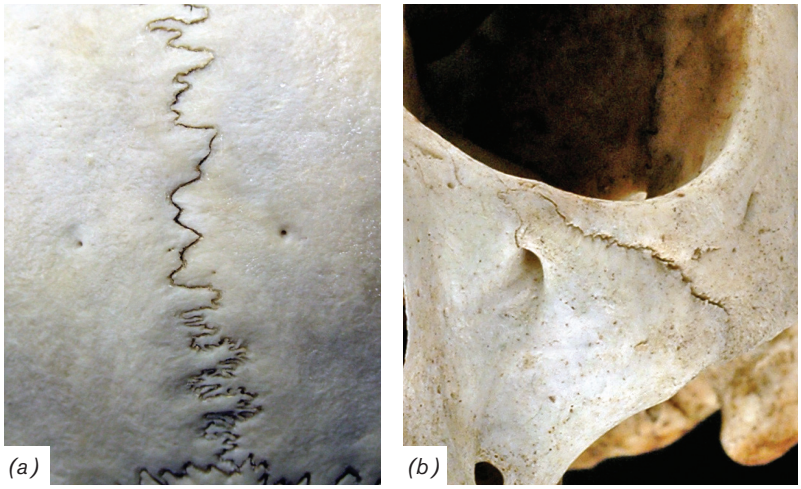


Figure 2.65. ***(a) Juxtaposed*** *[2], Sagittal Obelica (MC 7-76) and (b)* ***Juxtaposed*** *[2], Zygomaticomaxillary (MC 6-69).*

CHARACTERISTICS [STAGES]

1. Open
2. Juxtaposed
3. Partially obliterated
4. Punctuated
5. Obliterated

DEFINITIONS

1. *Open*: The suture is visible along its entire length, and there is a noticeable gap between the bones (Figure 2.64).
2. *Juxtaposed*: The suture is visible along its entire length, but the suture is narrow because the bones are tightly juxtaposed (Figure 2.65). If there are any bony bridges they are rare and small, sometimes with a trace of the original suture still evident.
3. *Partially obliterated*: The suture is partially obscured (Figure 2.66). There is no trace of the original suture in the bony bridges.
4. *Punctuated*: Only remnants of the suture are present (Figure 2.67). They appear as scattered small points or grooves each no more than two millimeters long.
5. *Obliterated*: There is no evidence of a suture (Figure 2.68).

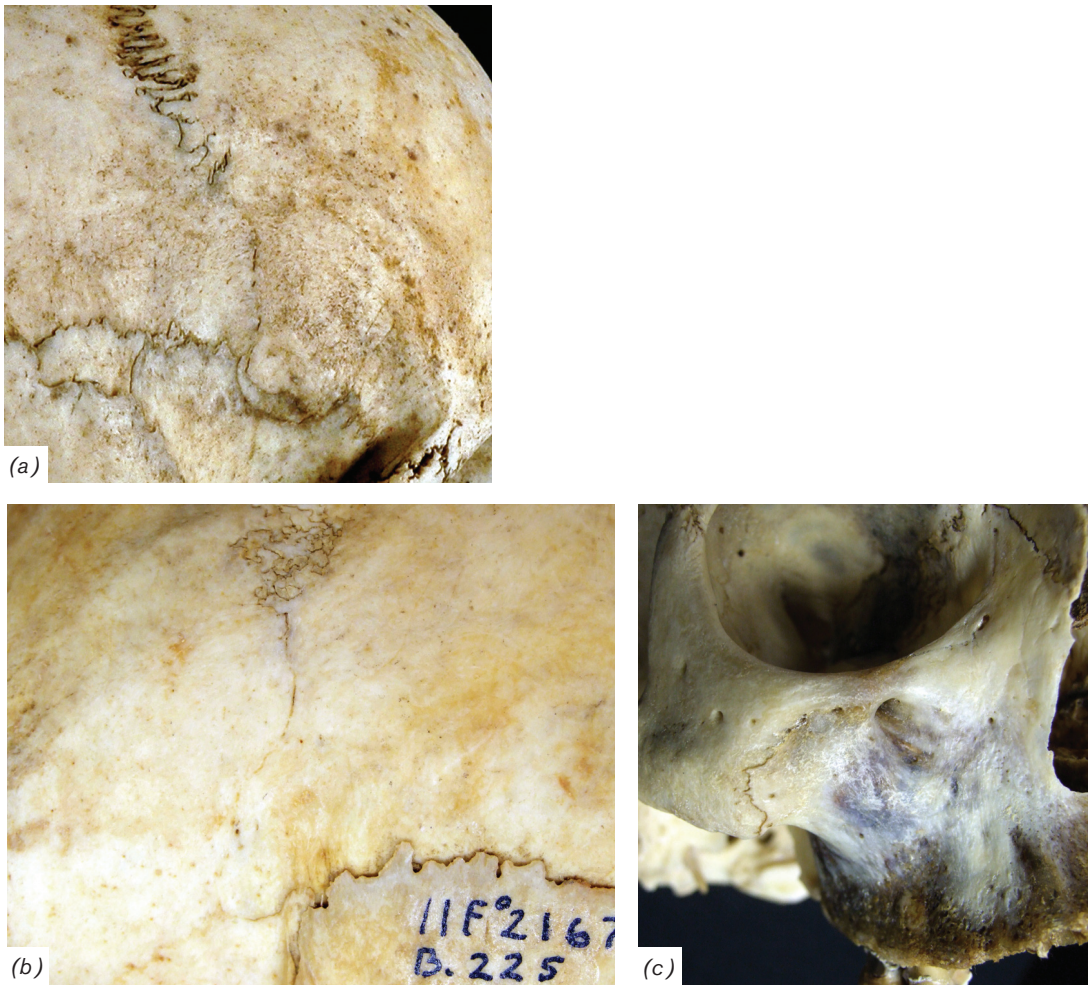


Figure 2.66. ***(a) Partly obliterated*** *[3], Coronal Pterica (MC 6-69) and* ***(b) Partly obliterated*** *[3], Coronal Pterica (NF 225) and* ***(c) Partly obliterated*** *[3], Zygomaticomaxillary (MC 7-55).*

Figure 2.67. ***Punctuated*** *[4], Sagittal Obelica (only Obelica, not segments on either side) (MC 7-55).*

Figure 2.68. ***Obliterated*** *[5], Coronal Pterica (MC 7-55).*

V. Interpalatine (Median Palatine, Posterior Portion)

LOCATION

The suture located between the two opposing palatine bones is of interest (see Figure 2.69a). The *Open* [1] and *Juxtaposed* [2] distinction is not important because it is difficult to impossible to differentiate the two categories consistently. The *Juxtaposed* score [2] is eliminated for this suture to keep scoring consistent across all sutures and to reduce scoring error.

A small bony crest often forms along the midline of the palate that can make it difficult to record the extent of suture closure. In other specimens, the suture is barely visible in the depths of a deep and narrow groove. Both the ridge and groove make it hard or impossible to score the suture.

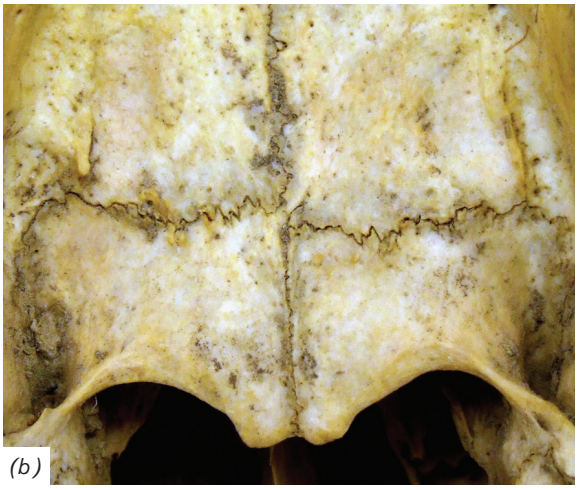
CHARACTERISTICS [STAGES]

1. Open (open and juxtaposed)
2. Partially obliterated
3. Punctuated
4. Obliterated

DEFINITIONS:

1. *Open (and juxtaposed)*: The suture is visible along its entire length, and there is a noticeable gap between the bones (Figure 2.69).
2. *Partially obliterated*: The suture is partially obscured (Figure 2.70). There is no trace of the original suture in the bony bridges.
3. *Punctuated*: Only remnants of the suture are present. They appear as scattered small points or grooves, each no more than 2 mm long.
4. *Obliterated*: There is no evidence of a suture.

(a)



(b)

Figure 2.69.
***(a) Open & Juxtaposed** [1], Interpalatine (MC 6-69) and **(b) Open & Juxtaposed** [1], Interpalatine. These two stages are combined for the Interpalatine suture only (NF 229).*

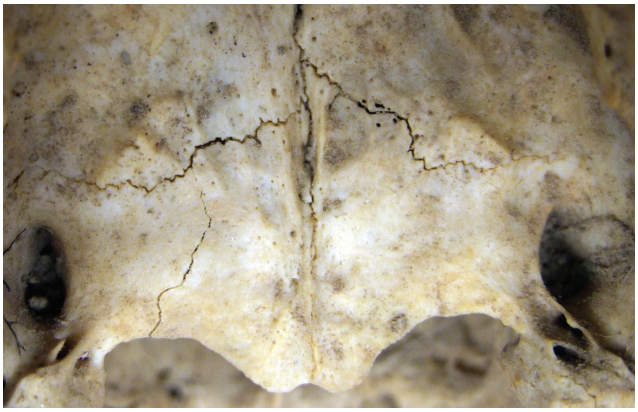


Figure 2.70. ***Partly obliterated** [3], Interpalatine (NF 225).*

Assignments:
Critical Summaries of Research Articles
Semester Long Assignment

Critical Summaries of Research Articles:

Assigned multiple articles to read and have the students critically summarize the pertinent article for each topic throughout the semester. For each article, students will write a paper comprised of two parts:

1) A summary – in their own words - of the main points in the article, and

2) A critique of the article – Have the students address: What are your thoughts, opinions, questions about, or criticisms of the material?

A good rule of thumb is to use two or three paragraphs to summarize, with one final paragraph to critique/offer your opinions.

Suggested Grading – Points will be deducted for:

- Brevity: Your critical summary should be at least one page, assuming 1" margins, 12 point font, and double spacing. The paper is too short if it takes up one page, but numerous lines are used up by your name, the course name, the date, etc., if margins are wide, or the font is unreasonably large.
- Incoherence/Bad Grammar: If you have trouble summarizing short articles, please consult the Writing Center for help. Please use spellcheck and proof-read your work before turning it in.
- Lateness: Any of the article summaries can be turned in early. I will deduct one point per day for any papers submitted past the due date.

You may assign any of the suggested reading articles within each chapter or articles in the references cited portion of each chapter.

Submitted by Sabrina Ta'ala

Exam Questions:
General Anthropology, History of Forensic Anthropology, JPAC

1. Who is noted as the father of American Forensic Anthropology?
   a. Alěs Hrdlička
   b. Doug Ubelaker
   c. William Bass
   d. Thomas Dwight
   e. Robert J. Terry

2. What founding father is noted for the first research in sex estimation from long bones, provided expert testimony in forensic anthropology in 1879, and gave the first lecture in forensic anthropology (the importance of the human skeleton in forensic medicine) at a medical convention?

   a. Gorge Dorsey
   b. Ernest Hooton
   c. Alěs Hrdlička
   d. Clyde Snow
   e. Thomas Dwight

3. The first major textbook published in 1962, *The Human Skeleton in Forensic Medicine* was authored by whom?

   a. Robert J. Terry
   b. Wilton Krogman
   c. Ellis Kerley
   b. William Bass
   e. T. Wingate Todd

4. What are the four fields of anthropology and where does forensic anthropology fit within these four fields?

5. What are the three Periods in the history of Forensic Anthropology? What defines each period? Include some key persons from each period and how they contributed to the development of the field. How has the field changed in the last 20 years (support your answer with specific examples)?

6. Which aspect of the biological profile was Mildred Trotter responsible for advancing with her research at CILHI?
A. Sex Estimation
B. Age Estimation
C. Ancestry Estimation
*D. Stature Estimation
E. Trauma Analysis

7. The first case to use the principles of forensic anthropology, as a science, in the United States was the:
A. Holmes Murder
*B. Parkman Murder
C. Wyman Murder
D. Webster Murder
E. Larner Murder

8. The anthropologist who consulted on the Leutgert murder investigation in 1894 was:
A. Thomas Dwight
B. Paul Stevenson
*C. George Dorsey
D. Ales Hrdlicka
E. T. Wingate Todd

9. The *Guide to the Identification of Human Skeletal Material* was written in 1939 by:
A. Harry Shapiro
B. T. Wingate Todd
C. Robert Terry
*D. Wilton Marion Krogman
E. Mildred Trotter

10. Which of the following pioneers in the field of Forensic Anthropology was the first to stress the importance of the human skeleton in the forensic setting by giving a talk at a Medical Conference in 1899?
a. Thomas Dwight
b. Earnest Hooton
c. Ales Hrdlicka
d. *George Dorsey

11. Who is considered the Father of Forensic Anthropology?
a. William Bass
b. *Thomas Dwight
c. George Dorsey
d. Robert Terry

12. Which of the following is not considered a Period in the history of forensic anthropology?
a. The Modern Period
b. The Formative Period
c. *The Tertiary Period
d. The Consolidation Period

13. Who was the driving force behind the Physical Anthropology Section of the American Academy of Forensic Sciences and the first president of the American Board of Forensic Anthropology?

a. Robert J. Terry
b. *Ellis Kerley
c. T. Wingate Todd
d. Clyde Snow

Small Group Assignment – Forensic Taphonomy

Team #:_____

Group Participants (Name, ID Number):

Tasks for the Small Group Assignment:

1. What type of taphonomic damage is found on the bones in Figure 1? How do you know this?

2. What type of taphonomic damage is found on the bones in Figure 2? How do you know this?

3. If a fully fleshed body is exposed to a 1200°F fire for 15 minutes (assuming even heat distribution, and barring any additonal trauma or burn hiderance) what parts of the body will exhibit damage, and what is the likely extend of this damage?

4. According to Behrensmeyer 1978, if a bone exhibits flaking of the outer surface with associated cracks and exfoliation has started, what weathering stage is it in and what is the RANGE in years since death?

5. At what stage of Canid Assisted Scavenging (Haglund, 1997) would you expect that the the ventral thorax would be removed, both upper extremities would be removed and lower extremities would be partially removed? What range of postmortem interval does this stage suggests?

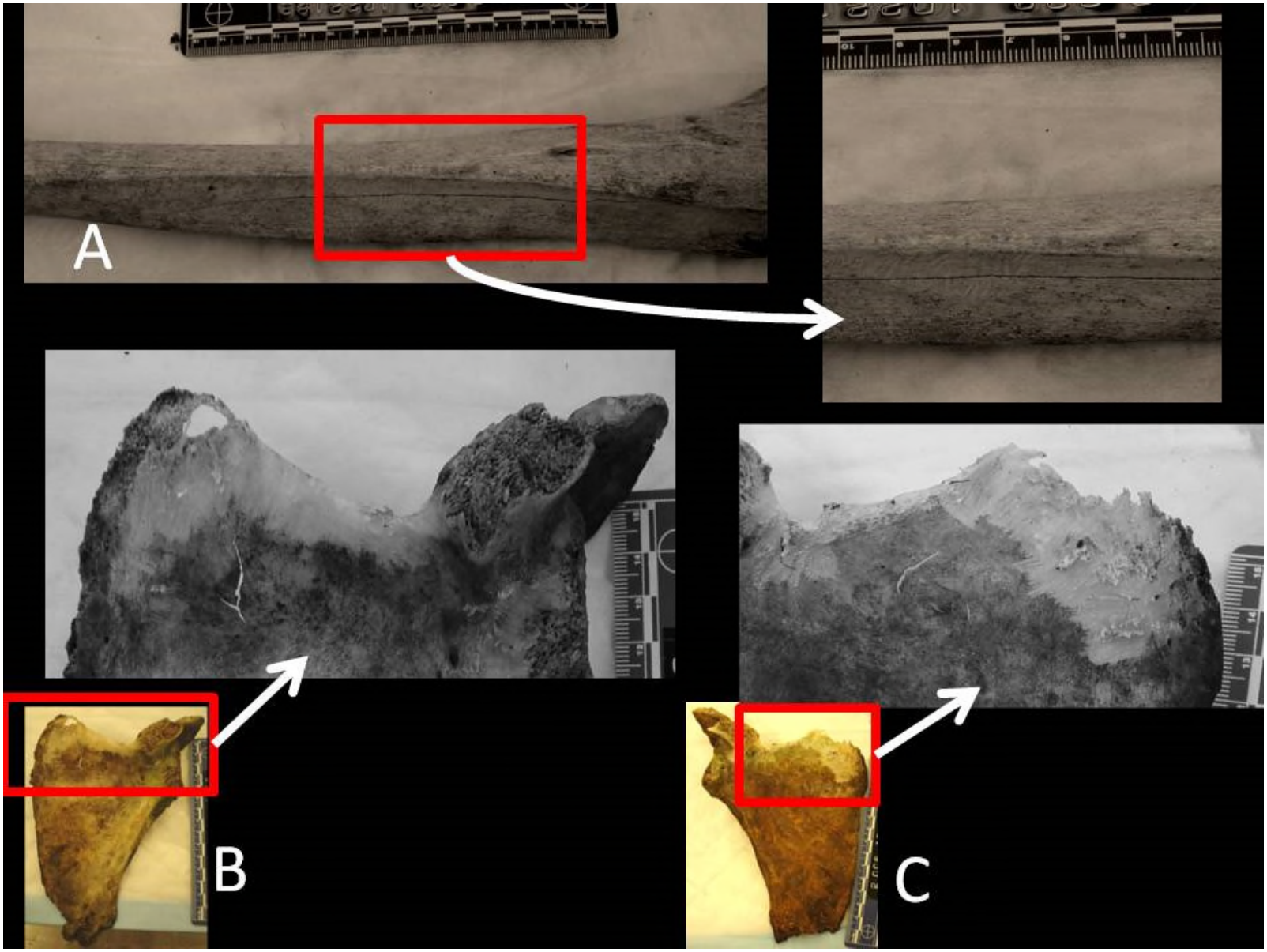


Figure 1: Bones A, B and C are from the same case and experienced the same post-mortem taphonomy. What caused this taphonomic damage?

Figure 2: What type of taphonomic damage is shown in this image?