Anthro 235
Lab Manual 2018

University of Auckland

Judith Littleton and Caitlin Bonham Smith

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Course Syllabus

Anthropology 235: The anthropology of human remains

Second Semester 2018

Course description

Human remains reflect the lives of the dead as well as the lives of those who buried them. In this course you will be introduced to the various ways in which we study the dead. The course will cover three areas: the interpretation of mortuary practices, the interpretation of past lives from human remains, and the practice of burial archaeology in the southern hemisphere. The course explicitly focuses on the cross-over between biological anthropology and archaeology, so you will be introduced to the relevance of the two sub-disciplines for each other. In addition we will discuss archaeological practice, particularly in relation to this part of the world.

Course Details

Course value: 15 points

Lectures:
Wednesday 3-5 pm

Tutorials/Labs:
One one-hour lab per week starting in Week 2

Human Sciences Building
Room 706

Course Staff

Convenor:
Prof Judith Littleton
j.littleton@auckland.ac.nz

Office hours: 2-3
Wednesday; 10-11 Friday.
Room 722
Human Sciences Building

Tutors:
Caitlin Smith
Csmi874@aucklanduni.ac.nz

Course Aims

In this course we aim to:

Introduce you to the area of bioarchaeology and the analysis of both human and mortuary remains;
Give you an opportunity to undertake analysis in this area;
Demonstrate how different research questions and theoretical perspectives lead to different outcomes;
Understand how assumptions underlie different analyses and learn how to identify them.

Learning Objectives: By the end of this course, you will be equipped with the tools to:

Understand the limitations and promises of the analysis of human remains;
Thoughtfully evaluate human bioarchaeological analyses;
Identify the first principles of analysis of human remains within an archaeological context;
Identify what constitutes best practice in relation to human remains;
Master and demonstrate basic research skills; and
Write coherent explanations of research and concepts relevant to course content.

Employability:
Able to analyse – undertaking independent research, identifying and using theoretical frameworks and concepts.
Practical skills for cultural resource management and archaeology – including appreciation of legislation, ethics, and the excavation and recording of burials and human remains.
Communication skills: presenting work in an oral and written format concisely and accurately; able to debate sensitive issues
Social and environmental skills: awareness of ethical issues and the multiple responsibilities of a researcher, cultural sensitivity.

Course Texts

Recommended: For each lecture there are two articles for you to read to have a background in the topic. There is also an additional reading you might be interested in (in italics). These are available through links on Canvas. We expect you to do these readings prior to class and to quickly revise them after class.

Course Requirements:

Lectures will be the primary learning venue for this course. Attendance at lectures is not required but is strongly advised, as material from lectures may not be reproduced elsewhere and may be included in course examinations. You are required to enrol in a *lab stream* – these labs are held weekly and will involve you undertaking a set of practical tasks related to burial archaeology and human remains.

Assigned *readings* are required, unless otherwise noted, and should be completed prior to the day for which they are assigned. All *tests, assignments* and take home exams are mandatory course components.

LECTURES Wednesday 3-5 pm.

Tutorial: Lab sections are meant to expand on topics covered in lecture through participatory activities. Studying human remains is about learning to analyse evidence, including interpreting what others have written, as well as learning to make your own observations. Toward that end, you will have opportunities to learn through various means. Labs also provide opportunities to clarify and discuss topics covered in lecture that you find interesting or confusing. Lab is intended to be dynamic, useful and often fun. There will be 10 one hour lab sessions. There will be three lab assignments.

Tutorial Times: Tutorials meet in the biological anthropology laboratory, HSB 706 unless otherwise advised.

Readings: The readings are listed attached to each week and are provided through the course website as an electronic reader.

Assessment

Task	Value	Due Dates
Reading quizzes	10% (1 mark per quiz)	Question will be asked in Wednesday's lecture – one quiz per week commencing week 3
Lab Assignment 1 (c3-5 pages, 1000-1200 words)	20%	Oral presentation week 3 or 4 in lab, written version 15 August, 3pm on Canvas
Lab Assignment 2	20%	In lab 20 September.
Lab Assignment 3 (c3-5 pages, 1000-1200 words)	20%	10/10 3pm on canvas
Take home exam	30%	Handed out on Friday 20

(2 essays – 3-5 pages each)		October, due 24 October, 3pm on Canvas.

Lecture quizzes (5%)

Starting at the beginning of Week 3 on each Wednesday, there will be a brief quiz. The aim of the quizzes is to check that you are keeping up with the readings, understand concepts and to prepare you for the final exam.

Lab assignments

Assignment 1: Analysis of a Monument

Oral presentation undertaken in Week 3 and 4 in labs 5%

Written analysis due 15th August, 3pm (on canvas) 15%

Task:

Identify a place or monument concerned with the dead (that is pretty widespread) and analyse it. That means thinking up a research question about that place (keep it simple but think both about what you read for Week 1 and 2 particularly Parker Pearson as well as the sorts of issues we discussed at Symonds St cemetery). You will translate this to a 1000 word (3 page report) submitted to Canvas as a PDF (that way you can have images etc).

This project is in two stages so

In Labs 3 or 4 (we will sort out a schedule) you will each come prepared with a 2 minute presentation of your monument and your research question (practice before hand and time yourself). You can have one powerpoint slide or one PDF page to display and talk to (You will send these to Caitlin by 3pm the Wednesday before). Now the aim of this is not to cause you pain but because it will be really interesting for us all to think about each other's projects and what sort of research questions you might ask or where might you go for information. So have an idea of your analysis (your question, your analytical frame) that we can discuss and workshop.
In Week 5 you will submit your 1000 -1200 word report (3-5 pages) plus references to Canvas as a PDF. I will compile all reports (without the marking) into a single document so that you can see what people did and have it as a resource. The report will include an introduction – which tells us what you analysed and how; a description of the monument or whatever; and then the analysis of it with appropriate references (you don't need to go overboard here but you will probably need at least one relevant historical reference since that will help with context and one relevant reference from archaeological theory e.g. if you are dealing with landscape and placement then you probably want to read something about how archaeologists analyse landscape; if you are dealing with mortality then you will need something about that time in New Zealand and then a paper that deals with a similar issue elsewhere (providing a theoretical or comparative framework).
NOW: DON'T GO OVERBOARD, TRUST YOUR DESCRIPTION, THINK ABOUT THIS ENTIRE EXERCISE TAKING UP 10 SOLID HOURS OF WORK: HALF A DAY RECORDING AND DESCRIBING AND A DAY OF RESEARCH AND WRITING. IF YOU FALL IN LOVE WITH THE PROJECT REMEMBER YOU CAN FOLLOW THIS UP FURTHER FOR YOUR ESSAY.

In thinking about your exercise remember it is an introduction, a description, and an analysis and in the analysis you can pose a larger question or point to a bigger literature. So here is the example from Brendan (remember Hobson's grave): *In what ways does Hobson's grave reflect and or mask his social importance?* Now that's a question that allows Brendan to look at the archaeological literature (do we expect graves to reflect social status?) but it doesn't mean that his analysis of Hobson's grave is going to turn theory on its head. The theory will give us a set of ideas to think with (concepts like status, ranking, display, symbolism, identity).

Most of you have some form of that question very clear already but don't think you have to make grand claims, all I want is for you to realise out of this is that

a. it isn't difficult to think up questions for research,

b. research involves thinking with theories, using them, adapting them,

c. it can be a lot of fun (and hard work) and

d. you can all do it.

Finally useful references mentioned (all available via Google scholar):

Different types of burial and ideology:

Robb, J. O. H. N. "Burial treatment as transformations of bodily ideology." *Preforming Death: Social analyses of Funerary Traditions in the Ancient Near East and Mediterranean. The Oriental Institute of the University of Chicago, Chicago* (2007): 287-298. (available as pdf on line from google scholar0.

Communal tombs, wandering bones:

Weiss-Krejci, Estella. "Mortuary representations of the noble house A cross-cultural comparison between collective tombs of the ancient Maya and dynastic Europe." *Journal of Social Archaeology* 4.3 (2004): 368-404.

Status:

Cannon, Aubrey. "Mortuary Expressions of Status and." *Current Anthropology* 30.4 (1989): 437-458.

Communal burials:

Chénier, Ani. "Bones, people and communities: Tensions between individual and corporate identities in secondary burial ritual." *NEXUS* 21.1 (2009): 3.

Cenotaphs, memorials:

Fahlander, Fredrik, and Terje Oestigaard, eds. *The materiality of death: bodies, burials, beliefs*. Archaeopress, 2008. (Introduction)

Memory, monuments etc:

Bradley, Richard. "Ritual, time and history." *World Archaeology* 23.2 (1991): 209-219.

Bradley, Richard. *The past in prehistoric societies*. Routledge, 2002.

Places of death:

Cherryson, Annia, Zoë Crossland, and Sarah Tarlow. *A Fine and Private Place: The Archaeology of Death and Burial in Post-medieval Britain and Ireland*. University of Leicester, 2012. (Not on Google but maybe in library)

Tarlow, Sarah. "Landscapes of memory: the nineteenth-century garden cemetery." *European Journal of Archaeology* 3.2 (2000): 217-239. (Google scholar)

Tarlow, Sarah. "An archaeology of remembering: death, bereavement and the First World War." *Cambridge Archaeological Journal* 7 (1997): 105-121. (Library)

Rites of passage

Palgi, Phyllis, and Henry Abramovitch. "Death: A cross-cultural perspective." *Annual Review of Anthropology* (1984): 385-417. (maybe useful – not sure)

And for just about every topic under the sun:

Tarlow, S and Stutz, L 2013 The Oxford handbook of the archaeology of death and burial / edited by Sarah Tarlow and Liv Nilsson Stutz Oxford : Oxford University Press, 2013.

Assignment 2: Practical Lab Test

HELD IN LABS IN WEEK 9

This 60 minute lab test will present you with a puzzle.

Scenario: a collection of skeletal remains has just been unearthed at a crime scene. You have been asked to help in the investigation of this material. Answer the questions below:

Is any of this skeletal material nonhuman? If so, which bone is nonhuman? Why do you think this?
List all of the human skeletal elements, being as specific as possible. What is the minimum number of individuals represented?
Can any of the skeletal material be used to determine the biological sex of the victim(s)? If so, which bone(s)? What is the sex you determined? What evidence supported that conclusion
Based on the materials recovered, can you make any suggestions for future analyses you might use to further understand the circumstances surrounding the death of the victims(s)?

Assignment 3: A code of practice for bioarchaeology in New Zealand.

Anthro 235

Assignment 3: A code of practice for bioarchaeology

Date Due: 10 October, 3pm (submit onto CANVAS)

In Anthro 235 we have made sure you do different sorts of writing and get a sense of how to produce independent description and research (Assignment 1), use first principles (Assignment 2) and in assignment 3 we are asking you to think practically again – this time preparing guidelines for professionals who work in the field about what to do when you find human remains in New Zealand.

Good guidelines don't just present a recipe book they tell people concrete information and they also explain why particular practices must be followed. They are sufficiently open as a set of principles that they can be applied in any situation. At the same time they are pithy and to the point (i.e. we are asking for 3 – 5 pages max.). But what we want you to think about are:

Legal responsibilities
Ethical consideration
Recording of context
Recording of characteristics in the field (what can be said, what can't be said)
When might excavation of remains be recommended and what further analyses might be considered with what provisos.
You are writing this for yourself and for other professionals in the field. You are not writing it for specialists trained in osteology but for a normal archaeologist or police officer who comes across remains in the course of a normal day's work. This means that you can't just make stuff up – references are essential as are explanations of why a particular recommendation is made.

The readings for Week 12 are relevant for this assignment as are these other sources and you could well find others:

Guidelines to the standards for recording human remains. BABAO, Department of Archaeology, University of Southampton, 2004. (Available online)

York Osteoarchaeology has links to some of the British documents:
http://www.yorkosteoarch.co.uk/guide.php

British forensic anthropology code of practice www.gov.uk/government/publications/forensic-anthropology-code-of-practice

And I will put up on CANVAS a document that Christina Johnston and I put together for practising archaeologists.

Plagiarism

The University of Auckland will not tolerate cheating, or assisting others to cheat, and views cheating in coursework a serious academic offence. The work that a student submits for grading must be the student's own work, reflecting his or her learning. Where work from other sources is used, it must be properly acknowledged and referenced. This requirement also applies to sources on the world-wide web. A student's assessed work may be reviewed against electronic source material using computerised detection mechanisms. Upon reasonable request, students may be required to provide an electronic version of their work for computerised review. Your attention is also drawn to the University of Auckland's position on Academic Honesty and Plagiarism, and to specific guidelines for the Conduct of Coursework and Conduct of Research. This information can be found on the University's website at:
https://www.auckland.ac.nz/en/about/the-university/how-university-works/policy-and-administration/teaching-and-learning/students/academic-conduct-statute.html

Due dates, late work

All coursework should be submitted by the due date and time. IF YOU ARE ILL OR HAVE SOME OTHER FORM OF EMERGENCY THEN CONTACT JUDITH AS EARLY AS POSSIBLE TO ARRANGE AN EXTENSION. Assignments will be accepted up to 48 hours late, with a penalty of 10% points per 24-hour period.

Attendance

University courses are about learning a wealth of material in a short period of time, with the goal being able to think critically about the topic at hand. Therefore, attendance at lectures will generally increase your ability to understand the course material. Lecture recordings, while undertaken, are not a replacement for attendance.
Labs are designed to get you practicing what you have learnt in a small, hands-on environment to facilitate your comprehension of the material. As such, each student is enrolled in a lab class which will run from Week 2 of the class. These are compulsory since 60% of your marks comes from work undertaken or discussed in these classes.

Having Problems?

University work is difficult and sometimes life gets in the way. The main thing is don't let issues compound. Adopt as a matter of course the practice of talking to Judith and Caitlin during your labs, during our office hours, seeing us not just when things are wrong but when things are going right. At all times come and see us (contact details next page) as soon as things start to slide. We are interested in ensuring that you all do well in this course to take advantage of us and our expertise.

If you need help with developing your writing skills or your ability to take effective notes, sign up with the Student Learning Centre. The Student Learning Centre is located in Room 320 of the Kate Edger Information Commons, and their hours are 9am to 5pm, Monday to Friday. More information about their workshops and other services can be found online at www.library.auckland.ac.nz/student-learing/. You might also wish to go to the English Language Enrichment (ELE) in the Kate Edger Information Commons. They state " If you think your English is holding you back from getting better grades, communicating effectively or participating confidently in university life, ELE on campus is a great place to be. You can use English language resources (DVDs, CDs, digital recordings, magazines, newspapers and books), get advice about your English (whatever your subject area), and participate in language learning groups. You can also use ELE computers in any way that supports your English language development".

Tuakana Arts Undergraduate Mentoring Programme

Tuakana Tutors are available to help Maori and Pacific Island students and others through a range of opportunities such as study groups, skill based workshops, and one-on-one assistance. Your Tuakana tutor for this course will be introduced both in person (in class) and via Canvas early on in the course.

Disabled students

If you have a disability that affects your capacity to participate in this course, please contact the convenor as soon as possible. Additional information for disable students can be found at the **University of Auckland Disability Services** website.

WK	Date	Lecture topic	Readings	235 Labs
1	18/7	Introduction to bioarchaeology and the human skeleton *What is bioarchaeology? The human skeleton and information we gain from it, ethics – what do we mean by ethics and why do they matter.*	Parker Pearson 1999 The Archaeology of Death and Burial College Station: Texas A&M University Press Pp 1-20 ISBN 1-58544-099-X Mays, S 2010 The Archaeology of Human Bones. London: Routledge. Pp1-14 Turner, B. L., Toebbe, D. S., & Armelagos, G. J. (2006). To the science, to the living, to the dead: Ethics and bioarchaeology. In *Symposia-Society For The Study Of Human Biology* (Vol. 45, p. 203). Cambridge University Press.	
2	25/7	Mortuary landscapes *SYMMONDS ST CEMETERY – an introduction to mortuary archaeology*	Tarlow, S. (1997). An Archaeology of Remembering: Death, Bereavement and the First World War. *Cambridge Archaeological Journal*, *7*(1), 105-121. doi:10.1017/S0959774300001499 Mytum, H. 2006. Popular attitudes to memory, the body, and social identity: The rise of external commemoration in Britain, Ireland and New England. *Post-Medieval Archaeology*, 40(1): 96–110.	Thinking about cemeteries – theory and readings
3	1/8	Finding and analysing human remains in the archaeological and forensic record *Human burials and burial practices, forensic anthropology, taphonomy and preservation*	Stodder, A 2008 Taphonomy and the nature of archaeological assemblages. In Biologicaal Anthropology of the Human Skeleton, Wiley, p71-114 Knüsel, C. J., & Robb, J. (2016). Funerary taphonomy: An overview of goals and methods. *Journal of Archaeological Science: Reports*, *10*, 655-673. Castex, D and Blaizot, F 2017 Reconstructing the Original Arrangement, Organisation and Architecture1 of Burials in Archaeology In *Taphonomy of Human Remains: Forensic analysis of the dead and the depositonal environment.* Johnwiley. P277-295	Describe a monument 1 Oral Presentations
4	8/8	Children and death *Identifying child remains, historic causes of death, canaries in the coalmine? Or liminal people*	Halcrow, S and Tayles, N 2008 The bioarchaeological investigation of childhood and social age: problems and prospects. J Arch Method and Theor 15(2):190-215 Moore, A *2009* Hearth and home: the burial of infants within	Describe a monument 2 Oral presentations

			Romanp-British Domestic contexts. Childhood in the Past 2(1):33-54 *Perry, M. A. (2005).* Redefining childhood through bioarchaeology: Toward an archaeological and biological understanding of children in antiquity. *Archeological Papers of the American Anthropological Association, 15(1), 89-111.*	
5	15/8	Embodying inequality *Identifying inequality in the bioarchaeological record – what do we mean by inequality, status, and identity, status and graves, status and health*	Knudson, K. J., & Stojanowski, C. M. (2008). New directions in bioarchaeology: Recent contributions to the study of human social identities. *Journal of Archaeological Research*, *16*(4), 397-432 Joyce, R. A. (2005). Archaeology of the body. *Annu. Rev. Anthropol.*, *34*, 139-158. *Quinn, C.P. ; Beck, J. (2016)* Essential tensions: A framework for exploring inequality through mortuary archaeology and bioarchaeology *Open Archaeology, January 2016, Vol.2(1), pp.18-41*	Bone as living tissue and animal versus human SUBMIT MONUMENT ANALYSIS 15th August 3pm.
6	22/8	Gender, labour and violence *Sexing adult remains, sex vs gender, trauma and violence*	Hollimon, S 2011 Sex and gender in bioarchaeological research: theory method and interpretation In Social Bioarchaeology edited by S Agrawal and B Glencross, Wiley-Blackwell, p.149-182 Stone, Pamela 2012 Binding women: ethnology, skeletal deformations, and violence against women. Int J Paleopath 2: 35-50 *Jordan, A. M. (2016). Her mirror, his sword: unbinding binary gender and sex assumptions in Iron Age British mortuary traditions. Journal of Archaeological Method and Theory, 23*(3), 870-899.	Human identification 1 Ageing and sexing and ancestry
		MID SEMESTER PERIOD		CATCH UP ON READINGS AND STUDYFOR TEST
7	12/9	Exploiting the environment – movement	Bramanti, B The Use of DNA Analysis in the Archaeology of	Human identification 2

		and diet *Stable isotope analysis, aDNA, mobility versus migration, diet versus nutrition versus subsistence*	Death and Burial *The Oxford Handbook of the Archaeology of Death and Burial* Edited by Liv Nilsson Stutz and Sarah Tarlow p.99-122. Wilson, A. S., Taylor, T., Ceruti, M. C., Chavez, J. A., Reinhard, J., Grimes, V., ... & Worobey, M. (2007). Stable isotope and DNA evidence for ritual sequences in Inca child sacrifice. *Proceedings of the National Academy of Sciences*, *104*(42), 16456-16461. *Kinaston R et al. 2013 The First New Zealanders: Patterns of Diet and Mobility Revealed through Isotope Analysis PLOSOne :8 iss:5 pg:e64580 doi:10.1371/journal.pone.0064580*	Stature and Pathology
8	19/9	Disease, disability and inequality *Palaeopathology possibilities and problems, disability?, care*	Dettwyler, K 1991 Can paleopathology provide evidence for Compassion? Am J Phys Anth 84(4):375-84 Tilley, L. (2012). The bioarchaeology of care. *The SAA Archaeological Record*, *12*(3), 39-41. *Robbins Schug, G 2016 Begotten of corruption? Bioarchaeology and the othering of leprosy in South Asia. Int J Paleopath 15:1-9*	PRACTICAL TEST In lab on 20 September.
9	26/9	Was agriculture the worst idea? *Agricultural transitions, sedentism, stress, health, coevolution*	Stock, J. T., & Pinhasi, R. (2011). Introduction: Changing Paradigms in Our Understanding of the Transition to Agriculture: Human Bioarchaeology, Behaviour and Adaptaion. *Human Bioarchaeology of the Transition to Agriculture*, 1-13. Larsen, C 2006 The agricultural revolution as environmental catastrophe: implications for health and lifestyle in the Holocene. Quaternary International 150(1):12-20 *Littleton, J., Allen, M. S., & McFarlane, G. (2015).* Multi-species Perspectives on Anthropogenic Environments: Dental Pathology Patterns, Marquesas Islands (Polynesia). *The Journal of Island and Coastal Archaeology*, *10(2), 277-301.*	Growth - Subadults

10	3/10	Colonial contagion: colonisation, depopulation and change *Colonialism, immunological naievity, depopulation, thinking beyond the germs, other areas of change.*	Dobyns, H. F. (1993). Disease transfer at contact. *Annual Review of Anthropology*, *22*(1), 273-291. Murphy, M. S., & Klaus, H. D. (2017). *Colonized bodies, worlds transformed: Toward a global bioarchaeology of contact and colonialism*. University Press of Florida.p7-30 *Klaus, H. D., & Tam, M. E. (2009). Contact in the Andes: bioarchaeology of systemic stress in colonial Mórrope, Peru. American Journal of Physical Anthropology, 138(3), 356-368.*	Ethics discussion SUBMIT SHORT ESSAY ON A CODE OF PRACTICE due 10 October 2017
11	10/10	The importance of bodies: post-mortem manipulation of the deceased. *The body politic, the value of bodies, cannibalism, moving bodies.*	Arnold, B 2014 Life after life: bioarchaeology and postmortem agency. Cambridge Archaeological Journal 24(3):523-9 Hutchinson, D and L Aragon 2008 Collective burials and community memories: interpreting the placement of the dead in the Southeastern and mid-Atlantic United stated with reference to ethnographic cases from Indonesia. Arch Papers of the Am Anth Associ 11:27-54	Taphonomy and context
12	17/10	Ethics and best practice in New Zealand *Ethics, legislation, ideas of the body, collaboration.*	Ashby, Edward. "Forensic archaeology in New Zealand: Review and future directions." *Australian Journal of Forensic Sciences* 45.1 (2013): 25-35. Historic Places Trust 2010 Archaeological Guidelines Series No. 8 Koiwi Tangata/Human Remains. ISBN 978-0-908577-98-9 (online)	NO LAB
				TAKE HOME EXAM Released 20 October 2018, Due 24 October, 2018

Week 2

Reading and Academic Writing

Goal:

The purpose of this lab is to introduce you to some resources and techniques relevant to the research you will do for your written assignments. Reading (and retaining) information from the course readings is crucial for success in this course. We will discuss various strategies for reading and note taking while learning more about memorials from one of the course readings.

Task:

We will have a brief introduction to the lab space and lab rules followed by some tips and tricks for reading, writing, and research for this course (applies to your others courses as well).

Then, we will discuss Tarlow (1997) - An Archaeology of Remembering: Death, Bereavement and the First World War. **Please bring a copy of the article and your notes.** We will use this article to show you how you can read academic sources effectively, so it is important that you come having read it.

We will also assign presentation days during this lab time for assignment 1. The options are either the 2 or 9th of August. I will ask for volunteers for the first day, and then we will decide by chance.

Resources:

The university provides several good resources for supporting you in your research and coursework.

The library offers free courses in a variety of subjects. You can sign up here:

http://www.news.library.auckland.ac.nz/2018/07/05/workshops-to-help-you-develop-your-academic-skills/?from-ref=homepage-hero#.W06by9UzaUk

There is a new resource for reading and writing advice provided by the university at:

https://flexiblelearning.auckland.ac.nz/writeatuni/index.html

If you are struggling to research a topic or find sources remember you subject librarian!

https://www.library.auckland.ac.nz/contacts/subject-librarian/

For writing and presentation assistance try:

https://www.library.auckland.ac.nz/study-skills/writing-presenting

For academic integrity and referencing help try:

https://www.library.auckland.ac.nz/study-skills/referencing#referencing

For subject research guides and resources try:

https://www.library.auckland.ac.nz/guides

For improvement of English written and spoken skills try:

https://www.library.auckland.ac.nz/services/student-learning/ele

All of these resources are free to students!!!!!

Quick guide for reading and note taking:

This information is adapted from https://writingcenter.gmu.edu/guides/strategies-for-reading-academic-articles.

1: Examine the article for its audience

Examine the article and its publisher for clues. Peer-reviewed academic journals are intended for scholars in that field, whereas popular titles (like *Time* or *Newsweek*) are intended for a more general audience. You may not be the primary audience for the text, and that's OK. If this is the case, the author may reference other scholarly works assuming that you've read them, or they may cite facts or events that you haven't learned about. If you encounter these elements, notice them, but try to keep moving through the article – sometimes you can keep moving without looking everything up. Also remember that if you are not the primary audience, you may not enjoy the writing style – so a little perseverance may be necessary!

2: Think about why your professor assigned this reading

You may not be the author's intended audience, but understanding the reason you've been asked to read the article can help you stay engaged and read with purpose. What subject will this article prepare you discuss? How does this article fit into the main questions or topics of the course? What will the instructor ask you to do with the knowledge you gain from the article?

3: Skim strategically to identify the main argument or idea in the text

Before you read the text from beginning to end, skim it strategically to locate the author's main purpose and argument. Having the author's purpose and main argument in mind can help you read and interpret the rest of the text. These are sections where you are likely to find info about purpose and main point:

The Abstract: The abstract is an "executive summary" that appears in academic texts, usually as a paragraph at the top of the text. As you read the abstract, try to identify the text's purpose, the main problem or question it answers, what its main findings are, and why readers should care. Abstracts are densely written – do not despair if you must re-read them. It is worth researching the terms in the abstract if you do not understand them.

The Introduction: This is a real gem: the introduction of an article often provides clear statements about the article's purpose, the question it answers, and its main point.

Conclusion: Pay close attention here, even if you assume the conclusion might be repetitive. The author may re-phrase a key point in a way that makes it clearer to you. This may also be the only place in the paper where the author discusses unanswered questions. These questions can help prepare you for discussion or fuel a written reflection.

4: Skim for the article's organization or "architecture"

Before you read the text from beginning to end, skim it to get a sense of its organization or "architecture." Doing this gives you a mental map that helps you see the different parts of the article and how they function in the overall argument. This perspective can help you read and process the article more easily. Strategies for building a mental map of the article's organization include these:

The Introduction (again): Look for a "forecasting statement" in the introduction. In addition to telling you about purpose and main point, the introduction often provides one or more statements that preview the article's content and structure. Such statements give you a road map that helps you interpret the rest of the article.

Section Headings: Flip through the article to read through all the section headings. Doing so can help you see the article's overall structure. Again, look up any terms you do not understand.

5: As you read the body of the text

Use your knowledge about the main point of the article and context clues from your class as you decide which parts of the article deserve most of your energy.

You should summarize these main points in your own words in your notes.
You should identify any terms you are not familiar with and write down their meaning in your notes.
You should highlight only key phrases if needed.
If you do this for each of your readings you will be prepared for any written assignments, exams, or reading quizzes.

Mind map for article:

Week 3 and 4:

Assignment 2: Presentation of monument

Goal:

This lab builds on our trip to the Symonds Street Cemetery in getting you to formalise your own observations, develop a research question and then write a brief analysis yourself of a monument as well as presenting that coherently to your colleagues.

Task:

Identify a place or monument concerned with the dead (that is pretty widespread) and analyse it. That means thinking up a research question about that place (keep it simple but think both about what you read for Week 1 and 2 particularly Parker Pearson as well as the sorts of issues we discussed at Symonds St cemetery). You will translate this to a 1000 word (3 page report) submitted to Canvas as a PDF (that way you can have images etc).

This project is in two stages so

In Labs 3 or 4 (we will sort out a schedule) you will each come prepared with a 2 minute presentation of your monument and your research question (practice before hand and time yourself). You can have one PowerPoint slide or one PDF page to display and talk to (You will send these to Caitlin by 3pm the Wednesday before). Now the aim of this is not to cause you pain but because it will be really interesting for us all to think about each other's projects and what sort of research questions you might ask or where might you go for information. So have an idea of your analysis (your question, your analytical frame) that we can discuss and workshop.

In Week 5 you will submit your 1000 -1200 word report (3-5 pages) plus references to Canvas as a PDF. I will compile all reports (without the marking) into a single document so that you can see what people did and have it as a resource. The report will include an introduction – which tells us what you analysed and how; a description of the monument or whatever; and then the analysis of it with appropriate references (you don't need to go overboard here but you will probably need at least one relevant historical reference since that will help with context and one relevant reference from archaeological theory e.g. if you are dealing with landscape and placement then you probably want to read something about how archaeologists analyse landscape; if you are dealing with mortality then you will need something about that time in New Zealand and then a paper that deals with a similar issue elsewhere (providing a theoretical or comparative framework).

NOW: DON'T GO OVERBOARD, TRUST YOUR DESCRIPTION, THINK ABOUT THIS ENTIRE EXERCISE TAKING UP 10 SOLID HOURS OF WORK: HALF A DAY RECORDING AND DESCRIBING AND A DAY OF RESEARCH AND WRITING

Presentation guidelines:

The quality of your presentation will factor in to your mark for the first written assignment. We will mark the presentations based on a few criteria: organization, clarity, and effectiveness. Remember that these are very short presentations (only 2 minutes) so you will want to be very organized in how you present information about your memorial. You should touch on all or most of these points:

When and where?
Who?
Why is this place/memorial relevant?
How are you going to analyse it?
Keep in mind you are only allowed one slide. It probably does not make sense to have a lot of text on this slide. Pictures are often much more useful in presentations. It could be just one photo or several. If you do have text make sure it is large enough to read (over 20pt). Make sure the photos are of high quality (resolution and size are appropriate).

Resources:

https://nzbpw.wordpress.com/2011/01/25/constructing-the-two-minute-speech/

https://vividmethod.com/a-short-speech-create-a-3-minute-speech-that-rocks/

On presentation day:

Come prepared to ask questions of your classmates about their presentations. After each presentation we will spend 2 minutes asking questions and discussing your project and ideas. This is meant to be constructive!

Week 5

Bone versus non-bone and Human versus animal

Aim:

The goal for this week is to give you familiarity with using anatomical terminology, learn the different types of bone and start to get an idea of distinguishing animal from human bone.

Procedure:

Before class –

Make sure you have read the information which is from Dianne France and is an overview of human and animal bone.

In class –

Work in your groups and complete the tasks at the end of the reading. Move around the room – as you finished you can approach your tutor for the answers but don't spoil it for those still working.

NB This is a new lab and we don't know how it will work time wise it is possible you won't finish but those of you wanting to finish up see your tutor during her office hours. Alternatively we will load the images of the trays onto Canvas so you can complete using photographs. What we do want you do to do during this lab is to handle and look at as much material as possible so that you start to get a feel as well as an eye in for the identification of bone.

LAB EXERCISES

(Work in groups). When you have finished an exercise you can go to the tutor to check your answers. Then go back and see where you went wrong BUT don't spoil it for other people by giving the game away.

We have laid out a tray with the femora of six different animals (including human). Pay attention to size and shape as well as comparing them to the articulated skeletons in the lab try to identify which animal each of the femora might have come from. When you do this you should also note either the relative (e.g. compared to your hand) or absolute measure of length so that you become familiar with size of different animals.

a.

b.

c.

d.

e.

f.

2.

We have laid out two trays of skeletal elements. Complete the following table for one of the trays. Remember to note for yourself which station you have done.

Station A or B

Type of bone (long, short etc)	Adult or juvenile	Element	Species
a.			
b.			
c.			
d.			
e.			
f.			
g.			
h.			
i.			
j.			

3 Anatomical terminology

Look at the articulated skeletons and answer the following questions:

The tibia is _____ to the femur.

The fibula is _____ to the tibia.

The sternum is _____ to the vertebrae.

The _____ surface of the scapula has a large spine which forms the upper part of the shoulder joint.

There are _____ carpals but _____ tarsals in a human skeleton.

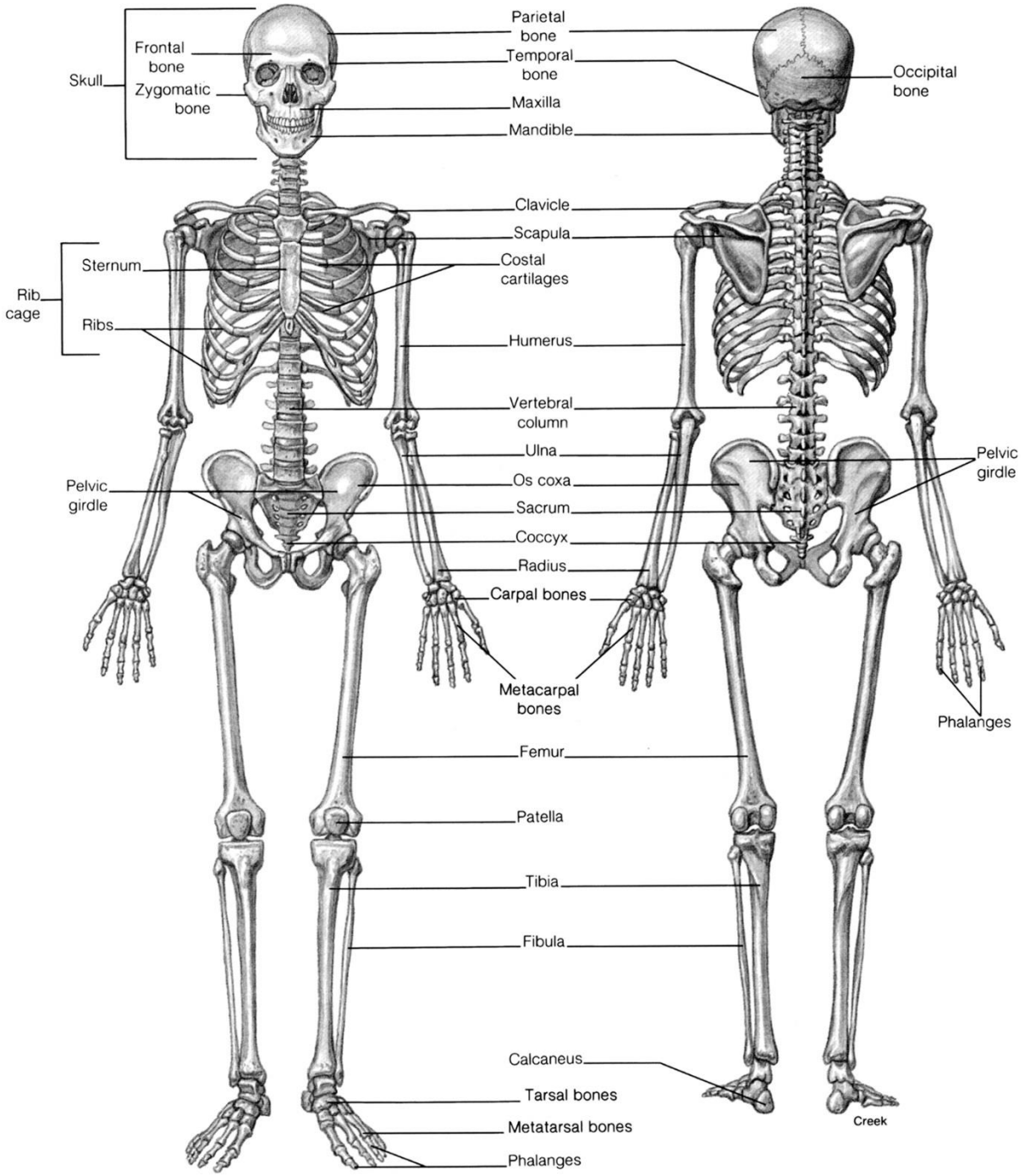
All fingers have three phalanges. True or false?

Identify one long bone

Identify one short bone

Identify one flat bone

Identify one irregular bone


Parietal bone
Frontal bone
Temporal bone
Skull
Zygomatic bone
Occipital bone
Maxilla
Mandible
Clavicle
Scapula
Sternum
Costal cartilages
Rib cage
Ribs
Humerus
Vertebral column
Ulna
Pelvic girdle
Os coxa
Pelvic girdle
Sacrum
Coccyx
Radius
Carpal bones
Metacarpal bones
Phalanges
Femur
Patella
Tibia
Fibula
Calcaneus
Tarsal bones
Metatarsal bones
Phalanges
Creek

Part I

Introduction

Before diagnosing whether or not a bone is human (indeed, at the start of any forensic investigation involving suspected skeletal remains) the first step is to determine whether or not the object in question is actually bone. Many organic and inorganic materials can mimic bone (see Figure 1.4). This can be even more confusing because bone can take on the color of its environment (bone can be darker when in dark soil, red in red soil, greenish when exposed to copper, and can be bleached white when exposed to the sun, wind, and water) (see Figures 1.5 and 1.6).

Figure 1 .4 Human femur (top), wood (middle), very weathered bone (bottom).

Figure 1 .5 Bleached white vertebra that has been in the elements (left), vertebra that was discovered in reddish soil (middle), vertebra that has been cleaned and preserved (right).

Figure 1 .6 Copper-stained bone (on left) from contact with copper while decomposing.

Figure 1 .7 Human femoral neck. Note external textural differences between the femoral head and the neck.

In addition to the general gross morphology (shape) of the skeletal element, the external and internal textures of the bone are vital to diagnosing the bone and the species (see Figure 1.7 for an example of texture on bone). The basis for understanding why this is important involves knowledge of the different components of bone.

While the color of the bone is not as important as other considerations when diagnosing species, it is very important in determining the ***taphonomic*** influences at work. ***Taphonomy*** is defined as anything that happens to a body after death. This includes the decomposition environment and patterns (climate, water, and insects, for example, and even the temperature of the laboratory in which the remains are stored). The postmortem (after death) history of the remains is sometimes one of the most important clues in solving a forensic case, and should never be dismissed when collecting evidence (including remains).

What Is Bone?

Bone is composed of both an organic and an inorganic component. That is, bone is not entirely mineral; there is a soft tissue component as well. The mineral component is a compound of calcium and phosphates called hydroxyapatite that is formed in and around an organic matrix containing collagen. Collagen is similar in consistency to very thick, relatively hard gelatin (like a hard Jello® made with much less water than usual). In living bone and in bone that is still relatively fresh after death, the collagen component is significant, but as the body and bone decompose, this organic collagen component usually decays before the mineral component is significantly affected. There are exceptions to this rule if, for example, the bone is exposed to chemicals that dissolve the mineral component and leave the organic component (most people will remember grade-school biology in which chicken bones were soaked in vinegar to dissolve the minerals and leave a rubbery, soft material that looked like a chicken bone) . Remembering that there is an organic as well as an inorganic component to bone also helps to explain the way in which bone develops and the way it reacts to various stresses (fractures, cuts, dis- eases, etc.).

Bone Morphology

Bone is a living, dynamic tissue that responds to its environment.To a large extent, the form of a bone is determined by its function and the function is determined by its form.For example, humans use our forelimbs largely for manipulating and carrying objects, while a cow uses its forelimbs for locomotion and to support the cranial half of its body. It makes sense, therefore, that a cow forelimb will be more massive and have a narrower range of motion than will the human forelimb. If an investigator under- stands and uses this basic principle, it will not be necessary to memorize the form of each bone of each species to diagnose whether or not the bone is human!

At the same time, however, it is interesting that the individual bones of human and nonhuman mammals (the concentration of this book) are similar enough in morphology that it is relatively easy to determine whether the bone is an ulna or a femur (Figures 1 .8 and 1 .9) . If the investigator is able to determine which bone of the body he is holding, it becomes relatively easy to determine whether or not the bone is human. This book contains hints

intended to help with this initial determination.
In determining whether or not a bone is human, it is important to distinguish between an area of bone-to-bone articulation, an area of muscle attachment (origin and/or insertion), and an area of relatively smooth bone that is neither an area of articulation nor an area of muscle attachment (Figure 1 .10). In healthy bone, the area of articulation between two bones that are designed to move against each other* will have a smooth surface.

Figure 1 .8 Ulna of human (left) and antelope (right).

Figure 1 .9 Femur of human (left) and moose (right).

* There are other types of joints between bones in which motion is limited or essentially absent (such as at the sutures of the cranium). These articular surfaces are not smooth.

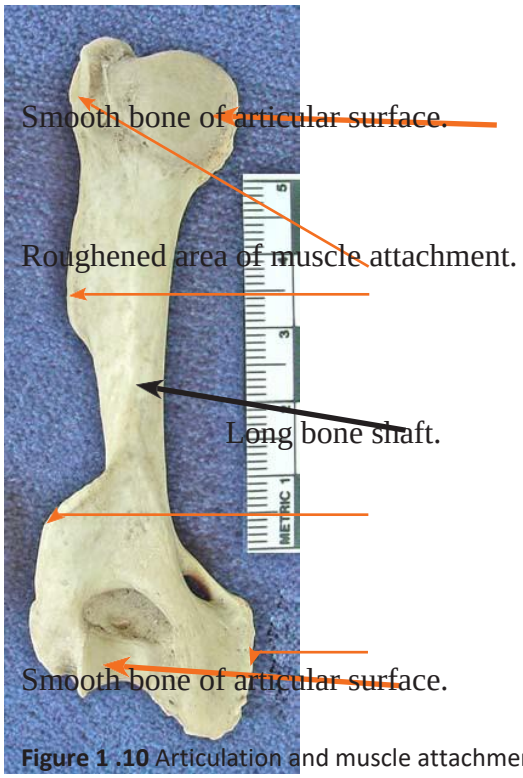


Figure 1 .10 Articulation and muscle attachment areas of a common long bone.

This surface will be separated from the articular surface of the other bone by a layer of cartilage able to withstand normal movement, and is sometimes filled with a slippery lubricant called synovial fluid (somewhat like egg whites, and in fact the word can be broken down to "syn" meaning "together" and "ovia" meaning egg) . If the cartilage or articular surface is damaged, the joint surfaces may break down causing degeneration and perhaps areas of eburnation (areas where the bones polish each other by the rubbing action) (Figure 1 .11). This and other pathological conditions may confuse the diagnosis of species, and if a pathological condition is suspected, the bone should be taken to an expert for d i a g n o s i s .

The area of origin or insertion of a muscle (or muscle tendon) or ligament on bone is rough and often raised (though not all rough areas are locations of muscle attachment). Generally, the larger and more powerful a muscle is, the more area of the bone it needs on which to anchor itself. Note, for example, the large crest at the back of the cranium of the moose in Figure 1.12a and compare that to the smoother corresponding area on the human (Figure 1.12b). The neck muscles in the moose must work against gravity to hold up a very large head, while the head of a human is balanced on top of the spinal column and does not require large muscles to hold the head up (the specifics of these actions will not be covered in this book).

After determining the bone in question (femur, humerus, etc .) and identifying the areas of articulation and muscle insertion on the bone, one can determine whether the bone is from a quadruped and whether it is from a mature individual. Figures 1.10, 1.13, and 1.14 show common features and terminology used in osteological analysis.

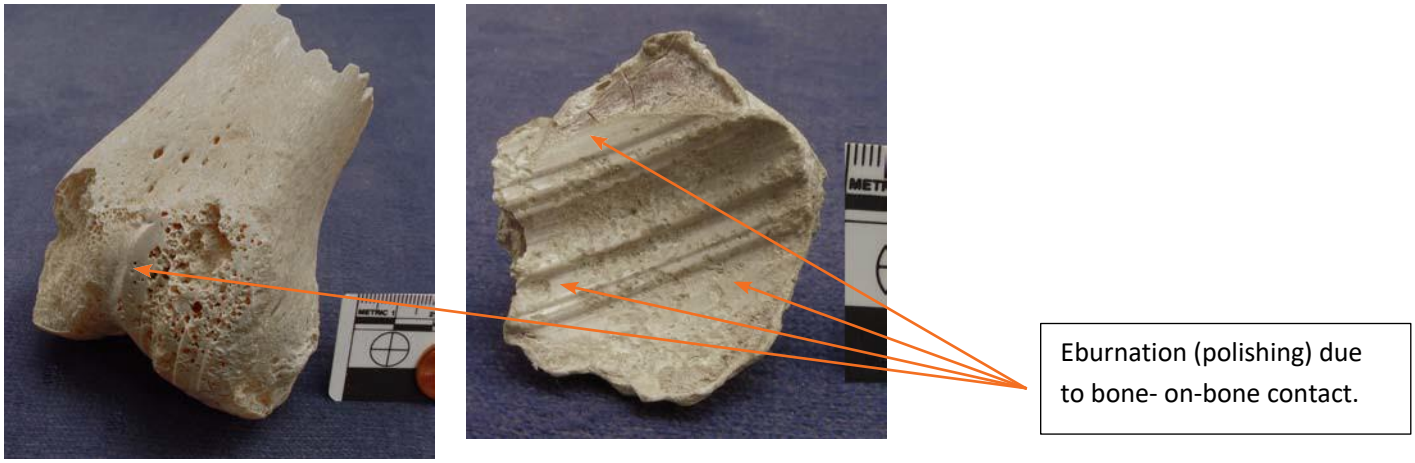


Figure 1 .11 Degenerative process in knee joint with breakdown of the articular surface and eburnation (polishing).

Figure 1 .12 Moose cranium (left) showing large area of muscle insertion and human cranium (right) showing smaller area for muscle insertion.

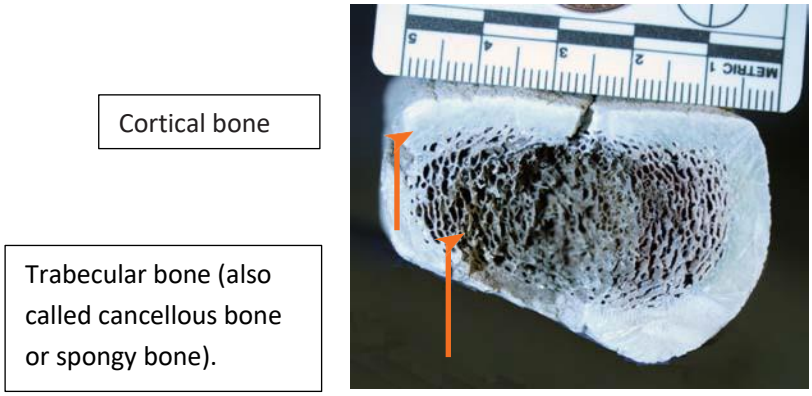
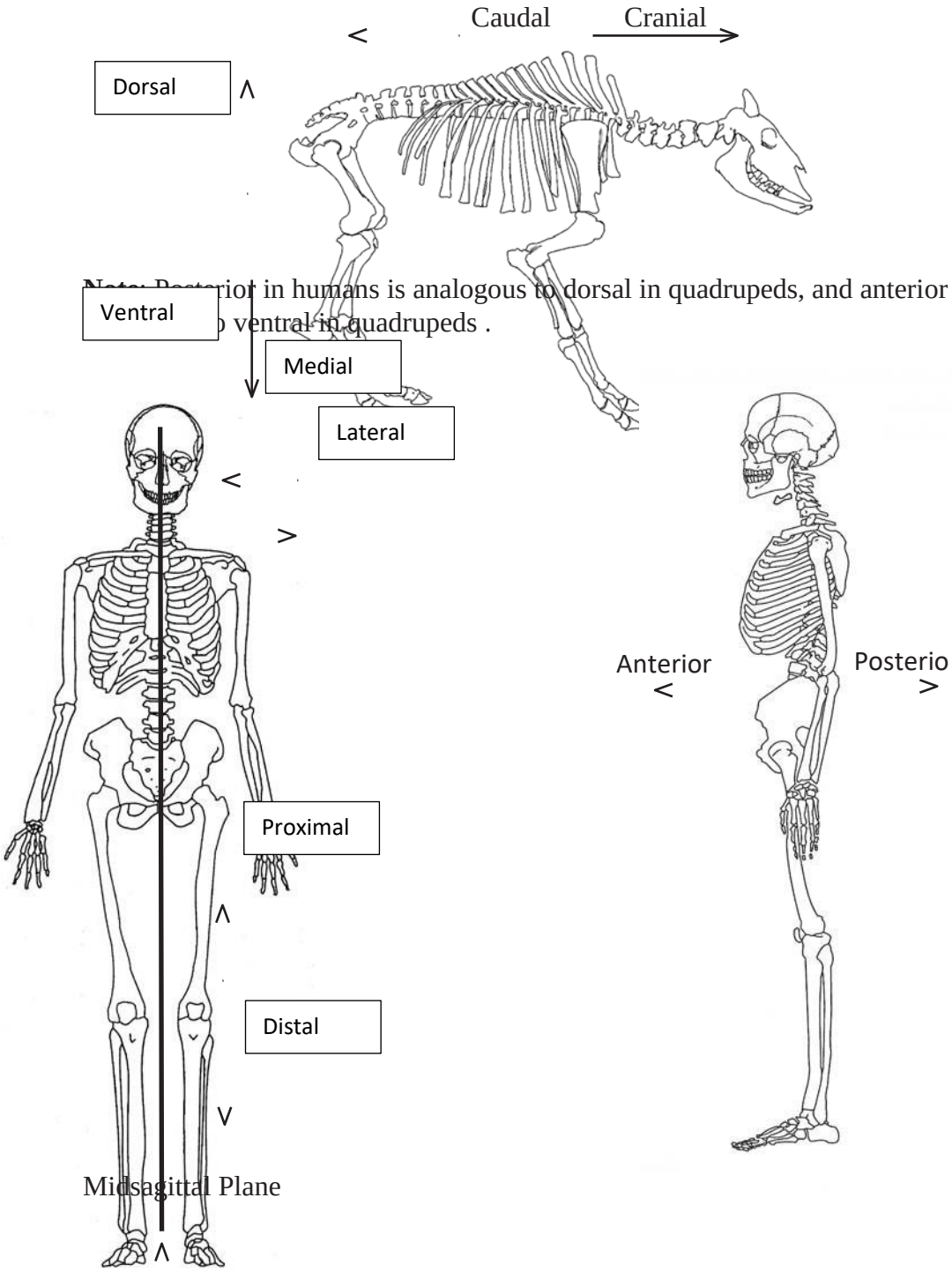


Figure 1 .13 Cross section of typical long bone.



Note: Posterior in humans is analogous to dorsal in quadrupeds, and anterior in humans is analogous to ventral in quadrupeds .

Figure 1 .14 Planes of the body.

Table 1.1 *Anatomical terminology*

Anterior: in front (analogous to ventral in nonhumans) Appendicular: the skeleton of the limbs

Axial: the skeleton of the head and trunk Caudal: toward the tail

Coronal plane: parallel to the coronal suture Cranial: toward the head

Distal: away from trunk of body along a limb Dorsal: in back (analogous to posterior in humans) External: outside of

Inferior: lower

Internal: inside of

Lateral: perpendicularly away from midsagittal plane Longitudinal: coursing or placed lengthwise

Medial: perpendicularly toward the midsagittal plane

Midsagittal plane: in a line defined by the sagittal suture of the cranium Posterior: behind, to the back (analogous to dorsal in nonhumans)

Pronation: rotation of the hand and forearm so that the palm faces posteriorly Proximal: toward the trunk of the body along a limb

Sagittal section: any section of the body parallel to the sagittal suture of the cranium Superficial: near the surface

Superior: above, top

Supination: turning the palm of the hand anteriorly

Transverse: any crosswise section

Ventral: in front (analogous to anterior in humans) Vertex: top, highest point

In mouth:

Buccal: toward the cheek

Distal: at the greatest distance from the anterior midline of the mouth Labial: toward the lips

Lingual: toward the tongue

Mesial: toward the anterior midline of the mouth Occlusal: the chewing surface of the teeth

Table 1.2 *Features of Bone*

Feature (plural)	Definition
Cavity (cavities):	an open area
Condyle (condyles):	rounded process near the point of articulation with another bone
Crest (crests):	a projecting ridge
Diaphysis (diaphyses):	the shaft of bone
Epiphysis (epiphyses):	a process of bone initially attached by cartilage, and usually later consolidated with it by bone
Fontanelle (fontanelles):	membranous space between cranial bones in fetal life and infancy
Foramen (foramina):	a hole or opening
Fossa (fossae):	a pit, depression, or cavity
Meatus (meatuses):	a canal
Process (processes):	any outgrowth or prominence of bone (projection)
Sinus (sinuses):	bone cavity lined with mucus membrane
Suture (sutures):	areas of articulation between cranial bones
Torus (tori):	an elevation or prominence
Tubercle (tubercles):	a small, knob-like projection on bone
Tuberosity (tuberosities):	a large, rough eminence or projection on bone

Comparisons of quadrupeds and bipeds

Hints:

More sculpted bones are usually nonhuman, even in immature bones.
More sculpted articular surfaces have decreased range of motion while less sculpted articular surfaces may have greater range of motion.

Quadruped: an animal that habitually walks on four limbs

Bipeds: an animal that habitually walks on two limbs

This book is intended to be a guide to the differentiation between human bipeds and nonhuman quadrupeds. Quadrupeds (or those animals who habitually walk on four limbs)

and bipeds (humans who walk on two legs) are not the only two categories of locomotion, but they are the two categories pertinent to this book. For example, brachiators (those primates who habitually swing from branch to branch in trees) have significantly different skeletal morphology because of this greatly different loco- motion pattern, and will not be covered in this book.

Among the quadrupeds covered in this book, the differences in locomotor patterns are reflected in the morphology of the skeleton (particularly the postcranial skeleton). The skeleton of a deer reflects the need for an animal of moderate size to move quickly.Elk need to move quickly, but they are larger animals than deer, and the skeleton reflects that size difference (the bones are larger and more massive). The buffalo and cow are massive animals that do not move quickly, so their skeletons must support much more weight without the need for speed. Horses are large, fast animals, and their skeletons are interesting because they are significantly different from any other animal studied in this book.Sheep and goats are relatively short animals with significant weight for their height and a moderate need for quickness. Dogs, and particularly cats, are fast runners that do not carry much weight. Beavers show skeletal modifications near the tail that allow for large muscle insertions to control that large tail. Badgers are digging animals and their forearms demonstrate that pattern.

The Vertebral Column and Thorax (Chest) Area

The vertebral column is divided into five sections: cervical (usually 7 in number), thoracic (usually 12 in number), lumbar (usually 4 to 6 in number), sacral (usually 4 to 6 in number but fused in the adult to form the sacrum) and coccygeal (varies in number according to whether or not the species has a tail). Humans and nonhumans have about the same number of vertebrae (even giraffes have only 7 cervical or neck vertebrae! See Figure 1 .15), but the shape of the vertebral column a n d of the individual vertebral bodies differs. The vertebral column in a typical quadruped has a single gradual curve from the neck to the pelvic girdle (somewhat like a cantilever bridge), while the human has an “S”-shaped column. This difference in vertebral column shape is reflected in the morphology of the vertebrae as well. The quadruped typically has a longer, more cylindrical vertebral body than does the human, and the vertebral bodies are more similar in length from the neck region to the pelvis. Humans have more wedged-shape vertebrae (Figure 1.16), and the bodies of the vertebrae are gradually larger from the neck region to the pelvis (each vertebra carries more weight than the vertebra above it, so the bodies are larger as one progresses “down” the vertebral column).

The spinous process of a vertebra (in all species) is that projection on the dorsal or posterior aspect of the vertebra (dorsal in a quadruped is analogous to posterior in the human).The spinous process is the area of insertion muscles along the spine, and is very different between large quadrupeds (cows, horses, etc.) and humans or small quadrupeds. This is the general area of insertion of the neck muscles responsible for holding the head up against gravity. Note that in the large quadrupeds the spinous processes are huge relative to the size of the vertebra (see Figure 1.17).

Note that the thorax (chest cavity including ribs) is deep and narrow in quadrupeds and shallow and broad in humans (which brings the center of gravity of humans closer to the vertebral column).

This, naturally, changes the shape of the ribs, making ribs straighter in quadrupeds and more curved in humans (see Figure 1.18).

Figure 1 .15 Second cervical vertebra of human (left) and giraffe (right) placed in same plane. Notice the size of the scale in each photograph (smallest ticks are millimeters in each).

Figure 1 .16 Wedge-shaped vertebra of human (left) and cylindrical vertebra of mountain lion (right) .

Figure 1 .17 Spinous process of thoracic vertebra in bison (above) and human (right) .

Figure 1 .18 Typical ribs of human (left) and cow (right) .

Figure 1 .19 Superior human clavicle (left) and inferior human clavicle (right) .

Figure 1 .20 Human (left) posterior scapula and moose (right) dorsal scapula .

The clavicle maintains the distance between the sternum and the scapula and provides support for the shoulder girdle. It is present in humans and in some other mammals in which the forelimbs are used for manipulation (such as the beaver), though it is vestigial or absent in many mammals and is therefore of limited use in species identification.The clavicle of the human is shown in Figure 1.19. In both photo- graphs, the sternal articular surface is on the left and the scapular articular surface is on the right.
The scapula is elongated in most nonhuman mammals, with the glenoid fossa (the point of articula- tion with the humerus) at the end of the long axis. In humans the scapula is more triangular in shape, with the glenoid fossa along the most lateral surface (see Figure 1.20).

The Cranium

As stated above, the area of the occipital region of large quadrupeds is modified for the attachment of large neck muscles devoted to counteracting the effects of gravity on a large skull. The nasal region of many quadrupeds is long and narrow. In many animals, the increased sense of smell is reflected in this long nose though in some animals the length of the face is a reflection of the morphology of the dentition.For example, the canids have a keen sense of smell as carnivores while the horse has a dental complex that reflects its vegetarian diet.The foramen magnum of a typical quadruped is located more posteriorly (which makes sense because the skull is in front of the spinal column).

The foramen magnum in a biped is more centrally located under the cranium, which helps in balanc- ing the cranium on the vertebral column (Figure 1.21). The mastoid process (see Figure 1.22) is the point of insertion of the sterno-cleido-mastoid muscle that originates on the clavicle and sternum, and is responsible for maintaining the balance of the skull on top of the vertebral column and for turning the head. The mastoid process is very small in quadrupeds, as there is little need to bring the cranium from a dorsal to a ventral position.

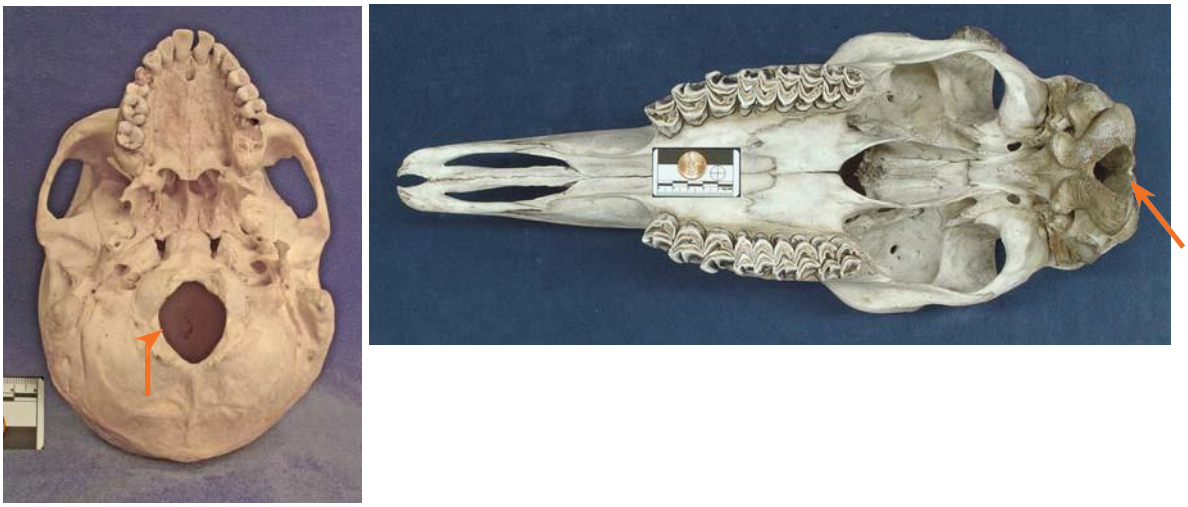


Figure 1.21 Foramen magnum in the human (left) and moose (above).

Figure 1 .22 Mastoid process in human (left, at arrow) and corresponding area in wolf (right) .

The Pelvis

Because of the changes in the ilium, the center of gravity of quadrupeds is different from that in the biped . The pelvic girdle (os coxae and sacrum) in quadrupeds is long and narrow and reflects the function of the leg muscles that attach to the pelvis . The lower limbs in the large quadrupeds move antero-posteriorly with very little lateral motion, so the strength of the muscles of the leg that make this movement possible are benefited by a long pelvis (which acts as a long lever arm) The pelvic girdle in humans has become shorter and wider, reflecting the different locomotion patterns (balancing the weight over each leg independently as forward movement occurs) as well as the difference in support of the abdominal contents and the need for a large pelvic outlet for childbirth in females (Figure 1.23).

Figure 1 .23 Human pelvic girdle (left) compared to pig pelvic girdle (right) .

The Limbs

In general, the forelimbs and hindlimbs of quadrupeds are of roughly equal length, while in humans the hindlimbs are considerably longer than are the forelimbs . The forelimbs of most quadrupeds carry somewhat more weight than do the hindlimbs, as the center of gravity is usually closer to the forelimbs.

Certain bones of the forelimbs and hindlimbs of many quadrupeds are modified to increase the power to the legs . The concept of lengthening certain bones (and therefore muscle attachment areas) to increase the power of the muscle is easy to understand if we liken it to jacking up a car to change a tire. If you are trying to use a jack to lift a car, would you use

more energy if you used a short handle or a long one? Naturally a long handle would use less of your energy and it would move through a greater distance to get the car the same distance off the ground . The biomechanics of a long lever arm in animal locomotion works the same way . The animal uses less energy to move what is on the end of the long lever arm . In addition (and this is particularly important in animals that run at high speed), that lever (or leg) moves through a greater range of motion than does a leg that is shorter or that has a shorter lever arm .

The radius and ulna and tibia and fibula allow rotary (pronation and supination) motion in humans and in most smaller mammals . In humans, the radius and ulna are roughly equal in size and allow great flexibility in pronation and supination (Figure 1.24). The tibia and fibula in humans still allow at least a little rotary motion in the foot (though it is greatly reduced when compared to other primates) . In many small quadrupeds the tibia and fibula are still separate bones and allow some rotary motion, but in many of the large quadrupeds the fibula is greatly reduced, so that there is no rotary motion of the foot . Likewise, in many of the large quadrupeds the radius and ulna fuse in the adult, so that there is no rotary motion of the forelimb.

In general, the articular surfaces of the limbs of quadrupeds such as dogs, cats, and horses are more sculpted than those of primates (and higher primates and humans in particular) . Observe the articular surface of the distal femur of a moose and compare it to the human distal femur (Figure 1 .25) .

Figure 1 .24 Human radius and ulna (left) and Moose radius and ulna (right) . Arrows point to olecranon process of the ulna, insertion point of muscles that extend the leg . Note the increased area of bone devoted to muscle insertion in a large quadruped (right) . Also notice that the two bones in humans are roughly the same size and allow for pronation and supination (described in text) .

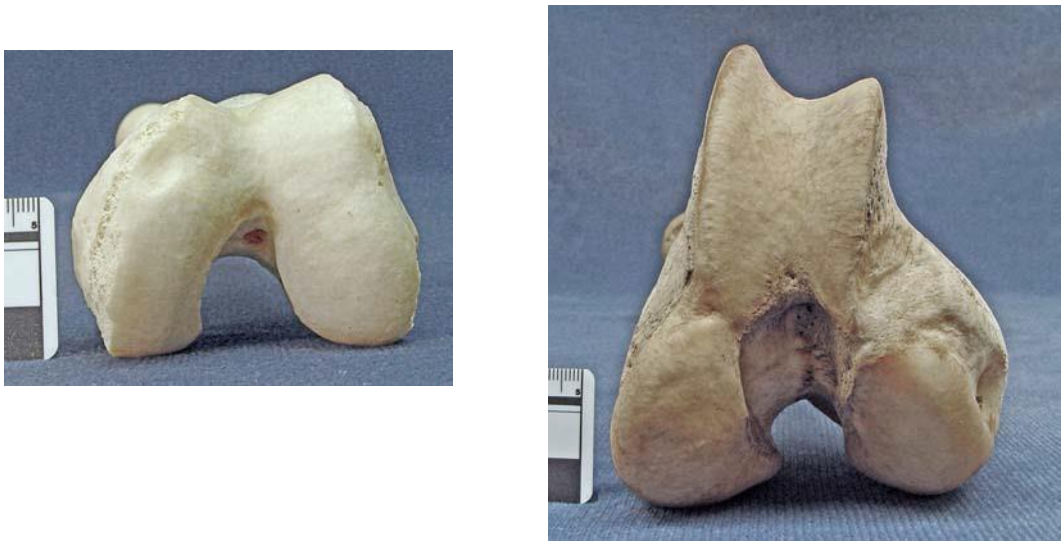


Figure 1 .25 Human distal femur (above) and moose distal femur (right) .

Figure 1 .26 Hand of human (left), paw of wolf (middle) and hoof of a horse (right) .

The hands and feet reflect different lifestyles in mammals. Most mammals have five fingers and five toes, but the larger quadrupeds have reduced fingers and toes — the mammals such as cow and sheep have two digits while the horse has one . These mammals often have rudimentary digits higher up the hoof . The dog and cat have four pads that touch the ground, but also have a "dew claw" higher up on the forelimb and hindlimb (Figure 1.26).

Growth and Development

One of the most confusing aspects of determining whether or not a bone is human is trying to diagnose an immature bone. Very young bones (fetal or, depending upon the species, varying lengths of time after birth) are not as "sculpted" as are adult bones. Human bones, for the most part, remain less "sculpted" throughout the life of the individual.

As was mentioned earlier, bone is composed of both organic and inorganic components.Most bones of the mammalian body are first formed as a cartilage matrix, although some bones, such as many bones of the cranium, develop from a different kind of soft tissue (membrane). The initial cartilage matrix grows in the fetus, and at some point in its development cartilage begins to be transformed into bone. When this occurs depends not only upon the species, but also the individual bone within the body, as different bones throughout the body will develop at different rates and ages. Experts can take advantage of this fact in diagnosing the age of an individual.

At the very earliest stages, the centers of bone growth start as a single bone cell, and for a time are indistinguishable from other centers of bone growth of the same size in the body. Their location in the body can, of course, be determined if the body is intact, and this can give valuable information about the age of the individual; however, if the amorphous centers are discovered dry and out of context, they are often impossible to differentiate . In the cartilage model, osteogenic (bone-forming) cells overtake the cartilage cells and replace them with bone one bone cell at a time. Often a single bone goes through this process at different parts of the bone at different times. The first area of the bone for this to happen is usually in the primary section of the bone called the ***diaphysis (plural: diaphyses)*** (the approximate

center of the shaft of a long bone, for example)**.** Secondary centers of bone growth can occur at the ends of the bone and are each called an ***epiphysis (plural: epiphyses)*** (these usually begin bone growth later than does the diaphysis) . Until the bone ceases growth, there is the cartilage matrix between these centers and a unique surface at the ends of these growth plates (see Figures 1 .27 and 1 .28) .

A bone may have several secondary centers of growth (Figure 1 .29) . In bone that starts with the cartilage matrix, each secondary center will grow and develop and eventually fuse into the growing and developing primary center . Bone growth in a shaft begins where bone-forming cells (osteoblasts) enter the cartilage matrix and begin to secrete a substance that is quickly mineralized . These bone- forming cells enter the matrix through a blood vessel (the nutrient foramen) that leaves a foramen in the completed bone . The position and size of this foramen may help somewhat in identifying a bone in question . The area of rapid growth between the diaphysis and the epiphysis (or epiphyses) is the growth plate, or metaphysis . As the cartilage matrix is turned into bone at the diaphysis and the epiphysis, the cartilage between the two continues to grow and add new cells . In this way the bone growth between the diaphysis and epiphysis can continue . When the bone formation at the diaphysis meets the formation of bone at the epiphysis, the two unite and longitudinal bone growth ceases (that bone will not grow longer).

Figure 1 .27 Human femur at two stages of development .

Figure 1 .28 Epiphyseal surface (growth surface) in the human and nonhuman (from two different bones of the body) . Notice that the surface is a different texture than that of any other kind of bone surface .

Figure 1 .29 Different growth centers in the human femur .

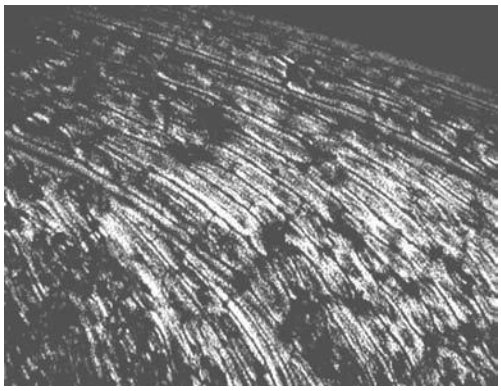
Figure 1 .30 Normal femur length (left) and shortened femur growth in an achondroplastic dwarf (right) . This may be confusing in species identification .

This union occurs at different times in different bones, and the sequence and degree of union are useful in determi- nating age at death. Also, if this happens too quickly, the bones may be shorter than normal (Figure 1.30). If it happens too late, bones may be longer than normal. This massive difference in size caused by acceler- ated or retarded union of the growth centers may create confusion in species identification.

Initial bone formation occurs very quickly and produces loosely woven bone (more a collection or weaving of spicules of bone). A significant amount of cartilage remains within these areas of rapid bone growth, and if dry bone (in which much of the organic component is removed) is observed at this stage, it will appear to be very porous (Figure 1.31). This bone growth is so rapid that it traps osteo- blasts, which then become osteocytes (bone cells).

Microscopically, these bone cells are important to age determination as well as (often) species des- ignation. As an individual ages, bone is constantly remodeled when bone-absorbing cells (osteoclasts) remove calcium in tunnels they create through the bone cells. New bone is formed in these tunnels but it overlaps the older osteocytes, creating fragmentary osteocytes. Relative age can be determined by counting the complete (younger) osteocytes and the fragmentary (older) osteocytes. Many species have osteocytes that differ from those in human bone. Artiodactyls, for example, have osteons that are more the shape of curved bricks (or *plexiform* bone) than the round pattern seen in humans (see Figure 1.32). Some nonhuman animals have round osteons, but the rest of the bone differs in microscopic and macroscopic morphology. This histological examination is within the realm of expert diagnosis, however, and will not be discussed in detail in this book.

Figure 1.31 Human infant femur (right) and immature chicken femur (left). Though very similar, and both have porous bone, note that the distal articular surfaces are quite different.



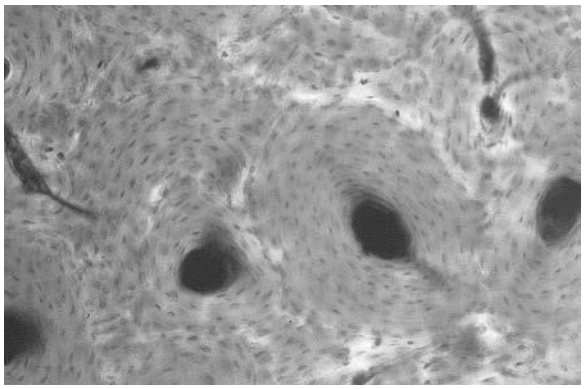


Figure 1 .32 Microscopic cross sections of deer bone (left) showing plexiform bone and human bone (right) showing round osteons .

Dental Growth, Development, and Eruption

There are two sets of teeth in mammals: the deciduous (or baby) teeth followed by the permanent denti- tion . All teeth develop from the crown to the tip (apex) of the root (Figure 1 .33), and begin to develop deep inside the maxilla or mandible before reaching a point in their development when they erupt beyond the gum line (or the alveolus in bone) and become notice- able in the mouth . Note that in a young mandible, there are large voids (called crypts) in which the crown of the tooth develops, and those voids close around the root of the tooth as it erupts beyond the alveolus . If you find that large void, (be careful you don't mistake it for a void caused by a disease process such as an abscess or a fracture before or after death) you know that a tooth was developing in it (Figure 1 .34) .

Beneath (in the mandible) or above (in the maxilla) the deciduous tooth, the permanent tooth is forming, and while it is expanding in size, the root of the deciduous tooth begins to resorb . When enough of the deciduous root is gone, the deciduous tooth falls out (Figure 1 .35) .

The difference in tooth morphology between humans and nonhumans is a very important way to distinguish between them (and between nonhuman species) .

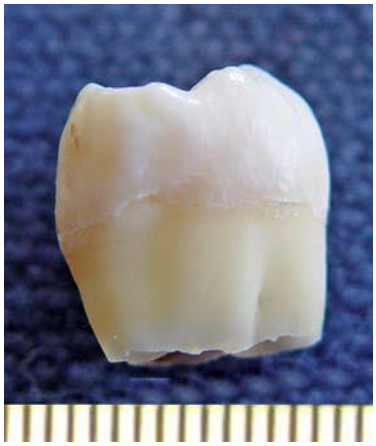


Figure 1 .33 Developing human molar . Dentition forms from the crown to the

Figure 1 .34 Tooth crypt .

Figure 1 .35 Cutaway mandible showing developing dentition .

Week 6

Ageing, sexing and ancestry

Goals:

In this lab you will be examining adult remains and identifying the characteristics of the skeleton that are used to determine sex, age and ancestry.

Tasks:

Before class – read the associated information and especially focus upon the differences in the photographs.

In class: work in groups, as you complete a task you can check the answer with your tutor but, as always, don't spoil it for your fellow class mates.

BACKGROUND INFORMATION

Determining sex

Once remains are identified as animal or human, the number of individuals has been estimated, and the juveniles sorted from the adults, the next task is estimating biological sex. This is based on sexual dimorphism between adult male and adult female bodies. Specifically we are focussed on size and shape. These are continuous variables so an individual skeleton may be more male or less male or more female or less female or simply indeterminate. Hence different characters are scored as Female, Probable Female, Indeterminate, Probable Male, Male.

Sex determination based on size.

In general there are size differences between males and females with males larger on average. There are always individual variations to this rule and the degree of variation differs via populations. So while there are measurements that can be taken such as the diameter of a femur head which are useful for indicating sex but the measurements associated with male and female may vary by population. A general rule for European remains is:

Femur head diameter <43mm Female

43-45 mm Indeterminate

45 mm+ Male (Bass 1986)

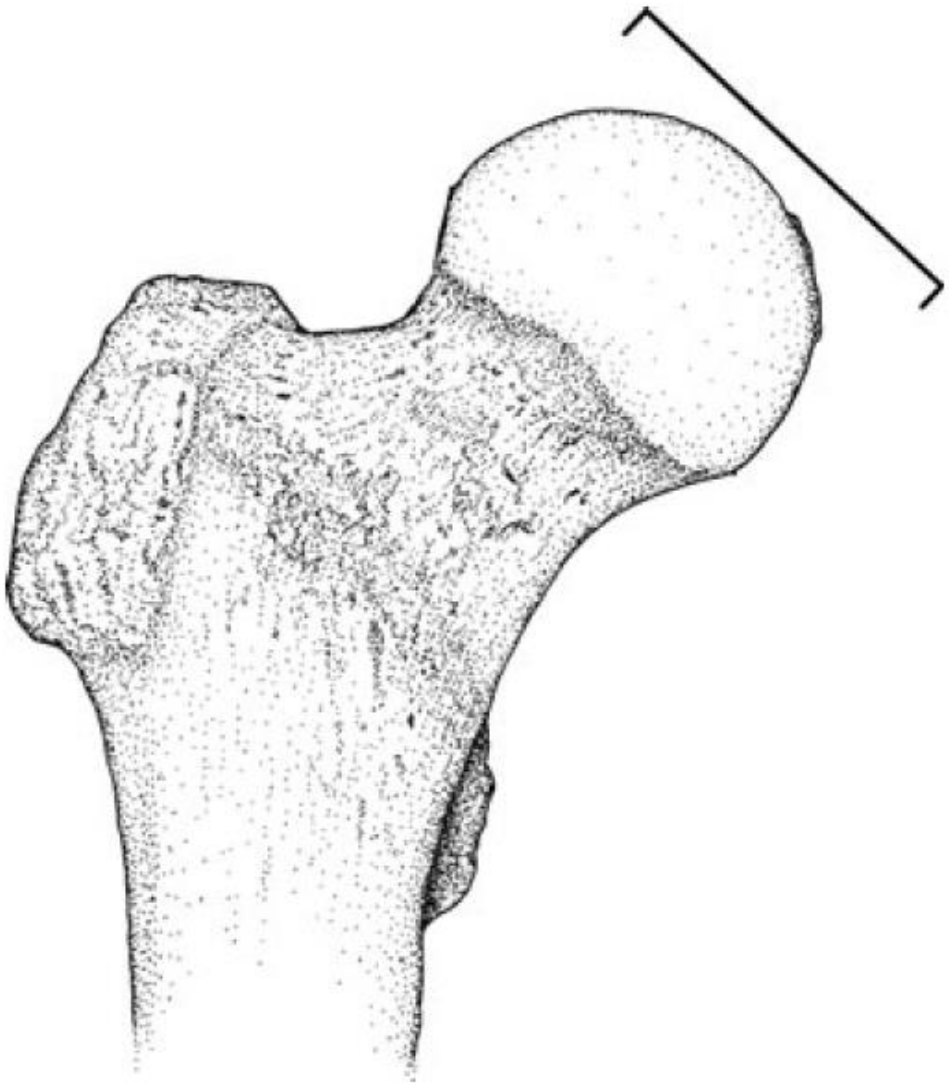
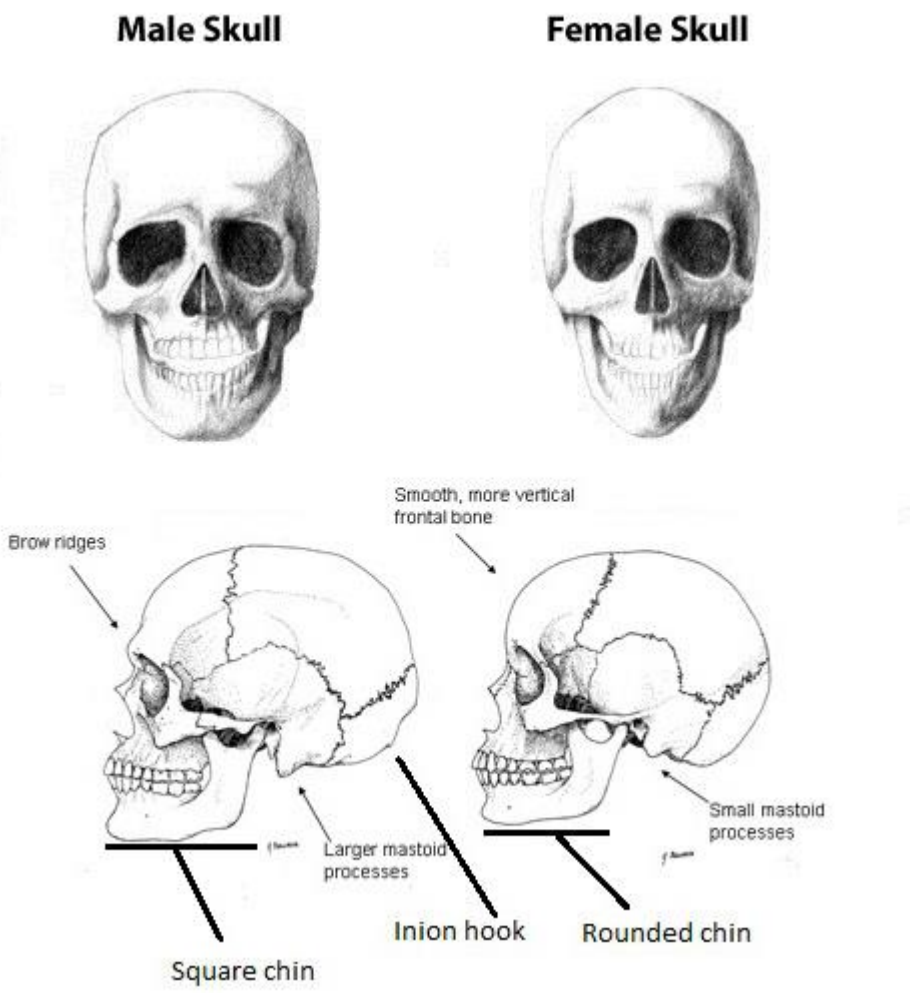


FIG. 2—*Femoral head diameter, with the longest dimension occurring nywhere around the circumference of the head.*

Milner and Bolsden 2012 J Foren Sci 57: 36

The cranium is often used in sex determination based on size. Generally the muscle attachments and cranial features are more robust and pronounced in males than in females. For example, males have more pronounced brow ridges and larger mastoids (behin the ear). Males also tend to have a squarer mandible and chin while female mandibles are rounded and their chins are pointed.

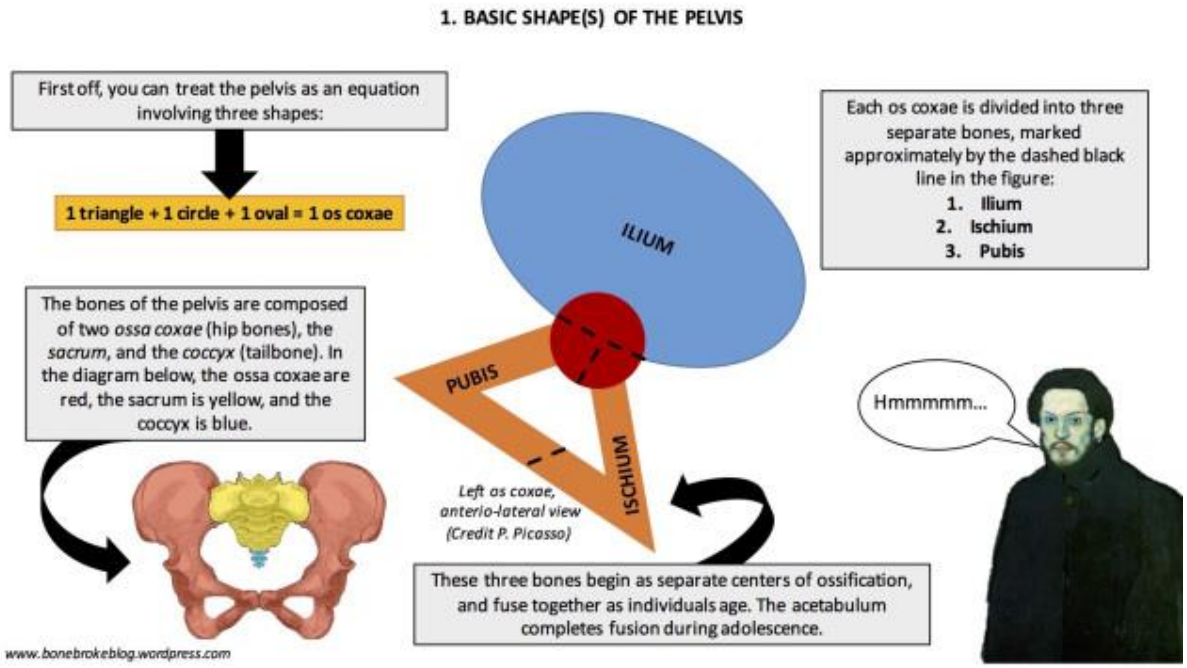


http://www.therideadvice.com/wp-content/uploads/2015/01/Male-Female-Skull.jpg

Sex Determination based on Shape

The most obvious functional differences in the skeleton are in the pelvis. The female bony pelvis has to be able to accommodate the passing of a foetus and that means there are a number of specific traits that vary between the sexes due to this functional distinction.

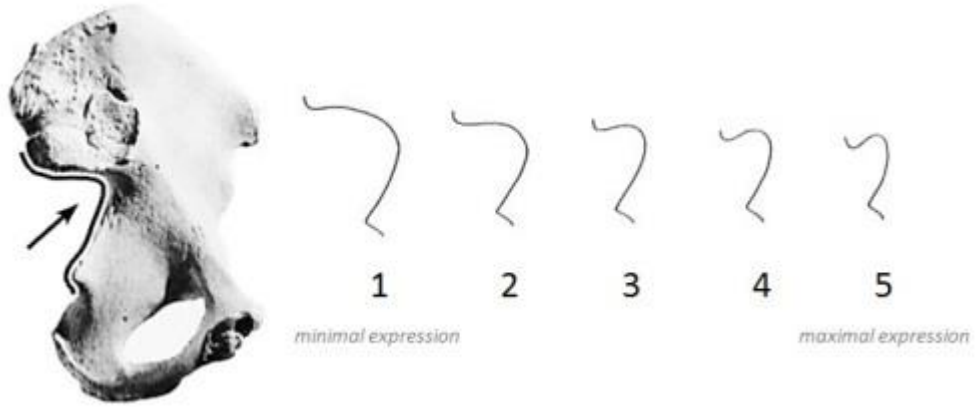
(Remember the *os coxa* or innominate bone is actually three bones fused: the ilium, the ischium, and the pubic bone)



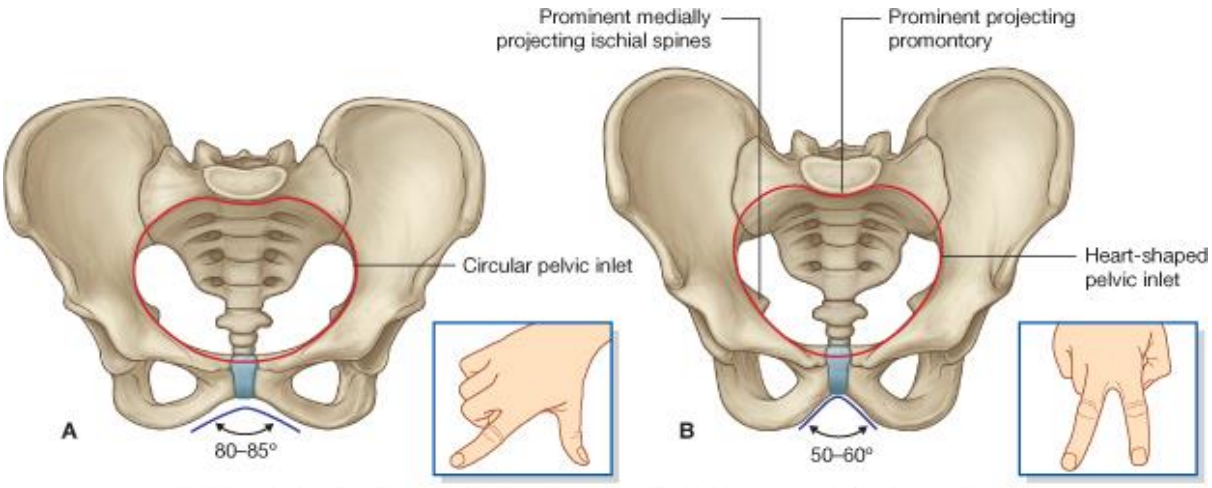
https://bonebrokeblog.files.wordpress.com/2015/10/slide11.jpg?w=640

A summary of the major differences are:

The sciatic notch in females in wider (stages 1 and 2 below).



Females have a wide subpubic angle.



The angle formed by the pubic arch can be approximated by the angle between the thumb and index finger for women and the angle between the index finger and middle finger for men as shown in the insets.

https://drkamaldeep.files.wordpress.com/2011/02/image3.png

If you only have one os coxa then place your index finger along the pubic symphysis (superior to inferior) so that your thumb is touching the inferior surface of the pubis. Then try to move your thumb away from the index finger – if there is space this shows there is a subpubic concavity, indicative of a wider pubic arch. No space is a narrow pubic arch and hence a male.

This is the scoring for the subpubic concavity from 1 on the left (female) to 5 on the right (male).

Determining age at death

Determining how old someone is at the time of their death is very difficult in adults and the indicators we have are less accurate at older ages.

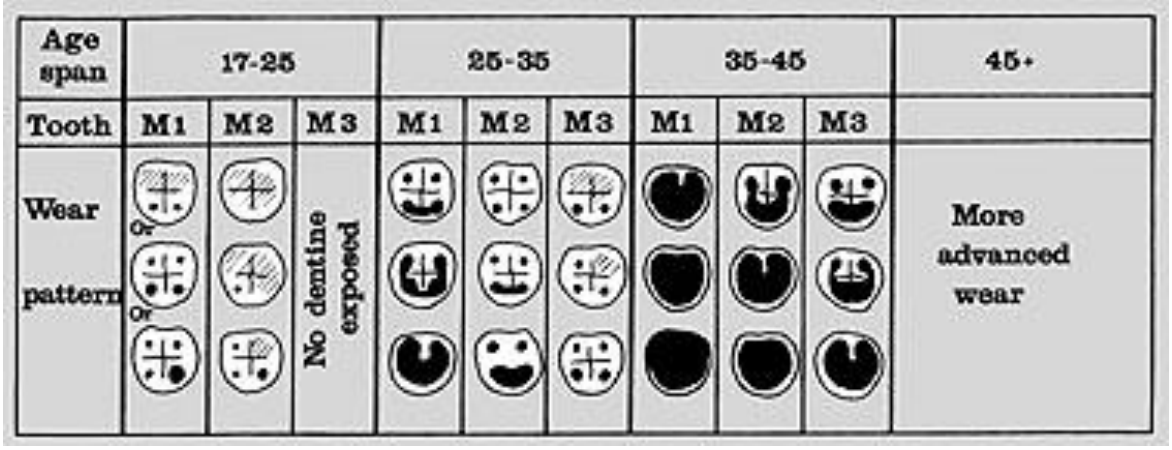
Most ways of aging adult skeletons are based on metamorphic or degenerative changes and these are observed on bone joint surfaces that have little or no movement during life:

e.g. the pubic symphysis (Suchey-Brooks ageing) – based on the prevalence of prominent and regular ridges on the symphyseal face which decrease with age while the prevalence of rimming and bony nodules on the symphyseal face increase with age. These changes occur at differing rates for males and females so different ranges and charts are use for the two sexes. The image below combines these.

Typical samples of each phase on the left pubic symphyseal faces (real images, left) classified with the Suchey–Brooks method and their 3D images (right) synthesized with the 3D scanner. Phase 1; male, 11 years old. Phase 2; male, 23 years old. Phase 3; male, 32 years old. Phase 4; male, 40 years old. Phase 5; female, 82 years old. Phase 6; female, 86 years old.

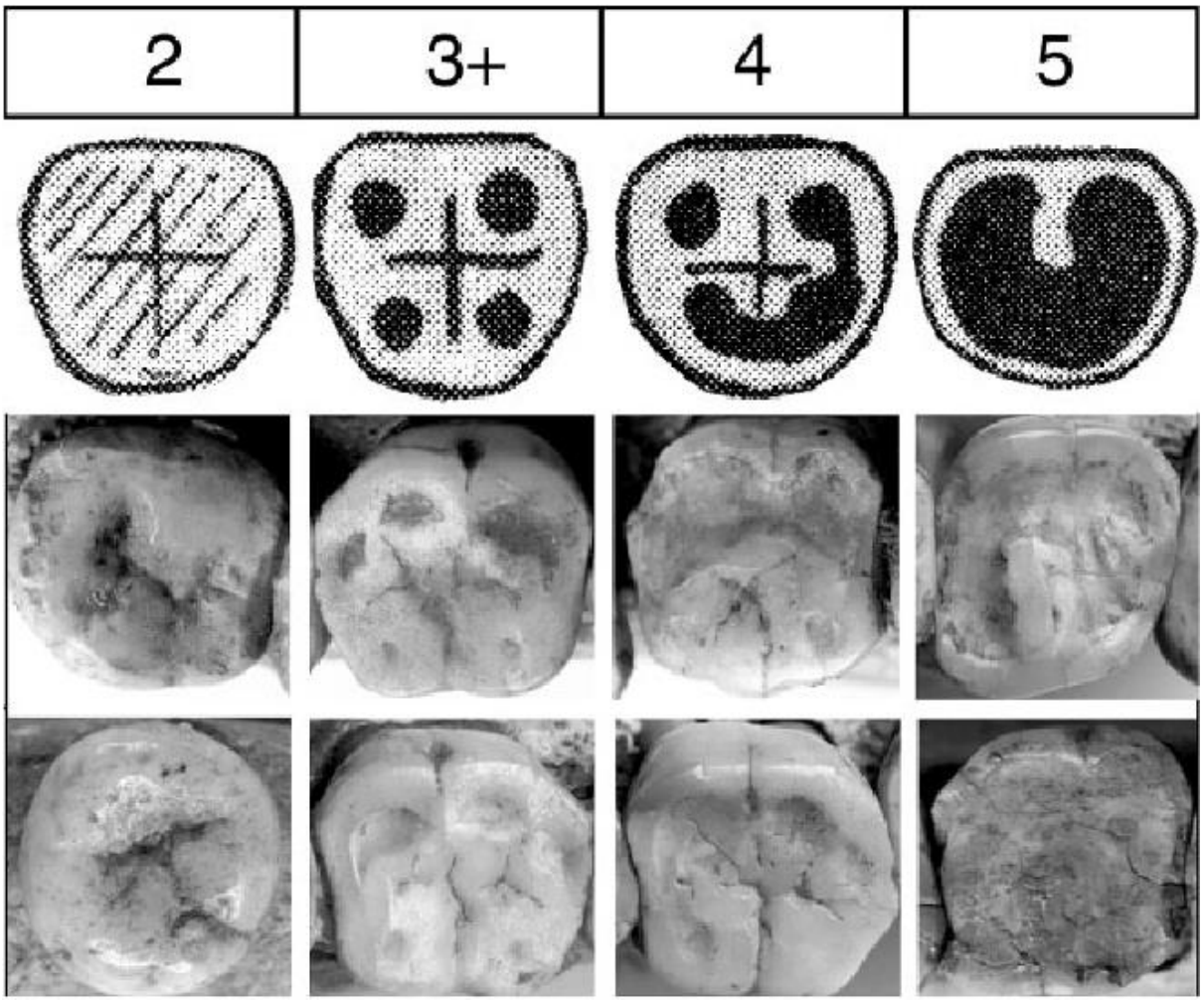
https://ai2-s2-public.s3.amazonaws.com/figures/2017-08-08/fb55b93cd403066ac5478610c6d9c5f7a51b11e0/2-Figure1-1.png

Another method for aging adults is using the degree of dental wear. Teeth wear down from the moment they reach the occlusal surface. Unlike bones tooth enamel does not remodel so the extent of tooth wear can be a general or relative age indicator. Some diets and activities result in more tooth wear than others so it is necessary to have a good idea of the progression of tooth wear in the population you are examining. Ultimately of course people may lose their teeth. The diagram below comes from Brothwell and was used to age Anglo-Saxon individuals in Britain. Based on my experience tooth wear in Aboriginal and Maori remains before contact is more rapid than this.



https://www3.nd.edu/~stephens/brothwell.jpg

M1 of course refers to the first permanent molar and so on. Enamel is shown in white, dentine in black. Below is an example showing you those stages.

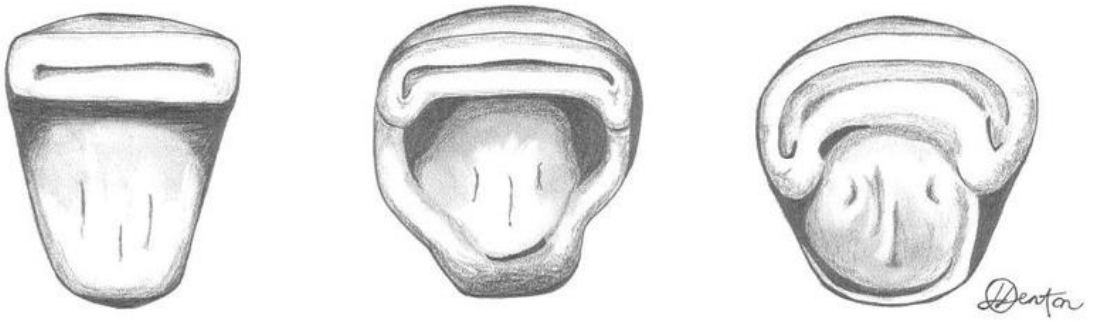


https://www.researchgate.net/profile/Jose_Leopoldo_Ferreira_Antunes/publication/227808869/figure/fig2/AS:302349710053377@1449097196232/Prehistoric-human-remains-from-Brazilian-archaeological-sites-different-teeth-classified.png

Assessing ancestry

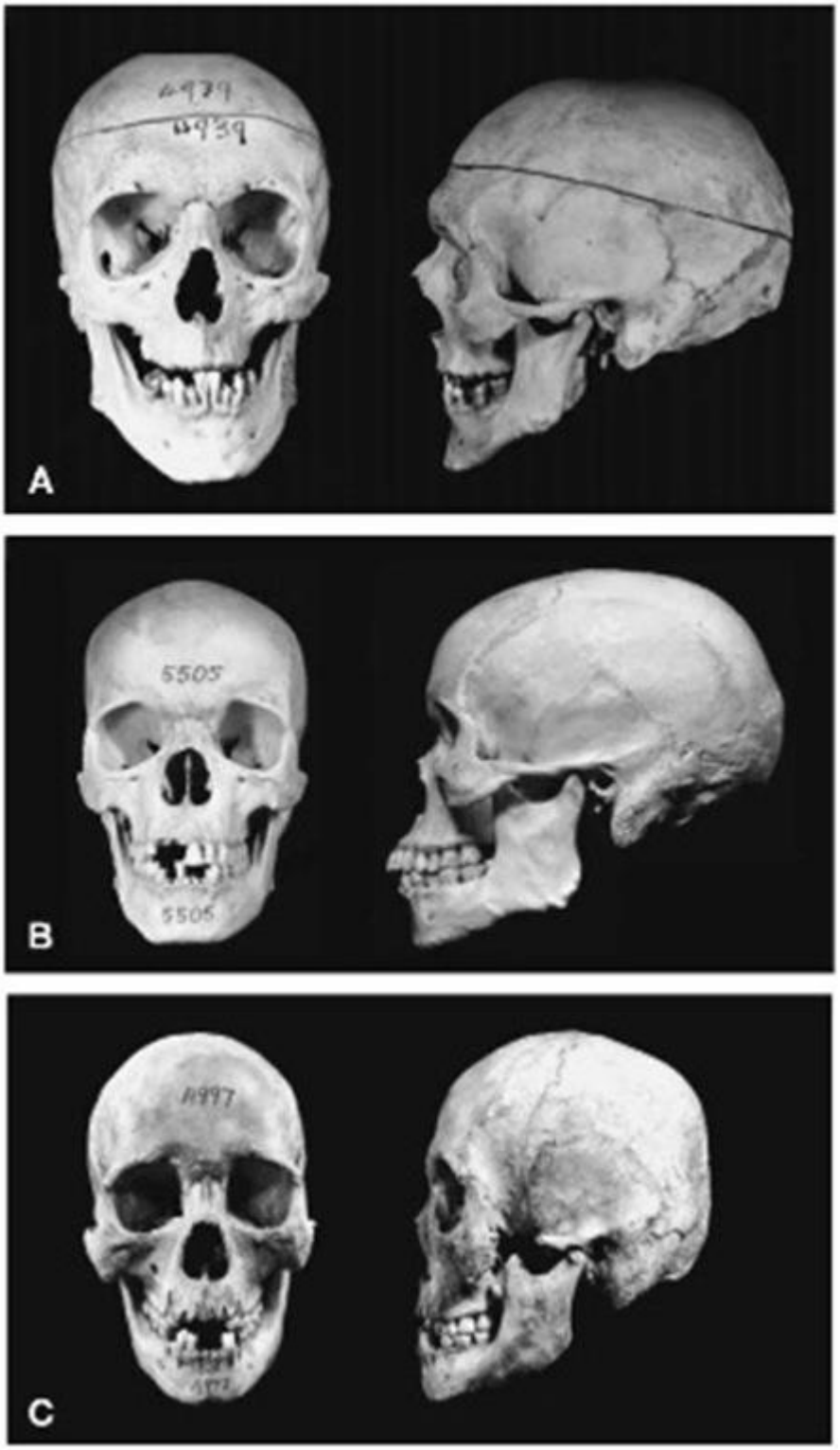
Often we are asked to determine ancestry of an individual because it is important in terms of deciding what to do with remains (e.g. for repatriation) or determining what might have happened. There are group differences in morphology – these are not fixed sets of characteristics but some characteristics (e.g. shovel shaped incisors) occur more frequently in one group or another.

Two sets of characteristics are used: metric traits (or measurements) and nonmetric traits (a trait one does or doesn't have). So shovel shaped incisors are a non metric trait. Below you can see degrees of shovelling from none to very marked. This drawing is from the occlusal surface.



https://www.researchgate.net/profile/Lauren_Denton3/publication/310330023/figure/fig3/AS:428894324039682@1479267783646/Occlusal-view-of-morphological-variation-in-shovel-shaped-incisors-Left-modern-human.jpg

In general there are traits lists of different cranial characters that can be used to help identify someone's ancestry. But as you will see in this lab this is not an easy task and relies to a large degree on experience and familiarity with a range of populations. On the other hand, however, you will see how widely different human skulls can be.



http://lh6.ggpht.com/_1wtadqGaaPs/TFE4OP1sKYI/AAAAAAAALXg/Dhdxh8tiU4k/tmp3931_thumb_thumb1.jpg?imgmax=800

A: European male

B: African American male

c. Asian male.

Characteristics that can be really useful are the overall shape of the skull (length versus width), the width and shape of the nasal bridge, the shape of the nasal sill (the edge of the bone at the base of the nose), the shape of the mandible.

No single trait however can be used to identify ancestry and biological ancestry itself does not tell us anything about the cultural or ethnic affiliation of the person during their life. Finally all of these are ranges which overlap.

LAB EXERCISES

Work with a small group to complete this exercise. As always see your tutor for answers during the class.

Sexing of the cranium

Which cranium is a female?

Describe and draw two cranial sexing traits you used to make this determination.

Sexing of the os coxae

Which os coxa is a female?

Describe and draw two sexing traits you used to make this determination.

Sexing of the femora.

Measure these two femoral heads. Record your measurements. Which individual is a male?

Individual	Measurement (mm)

Ancestry.

We have laid out casts of 'typical' European, Asian, African, Aboriginal and Polynesian skulls. (one group is males, one group is female (without the Aboriginal individual))

Which ancestry has shovel shaped incisors?

Which ancestries are associated with a sharp nasal sill?

Which ancestry has the longest skull?

Which ancestries has a 'rocker' jaw? (The lower border of the mandible is curved so that when it is placed on a table the chin is upturned and mandible rocks slightly)

Ageing

Here are two pubic symhyses. Look at the surface of the pubic symphysis, you can compare it with the guides placed on the table.

Who is the youngest individual?

Can you see how the younger individual has a billowed surface and no porosity.

In contrast the older individual has nodules, a flattened surface and porosity.

Have a go at assessing the stage of each individual and its associated age range using the guides on the table.

Individual	Stage	Age Range

Week 7

Stature and Pathology

Goal:

This week we aim to give you a sense of how bone reacts to pathology and trauma and the difference between normal and non-normal bone, as well as between antemortem and post-mortem damage. In addition we will teach you how to estimate stature which is a characteristic often very useful in the identification of individuals as well as a characteristic we use to compare populations or study sexual dimorphism.

Procedure:

Quite a lot of this lab will be show and tell and while we will have out both casts and real examples of pathology for you to look at what we will do is have you working in groups and your tutor explaining to you. Even then you still need to have done the reading beforehand otherwise you will hold everyone up.

Background Information

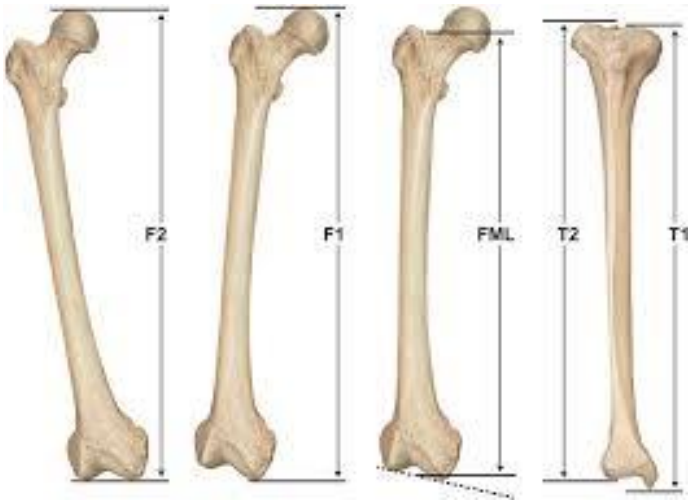
(from Soluri and Agarwal 2018 Lab Manual and workbook for biological anthropology. WWNorton. Pp 176-181)

Estimating Stature

A person's stature is based to a large part on the length of their bones. Some methods of stature estimation involve measuring the height of all bones that contribute to adult stature and then adding a correction for flesh but often these are unusable because skeletons are incomplete. A wide range of other methods take the measurement of a single or combination of long bones and using regression formulae derived from studies of individuals of known height then calculate final stature. Because bodily proportions vary between populations these formulae are population specific. So that means of course having an idea of where your person comes from and what ancestry they might conform to as well as sex of course.

To measure a long bone an osteometric board is used (see below) and the maximum length is measured. Note there are regular procedures in taking measurements so you always need to be clear which measurement is being used in a formula (e.g. femoral length can be taken as the maximum length or the physiological length).

https://www.researchgate.net/profile/Najam_Siddiqi3/publication/256094141/figure/fig1/AS:578631473008640@1514967901452/a-Femoral-bone-length-BL-being-measured-on-an-Osteometric-board.png



https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTKCo-FFbpMM4xnSB7jOVPFO26JGe_HIiJUqtVuqLCCbEadZ-RA

In the image above F1 is the maximum femur length while F2 is the physiological length of the femur.

Measurements are taken in mm but need to convert to cm in order to use the formulae. This measurement is entered into a formulae which produces an estimate and a standard error (or range). Final stature is then close to but not necessarily exactly the estimate. Adjustments are made for aging (people lose height with age) but in general for forensic cases it is best to use a wide range

while for bioarchaeology stature is a useful figure for giving people an idea about people in the past but for statistical comparisons it is best to just use the long bone measurements directly since these do not include all the assumptions and errors that come from using a regression formula.

EQUATIONS USED TO ESTIMATE STATURE, IN CENTIMETERS, WITH STANDARD ERROR, FROM THE LONG BONES OF VARIOUS GROUPS OF INDIVIDUALS BETWEEN 18 AND 30 YEARS OF AGE[a]

Males of European Descent						Males of African Descent					
3.08	×	Hum	+	70.45	± 4.05	3.26	×	Hum	+	62.10	± 4.43
3.78	×	Rad	+	79.01	± 4.32	3.42	×	Rad	+	81.56	± 4.30
3.70	×	Uln	+	74.05	± 4.32	3.26	×	Uln	+	79.29	± 4.42
2.38	×	Fem	+	61.41	± 3.27	2.11	×	Fem	+	70.35	± 3.94
2.68	×	Fib	+	71.78	± 3.29	2.19	×	Fib	+	85.65	± 4.08
Females of European Descent						Females of African Descent					
3.36	×	Hum	+	57.97	± 4.45	3.08	×	Hum	+	64.67	± 4.25
4.74	×	Rad	+	54.93	± 4.24	2.75	×	Rad	+	94.51	± 5.05
4.27	×	Uln	+	57.76	± 4.30	3.31	×	Uln	+	75.38	± 4.83
2.47	×	Fem	+	54.10	± 3.72	2.28	×	Fem	+	59.76	± 3.41
2.93	×	Fib	+	59.61	± 3.57	2.49	×	Fib	+	70.90	± 3.80
Males of East Asian Descent						Males of Mexican Descent					
2.68	×	Hum	+	83.19	± 4.25	2.92	×	Hum	+	73.94	± 4.24
3.54	×	Rad	+	82.0	± 4.60	3.55	×	Rad	+	80.71	± 4.04
3.48	×	Uln	+	77.45	± 4.66	3.56	×	Uln	+	74.56	± 4.05
2.15	×	Fem	+	72.57	± 3.80	2.44	×	Fem	+	58.67	± 2.99
2.40	×	Fib	+	80.56	± 3.24	2.50	×	Fib	+	75.44	± 3.52

[a]All bone lengths are maximum lengths (Hum = humerus, Rad = radius, Uln = ulna, Fem = femur, Fib = fibula length, in cm). The tibia is not included because of historical inconsistencies in the measurement and formula for this bone. To estimate the stature of older individuals, subtract 0.06 × (age in years − 30) cm. To estimate cadaveric stature, add 2.5 cm. From Trotter 1970.

Identifying Pathology

We have studied through this class the importance of identifying pathology in bone (pathology is the study of disease, a pathological lesion is the mark of a disease) as opposed to normal variation. Furthermore it is really important to determine whether a mark on the bone is:

Antemortem pathology i.e. pathology that developed during an individual's life

Perimortem pathology i.e. pathology or trauma that occurred around the time of an individual's death and might have contributed to that death and

Postmortem damage or pseudopathology i.e. changes to the bone that have occurred after death than might be confused with disease.

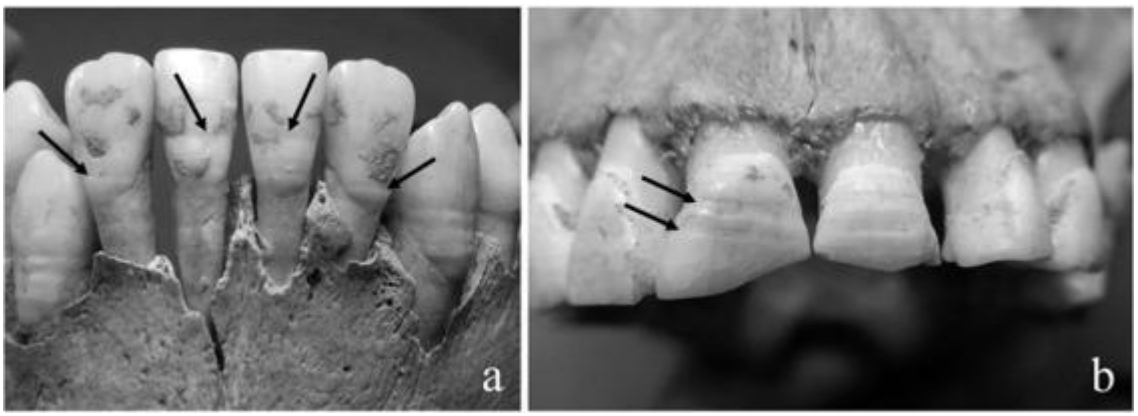
We cannot distinguish the cause of death from skeletal remains – that is a medical determination and often is completely reliant upon soft tissue and other information. We can infer the manner of death i.e. the circumstances surrounding death that may have contributed to death.

Antemortem Pathology

Pathology that occurs within an indivdiuals life can inform us about their health and the ecological conditions.

In general antemortem pathology can be categorised:

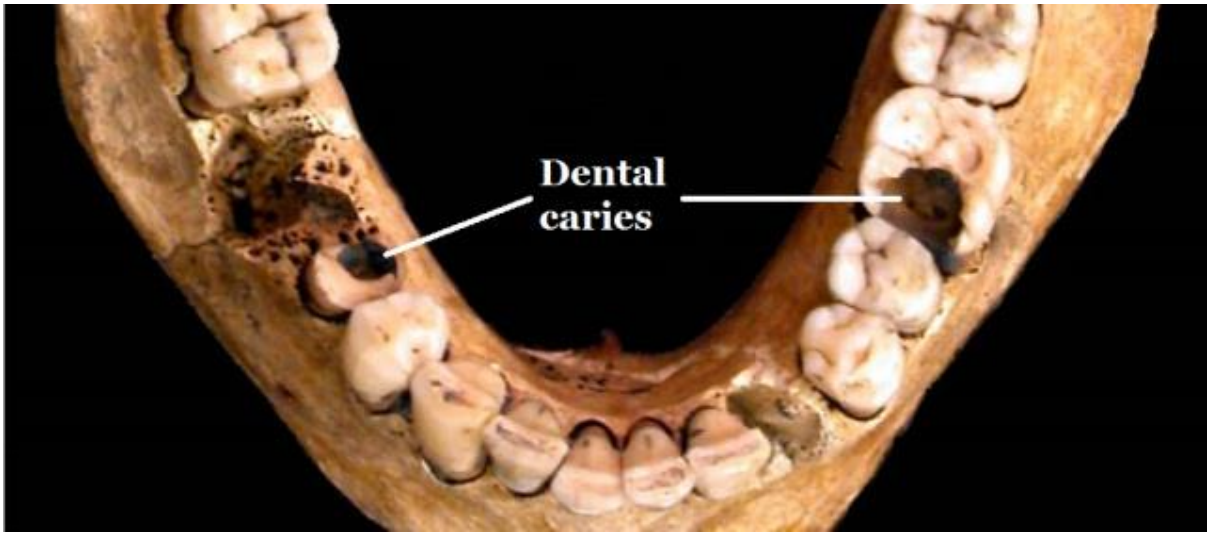
Pathology related to overall health and metabolic stress. This is when some physiological process e.g. growth is affected by an external stressor which might be nutritional or infectious or some combination of these and possibly other causes. Linear enamel hypoplasia is an example of such a nonspecific stress indicator. A hypoplastic defect is a mark that the individual has survived the stressor since the cells have started laying down enamel again.



https://ars.els-cdn.com/content/image/1-s2.0-S1879981716300365-gr2.jpg

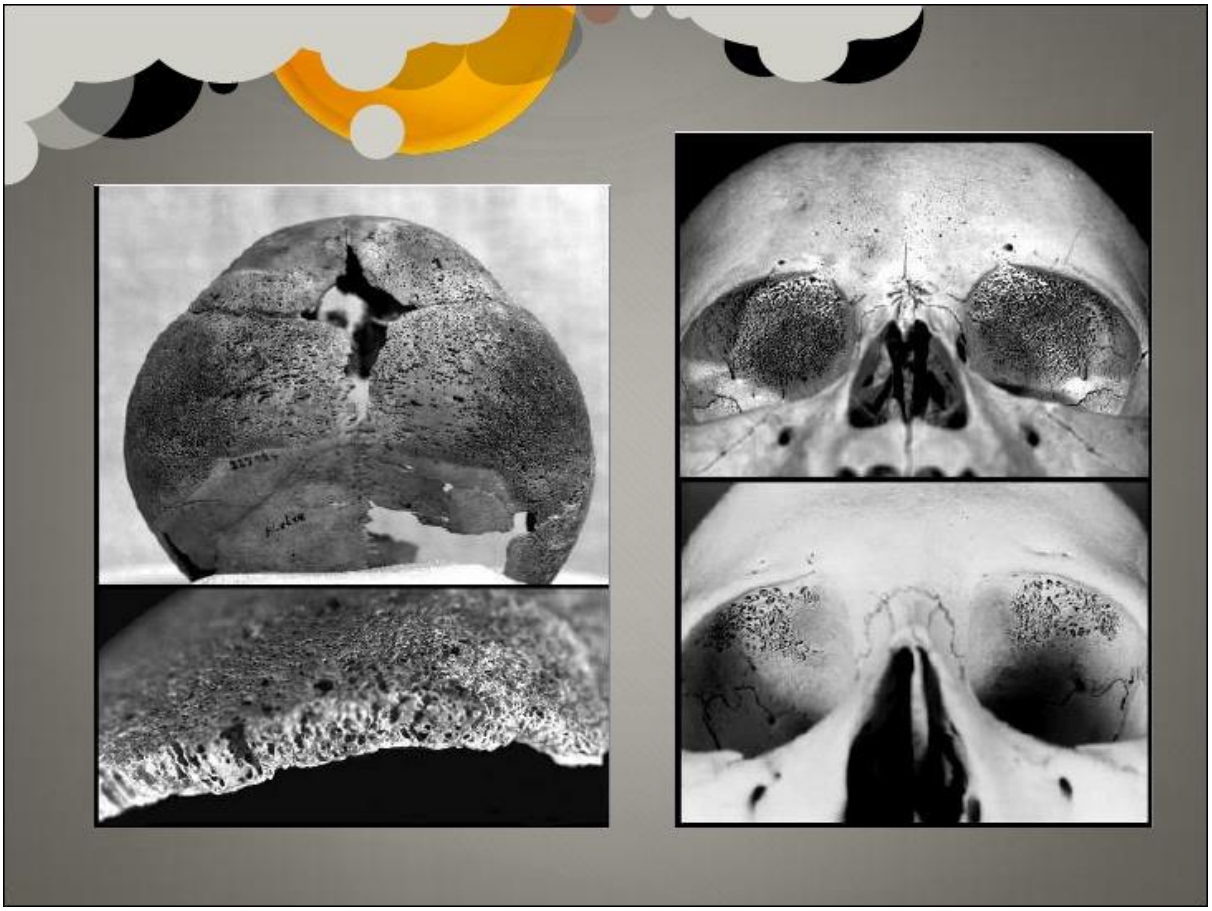
Dental pathology is often related to nutrition. Dental caries (or cavities) are areas of teeth that have undergone demineralization and decay due to acid exposure. The acid is formed by oral bacteria as the mouth begins to break down food for digestion. If the acids are produce in higher quantities or

not properly cleaned caries can form. Caries is much more common in populations with a diet high in fermentable carbohydrates (sugars etc) and has proven useful as a dietary indicator in the past.



https://allthingsaafs.files.wordpress.com/2015/07/dental-caries.jpg?w=640

Other lesions have multiple causes so for example porotic hyperostosis usually seen on cranial bones is often due to iron or other micronutrient deficiencies or some genetic disorders (such as thalassaemia). It occurs in children due to the expansion of the marrow cavity as the body tries to increase production of red blood cell. This causes the smooth cortex of the flat bones of the cranium to look porous and spongy. Because the bone in the orbits is particular thin they are often affected first.



Images from Ortner 1999

There are pathologies associated with chronic conditions. Osteoarthritis is common among humans and is where chronic wear and tear on the joints results in loss of the cartilage linings. As a result the bone surfaces at a joint end up contacting each other directly resulting in eburnation or polishing of the joint surfaces. The bone may also respond to dwindling cartilage by forming osteophytes around the margin of the joint surface.

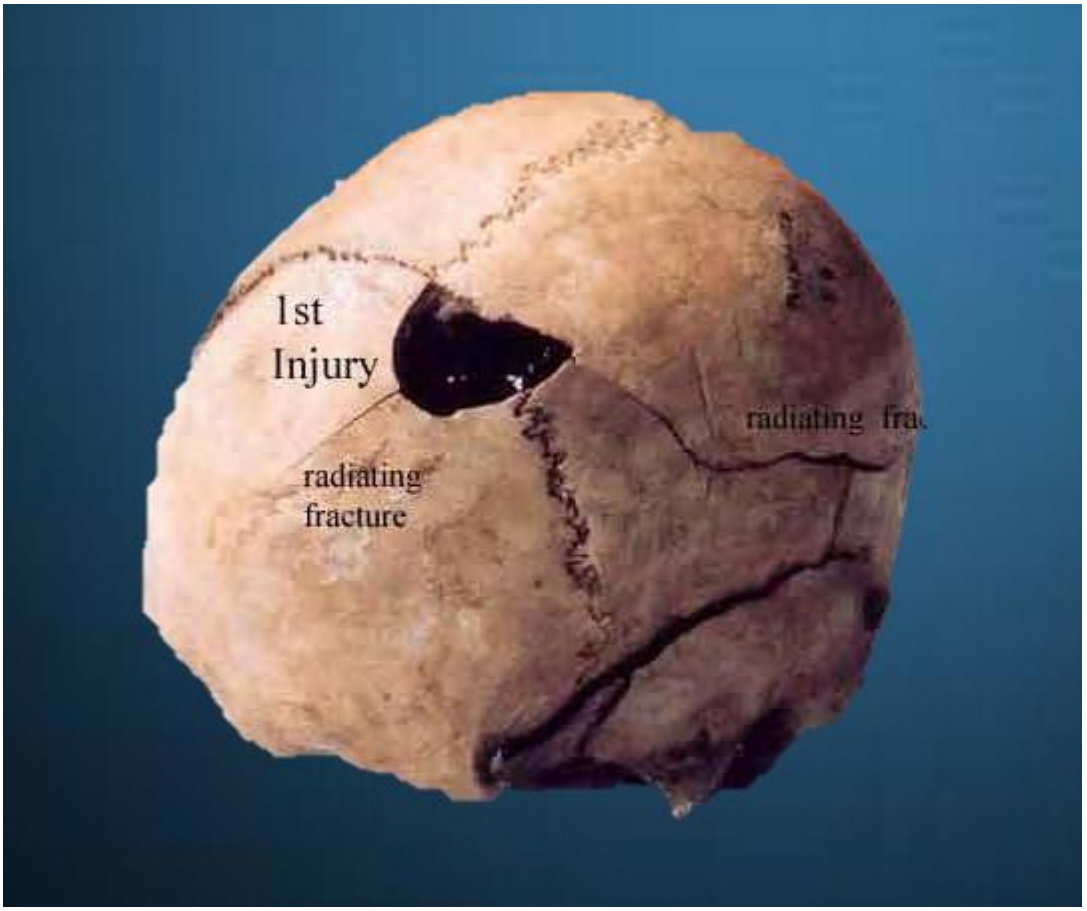
In the image below you can see both eburnation (the yellow patch of polishing) and osteophytosis the lipping at the edges of the articular surface of the distal femora.

https://www.researchgate.net/profile/E_Crubezy/publication/261296274/figure/fig8/AS:578495668994048@1514935523082/KGMA-15-041-male-40-50-years-Femurs-distal-view-osteophytes-and-eburnation-of.png

Perimortem Pathology

Perimortem pathology can be difficult to determine since its recognition depends upon the completeness and the condition of the bones. Most perimortem pathology involves severe, traumatic injuries. Such lesions are distinguished from antemortem injuries by a lack of bony reaction or evidence of healing. In reality though because bone reacts similarly when it is covered with flesh and in the early stages of decomposition the perimortem period may be days, weeks or even months after death so it takes consideration of context to determine if a trauma occurred at or after death and often this is unclear.

Blunt force trauma is trauma that results from contact with a blunt object. It could be the result of falling or being hit with an object like a stone. It is distinguished from sharp force trauma caused by a blade or large cuts marks or nicks in bone. Blunt force trauma is indicated by the presence of a depression in bone at the point of impact. There can also be bone cracks or fractures radiating out from the depressed area due to the force of impact.



http://ittacorp.org/wordpress/wp-content/uploads/2015/06/BluntForceTrauma.png

http://www.nhm.ac.uk/content/dam/nhmwww/our-science/our-work/origins-evolution-futures/cut-marks-on-cannibalised-human-skull-two-column.jpg

Often traumatic injuries do not contribute to death and have healed or are in the process of healing at the time of death. If the injury is well treated the bone may remodel very cleanly and sometimes it is impossible to be certain there has been a break (particularly if the injury occurred in childhood). If however the injury did not heal very well the bone may be distorted or there may be extra bone formation in the area of the fracture. Looking at this new bone and for signs of infection helps determine what had happened. But also types of fractures are caused by different forces and it is possible, looking at the pattern of injury in a person or across a group to hypothesise about past activities.

Healed femoral and humeral fractures of the midshaft all showing some displacement but also complete healing prior to death.

https://upload.wikimedia.org/wikipedia/commons/3/3a/Paleopathology%3B_Human_femurs_from_Roman_period%2C_Tell_Fara_Wellcome_L0008764.jpg

Psuedopathology or post-mortem damage

It can be difficult to distinguish pathology when bone is poorly preserved and one must always eliminate the possibility of post-mortem damage. In general clues to post-mortem damage are:

Are the exposed bone surfaces a different colour suggesting this bone has been exposed after burial.
Are the edges of the injury or lesion sharp and irregular (ragged, thinned, flaking). Fresh bone breaks cleanly and often in a spiral or helical direction, dry bone breaks at right angles.
What signs are there of taphonomic factors? What do we know of the context of excavation?
Is there any sign of bony reaction – rounding of the margins, new woven bone – all of this is sign of living tissue at the time of injury of disease.

https://anthropology.si.edu/writteninbone/images/animal_damage_2.JPG

LAB EXERCISES

A female victim has a maximum femur length of 495mm. She is of European ancestry. Using the table of equations estimate her adult stature. Include the range in your answer.

Pathology – we have laid out a series of cases of pathology and trauma and your tutor will talk you through these but them give you time to look at them and think about what has happened:
Is the lesion pseudopathology (due to post-mortem damage) or an actual pathological lesion? On what criteria have you based your decision?

Where is the lesion located (remember bone, side, aspect)?

Type of lesion: is it lytic (or resorptive), proliferative, deformative?

lytic lesions (loss of ***bone***); proliferative lesions (excess ***bone***); ***deformative*** lesions (malshaped ***bones)***

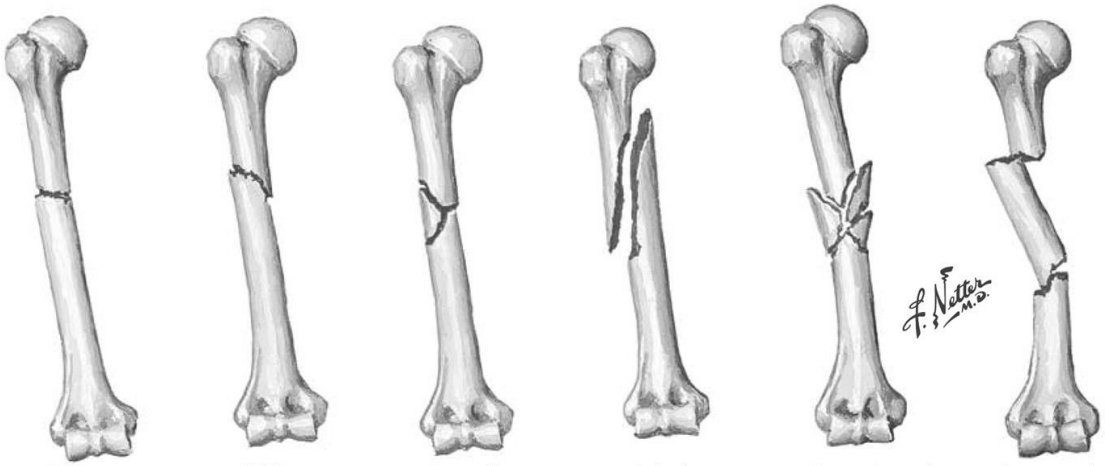
Does the lesion show any signs of healing (lamellar versus woven bone, rounded edges of the margins). Is healing complete or incomplete or hasn't even started? (This may be difficult to determine on cast material but have a go).

Trauma:
Description of the lesion: (include location, consideration of extent, size and direction of the injury, type of fracture (simple, comminuted), incomplete or complete fracture.

1. Open versus closed: A closed fracture is one in which the skin is intact over the fracture site and an open fracture is one in which the skin is disrupted.

2. Simple versus comminuted: A simple fracture is one in which there are only two major fragments and one fracture line. A comminuted fracture is one in which there are multiple fragments of bone and multiple fracture lines.

3. Complete versus incomplete: A complete fracture is one in which the fracture line goes completely across the bone. Incomplete fractures, most typically seen in children, have a fracture line that only crosses one cortex of the bone involved.



The force causing the trauma (circle one)

Tension Compression Torsion Bending Shearing Other

Justification:

1. Bending loading produces a transverse fracture

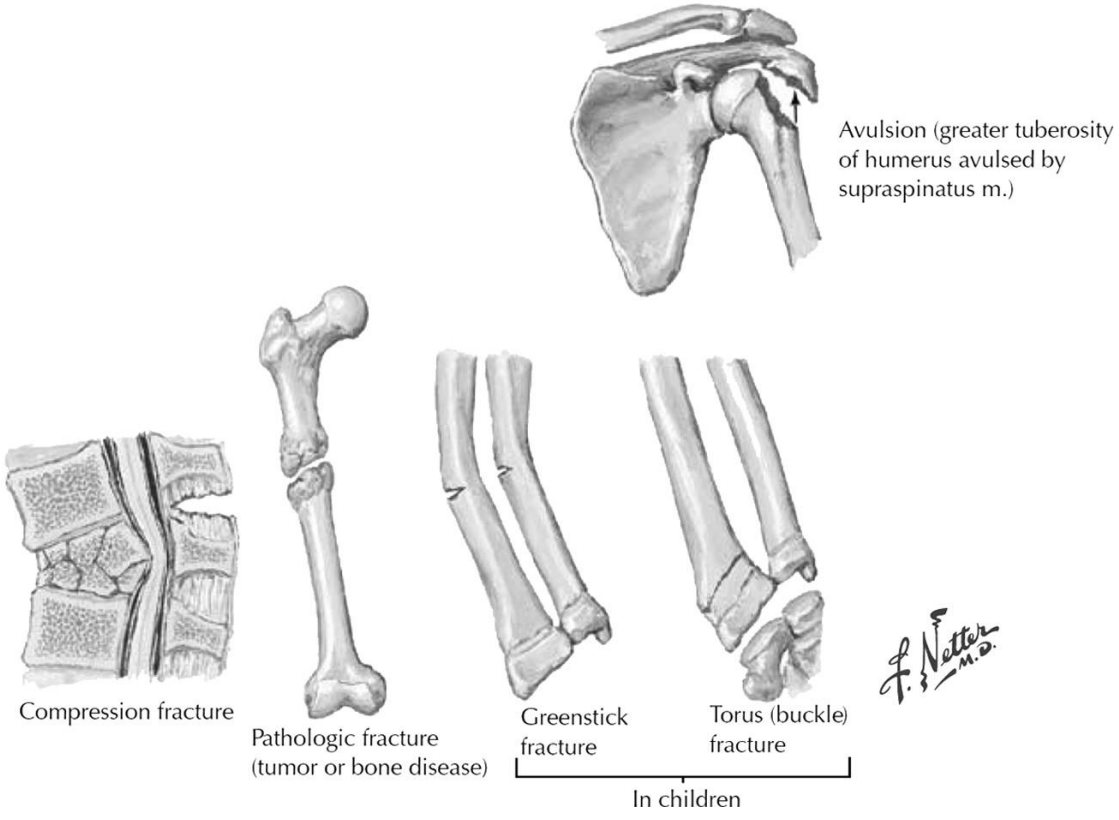
2. Torsional loading produces a spiral fracture

3. Axial loading produces a compression or impacted fracture

4. Tensile loading produces an avulsion fracture

5. Combined loading such as bending and axial loading, which together produce an oblique fracture.

Taken together with the degree of fracture displacement and comminution, the fracture pattern suggests the direction and amount of force applied during the injury. From the degree of injury an extrapolation can be made that predicts the amount of soft tissue damage associated with the fracture.



Speed of force (circle one): Dynamic Static
Justification:

Type of force: blunt sharp project other
Justification:

Timing of injury: antemortem perimortem post-mortem
Jusitification:

4. Degennerative joint disease

Is osteophytosis present? Yes No

Describe: size, extent and on what surfaces.

Is there any indication of porosity? Yes No

Describe: size, extent, on what surfaces.

Is there any indication of eburnation Yes No

Describe: size, on what surfaces.

Is there any associated deformation (e.g. vertebral collapse, narrowing of foramina, depression or abnormality in bone shape?)

Week 8

Assignment 2: Practical Lab Test

Held in your normal lab class and time.
THIS IS NOT AN OPEN BOOK TEST.

This 60 minute lab test will present you with a puzzle.

Scenario: a collection of skeletal remains has just been unearthed at a crime scene. You have been asked to help in the investigation of this material. Answer the questions below:

Is any of this skeletal material nonhuman? If so, which bone is nonhuman? Why do you think this?
List all of the human skeletal elements, being as specific as possible. What is the minimum number of individuals represented?
Can any of the skeletal material be used to determine the biological sex of the victim(s)? If so, which bone(s)? What is the sex you determined? What evidence supported that conclusion
Based on the materials recovered, can you make any suggestions for future analyses you might use to further understand the circumstances surrounding the death of the victims(s)?

Week 9

Children

GOAL:

To broadly acquaint you with aspects of human bone development and the basic techniques for distinguishing and ageing juvenile remains.

PREPARATION:

We have included information on the broad methods of ageing children primarily using the standards identified by Scheuer and Black. Make sure you read this information before coming to class. Your tutor will give you a brief introduction to the topic and we will lay out different standards and comparative material for you to look at.

If you want to follow up further on ageing children the most definitive text is:

Developmental juvenile osteology [electronic resource] / Louise Scheuer, Sue Black ; illustrations by Angela Christie. Louise Scheuer Sue M Black San Diego, CA : Academic Press c2000 (Available on the library website) Chapter 2.

Useful websites:

The London Atlas of Tooth Formation and Eruption (downloadable from itunes)

TASK:

Work in groups or pairs. You are going to be given an envelope with pictures and measurements of mystery child. Each of these does represent a case Judith has worked on. Your task is to decide his or her age as if in a forensic case.

This means you will need to construct an inventory of what bone is present (and its condition i.e. how complete, any damage etc), and then sort out what indicators of age are available to use, and what they indicate about the child's age at the time of death.

We have included the sort of tables you might find useful but since different methods of ageing children are more useful or accurate at different ages you won't be able to use all of them.

Background – assessing growth in children

Introduction

Remember from your first lab that ossification of bones occurs in two ways: intramembraneous ossification (e.g. the cranial bones) and endochronral ossification (e.g. the long bones). What this means is that some bones such as the bones of the skull begin to ossify from a central point in the bone. In other bones such as the long bones – the bone itself is initially several distinct growth centres (some of which are not visible at birth). These epiphyses form taking on the shape of the joint and ultimately fuse to the other growth centres for that bone. Remember an infant has 413 individual bones while an adult has 206.

Teeth of course are different again. The two sets of teeth: the deciduous and permanent follow a relatively invariant pattern of tooth formation and ultimately eruption. A tooth forms from the crown down to the root tip. So even in a very young child you may find a tiny scrap of an email crown representing just that first stage of enamel formation. Ultimately as the tooth is progressively formed – close to root being complete, the tooth erupts displacing the earlier tooth (if there is one).

All of this diversity means there are different ways of ageing children from their bones and some are more variable than others. Which method is used therefore depends upon:

What elements are observable
How old is the child i.e. what developmental processes where occurring at the time the child died.

The methods we will discuss here are:

Long bone growth – useful for infants particularly if there is no dental evidence.
Fusion of the primary ossification centres – fusion of bones which have formed in more than one part (this is often bones of the skull such as the frontal) – again primarily younger children
Fusion of the secondary ossification centres – the final stage of growth when the long bone is made complete through progressive fusion of the epiphyses to the metaphysis (remember the clavicle is the last bone to fuse in the human body)
Dental eruption and formation – the formation and eruption of the teeth.

Long bone growth

In the foetal period and early infancy there is relatively little dental development happening and it may also be difficult to identify the partly formed tooth crowns. However, there is not a great deal of difference between infants in terms of length of the long bones so these can be used as an indicator of the age (in weeks) of a child. This measure becomes particularly important if you are trying to work out if a child's death is associated with prematurity or small for gestational age or occurred soon after birth.

The table below (Table 1) is an example of one set of measurements taken by Fazekas and Kosa on a large collection of infant remains of known age. There are differing standards around but also there are population differences in body proportions. For example, Australian Aboriginal children even as foetuses have body proportions where the legs are longer (particularly the lower leg) relative to the trunk so this means using long bone measurements to assess age needs acknowledgment of instances where the

population the standard is based upon is not the population being analysed and of the potential role of illness or growth retardation. So for instance, in Bahrain the measurements of infants and young children often lag behind the age estimated by their dental development. I suspect this is the effect of malaria which is often associated with growth retardation. That then becomes a hypothesis we can test.

Table 1: Table of bone lengths of infant (Source: Scheuer et al. 2009)

Fazekas and Ko´ sa

Dry Bone Fetal Measurements-Femur

Prenatal

		Max length (mm)		Distal width (mm)	
Age(wks)	N	Mean	Range	Mean	Range
12	2	8.5	7.0–10.0	1.9	1.8–2.0
14	3	12.4	11.5–13.8	2.2	2.0–2.5
16	9	20.7	18.0–24.0	4.7	3.4–6.2
18	15	26.4	24.0–29.0	6.2	5.6–7.0
20	13	32.6	29.0–36.2	8.0	6.2–9.2
22	11	35.7	32.6–39.7	8.8	8.3–10.0
24	12	40.3	37.2–45.0	9.8	9.0–11.1
26	12	41.9	38.5–46.2	10.6	9.2–12.1
28	12	47.0	44.5–49.0	11.8	10.5–13.0
30	12	48.7	45.0–54.0	12.3	11.0–14.0
32	8	55.5	52.5–59.0	14.3	13.0–15.6
34	7	59.8	57.0–66.0	15.3	14.0–19.0
36	5	62.5	60.0–67.5	16.4	15.0–18.0
38	7	68.9	64.0–73.5	18.7	17.0–20.5
40	10	74.3	69.0–79.0	19.9	18.0–22.0

Source

Dry bone measurements on mid twentieth century Hungarian fetal remains from autopsy—males and females combined. Age was estimated based on fetal crown heel length.

Notes

Has been shown to be compatible with radiographic measurements taken from American foetuses (Warren, M.W. (1999). Radiographic determination of developmental age in fetuses and stillborns. Journal of Forensic Sciences 44(4): 708–712.)

Reference

Fazekas, I.Gy. and Ko´ sa, F. (1978). Forensic Fetal Osteology. Budapest: Akade´miai Kiado´ .

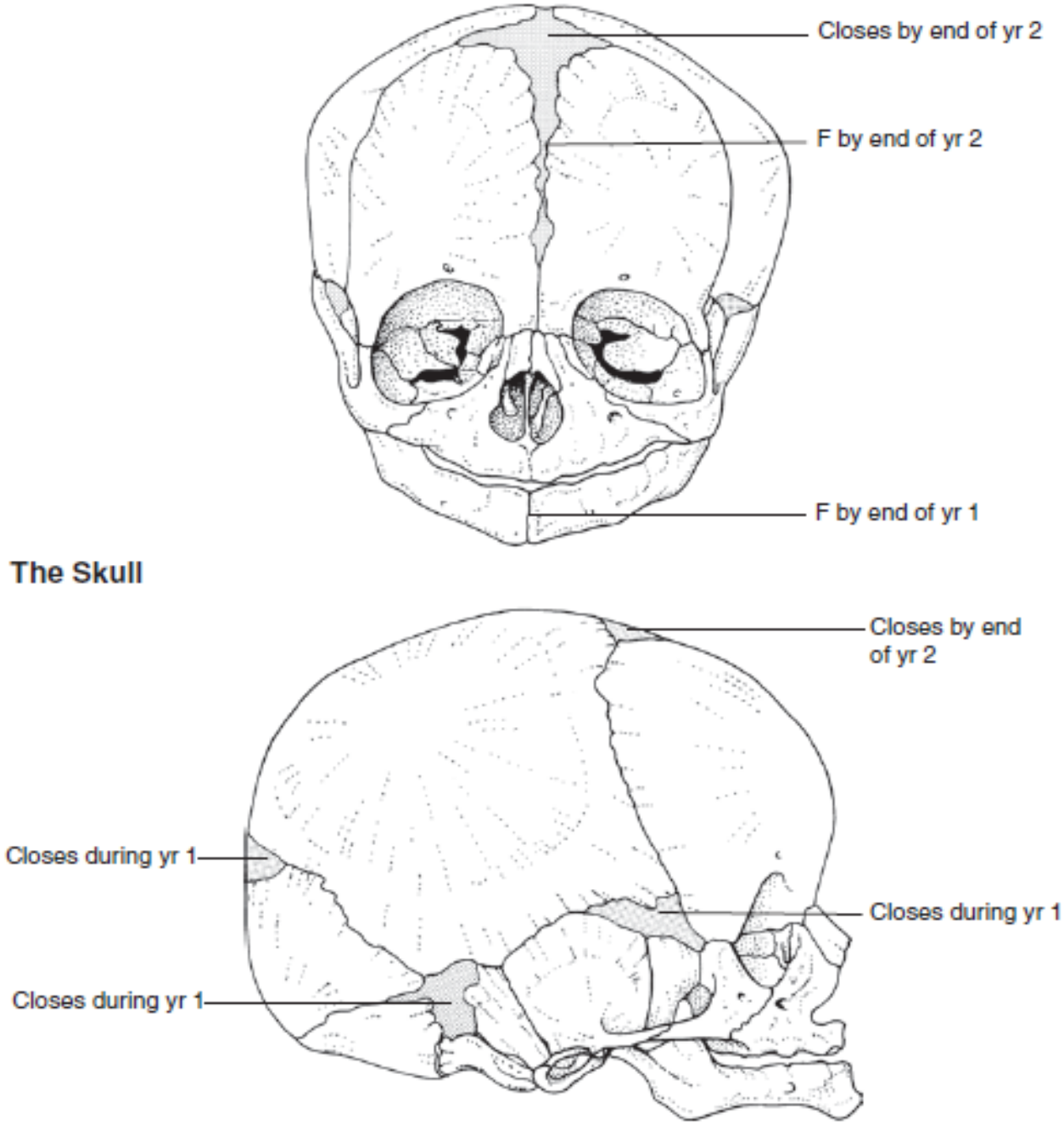
Fusion of the Primary ossification centres

A primary ossification centre is the first area of a bone to start ossifying. It usually appears during prenatal development in the central part of each developing bone. In long bones the primary centers occur in the diaphysis and in irregular bones the primary centers occur usually in the body of the bone. Most bones have only one primary center (e.g. all long bones) but some irregular bones such

as the os coxa (hip) and vertebrae have multiple primary centres as do some bones of the skull (see figure 2 below).

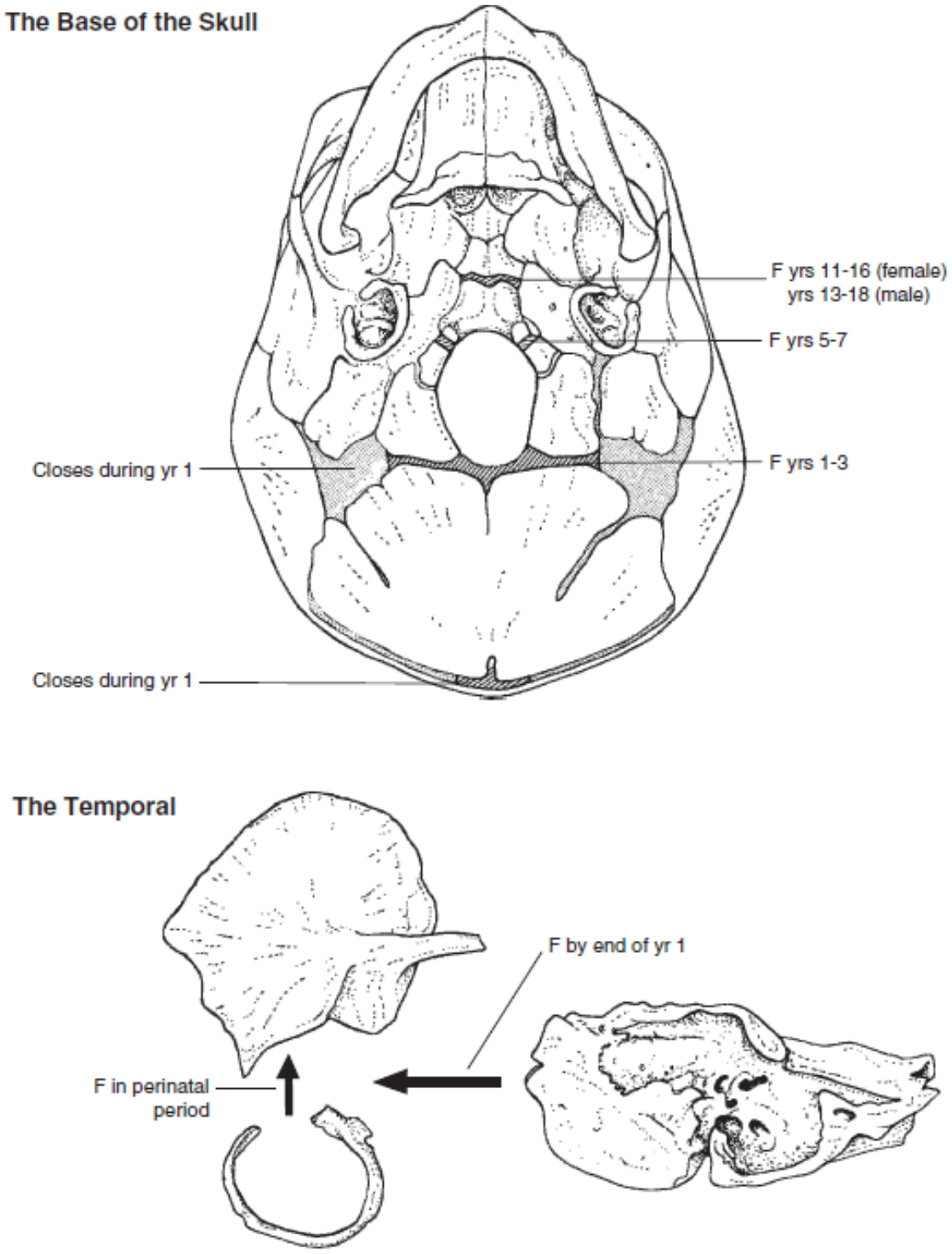
A secondary ossification centre appears after the primary ossification centre – most begin forming during the postnatal and adolescent years. Most bones have more than one secondary ossification centre. In long bones, the secondary centres appear in the epiphyses.

Fusion of the primary ossification centres is a good clue though with fairly wide age limits to the age of young children. The diagrams below and Table 2 identify those changes.



A = Appearance F = Closued (Fusion)

Figure 1. Closure of the cranial bones in infants. (Scheuer et al. 2009)



Closure of the bones of the cranial vault (Schaefer et al. 2009: 338)

Table 2: Fusion of Primary Centers of Ossification (Byers 2013: 146)

Site	Time of Closure
Fontanelles: sphenoid and mastoid Posterior Anerior	 Soon after birth During first year During second year
Mandible: Right and left halves	 Completed by second year
Frontal: Right and left halves	 In second year (remains open in c10% of pop)
Atlas Union of posterior halves union of anterior halves	 In third year In sixth year
Axis Dens, body and both arches	 In third and fourth years
Occipital Squamous with lateral parts Lateral and basilar parts	 In fifth year In sixth year

Formation and fusion of secondary ossification centres (epiphyseal closure)

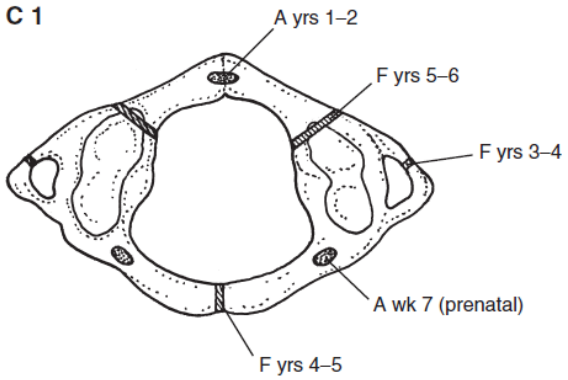
The secondary centres of ossification are often the epiphyses or joint surfaces which fused to the metaphysis of long bones (but also in bones like the clavicle, scapula). These centres appear at particularly ages often as very shapes small pieces of bone that then gradually take on the recognizable shape of the joint surface. They begin to fuse to the long bone shaft and this is visible as an incomplete gap between the two bones. Fusion is complete when the gap is closed and the line between the two has obliterated.

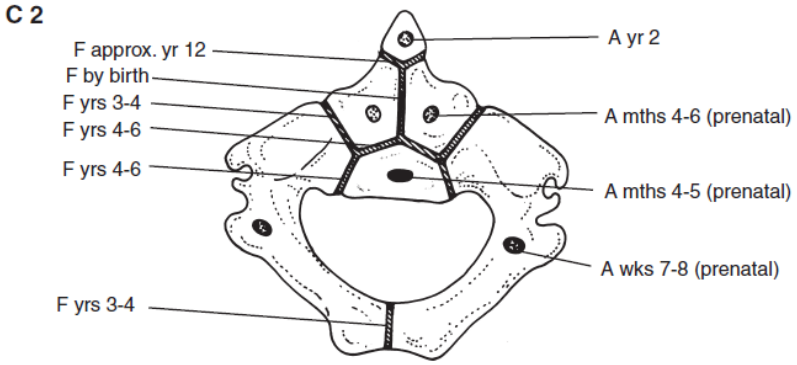
In the figure below of a cetacean vertebrae this has happened by Stage D. That means that at the early stage (i.e. unfused stage A in the figure) the only age estimate possible is less than e.g. if the distal epiphysis of the humerus fuses between ages 13-15 in females then a humeral shaft which does not have a fusing epiphysis is less than 15 years of age. A shaft where the epiphysis is fusing (stages B and C in the figure) is between 13-15 yrs. A humerus with a completely fused distal epiphysis is >15 years of age.

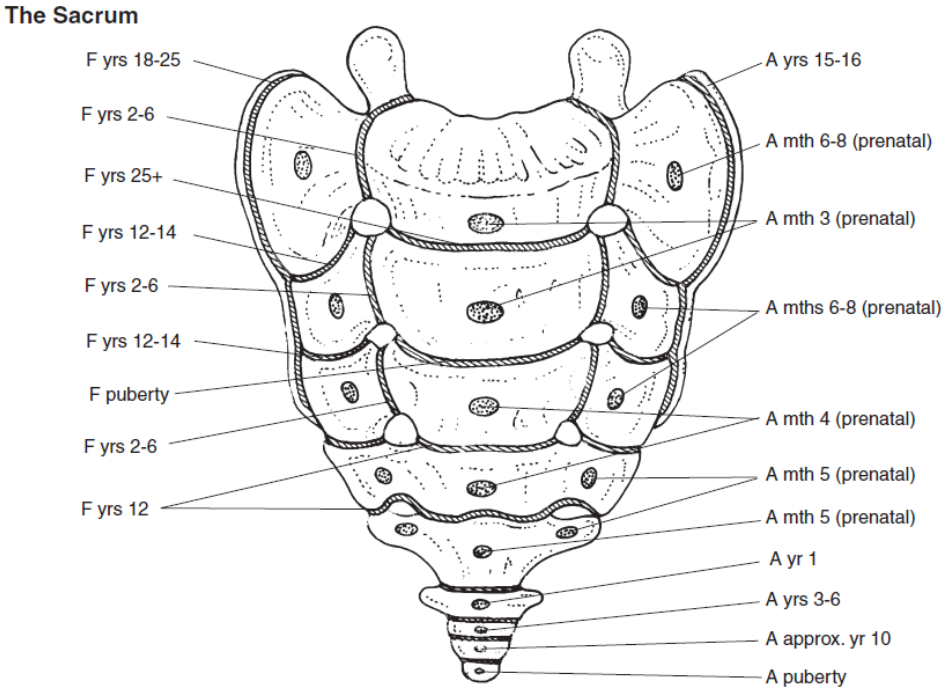
The figures below indicate ages of fusion for a range of elements and there is a summary version of this at the end. There are different standards of epiphyseal closure and some are sex specific so in this case the two need to be merged since it is difficult to sex child remains.

https://www.researchgate.net/profile/Paulo_Simes-Lopes/publication/256789932/figure/fig1/AS:297957380378633@1448049983598/Categories-of-epiphyseal-fusion-according-to-Galatius-and-Kinze-2003-see-text-for.png

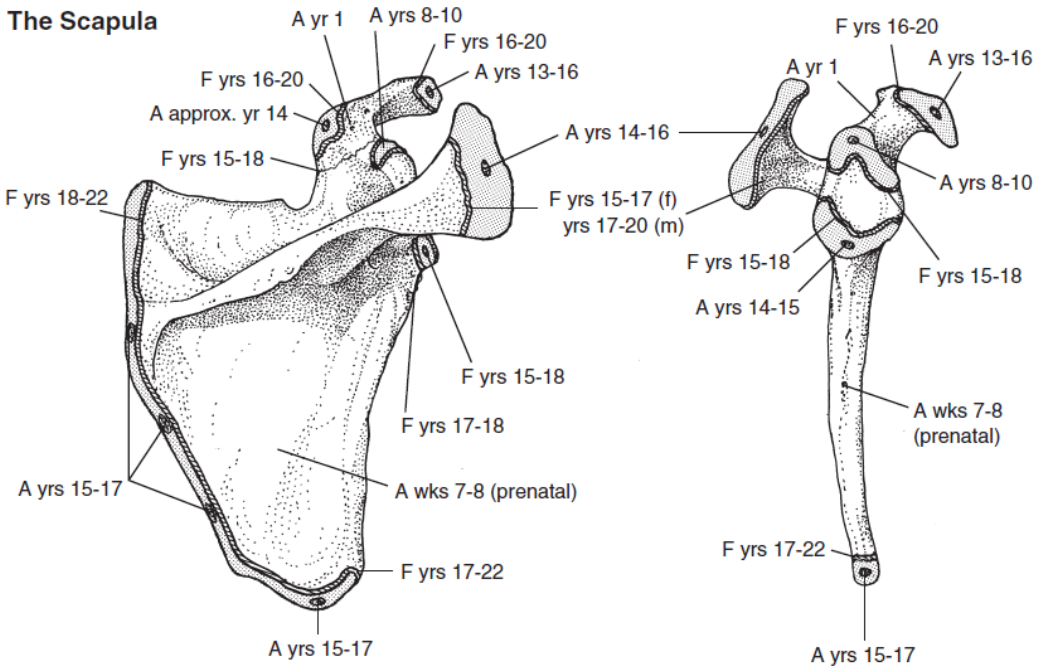
Figure 2: Fusion of the primary and formation and fusion of the secondary epiphyses (Scheuer et al. 2009)
A: formation of the centre, F fusion of the centre.



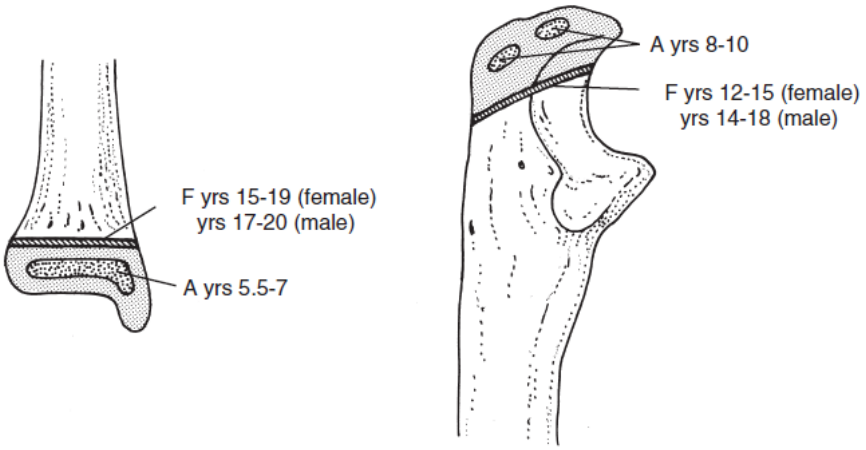




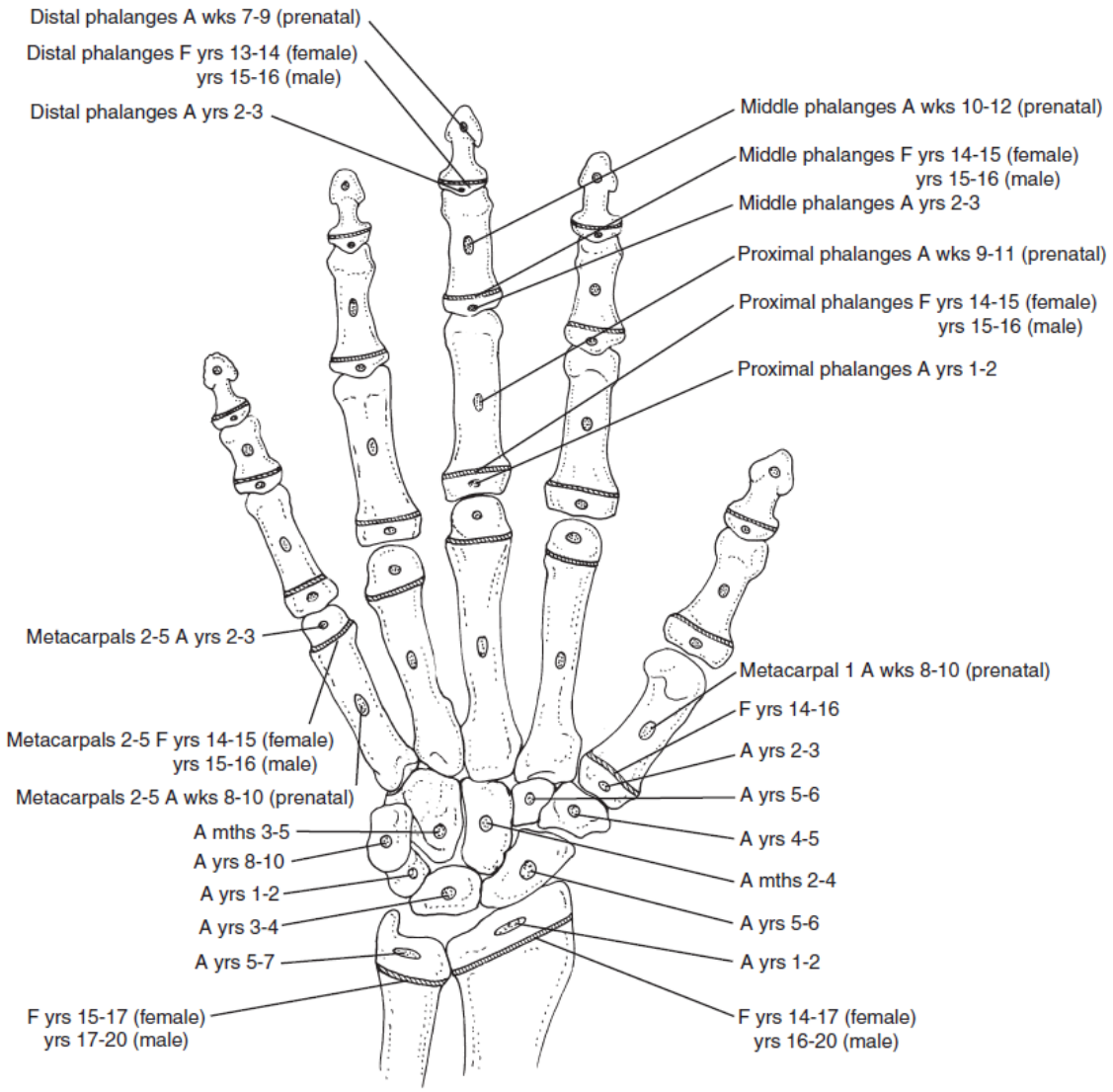
The Scapula



The Ulna



The Hand


Distal phalanges A wks 7-9 (prenatal)
Distal phalanges F yrs 13-14 (female)
yrs 15-16 (male)
Distal phalanges A yrs 2-3
Middle phalanges A wks 10-12 (prenatal)
Middle phalanges F yrs 14-15 (female)
yrs 15-16 (male)
Middle phalanges A yrs 2-3
Proximal phalanges A wks 9-11 (prenatal)
Proximal phalanges F yrs 14-15 (female)
yrs 15-16 (male)
Proximal phalanges A yrs 1-2
Metacarpals 2-5 A yrs 2-3
Metacarpals 2-5 F yrs 14-15 (female)
yrs 15-16 (male)
Metacarpals 2-5 A wks 8-10 (prenatal)
A mths 3-5
A yrs 8-10
A yrs 1-2
A yrs 3-4
A yrs 5-7
F yrs 15-17 (female)
yrs 17-20 (male)
Metacarpal 1 A wks 8-10 (prenatal)
F yrs 14-16
A yrs 2-3
A yrs 5-6
A yrs 4-5
A mths 2-4
A yrs 5-6
A yrs 1-2
F yrs 14-17 (female)
yrs 16-20 (male)

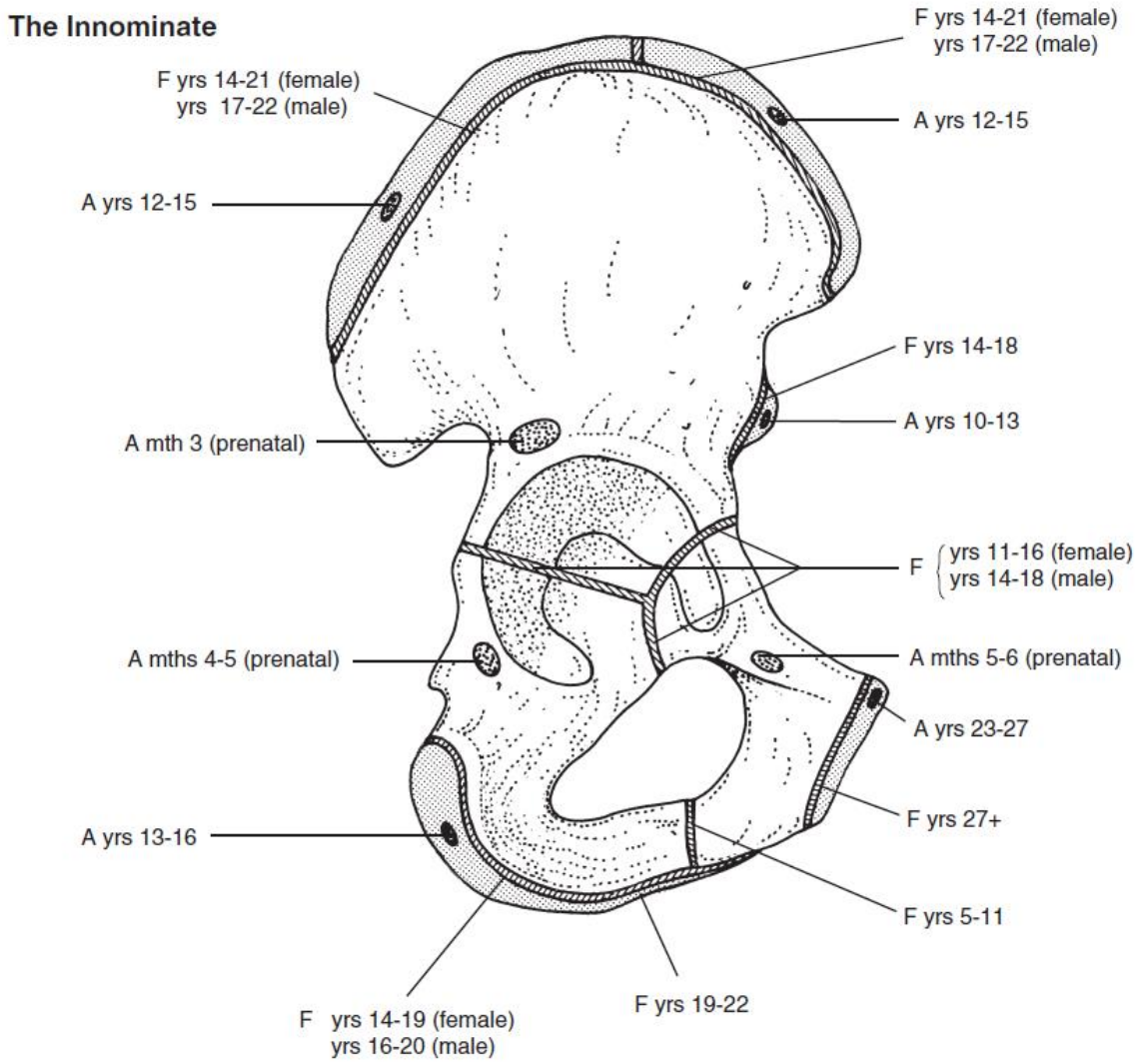
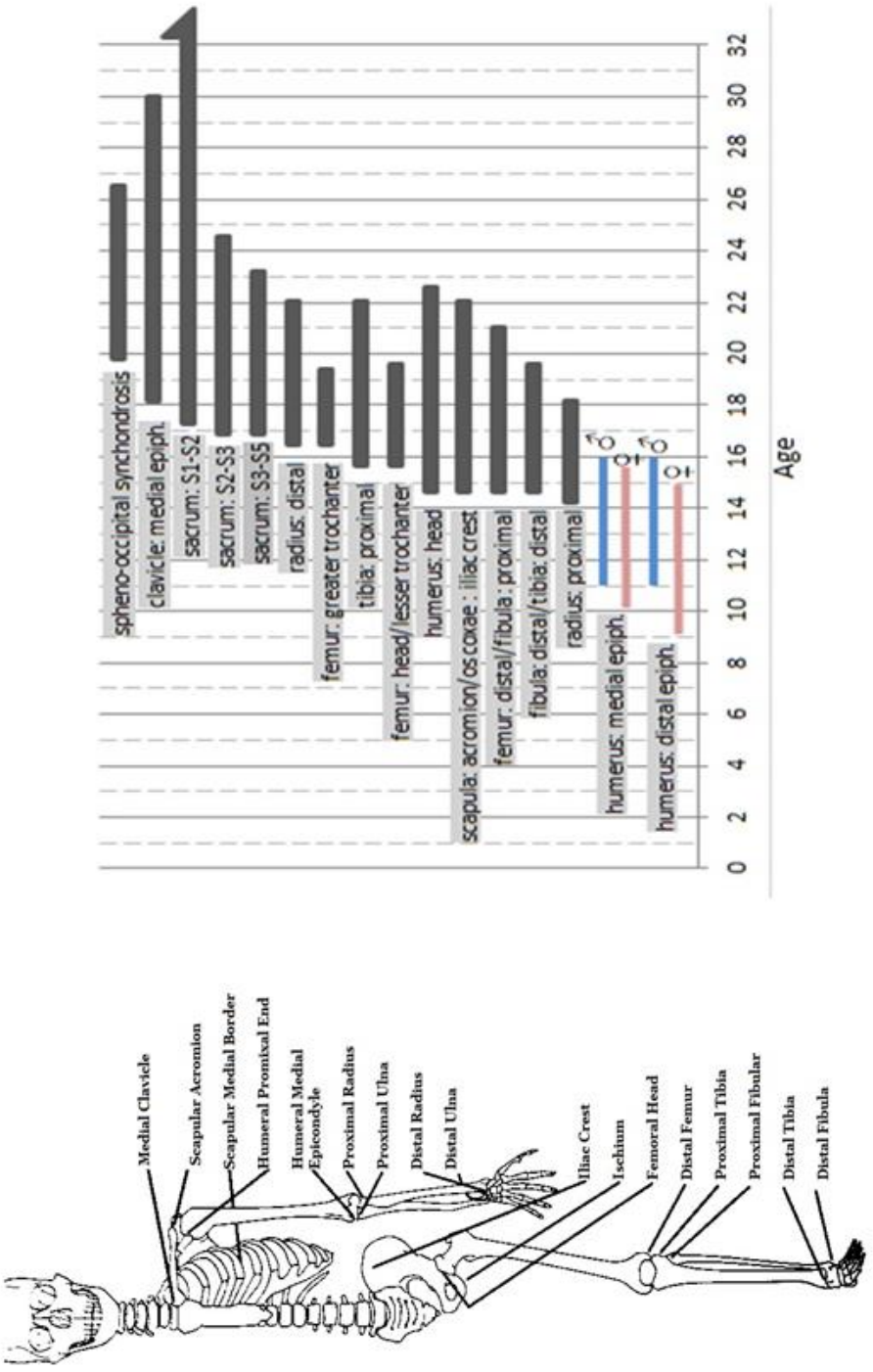


Figure 1. Fusion of the epiphyses (showing the initiation and completion).



Degree of epiphyseal fusion (bars show the period of time over which fusion begins and completes (From Buikstra and Ubelaker 1994).

Dental formation and eruption

The most accurate way of estimating child age is to examine the degree of formation and eruption of the teeth – both the deciduous and permanent dentitions.

There are a range of different standards used – some focus upon tooth formation only, others like the combined chart below combine both formation and eruption. These charts are easier to use in the field. The accuracy of age estimates depends upon examining multiple teeth to determine dental age. The associated age ranges with any stage of development are least for the young children and then increase with age. By the end eruption of the third molar is quite variable (particularly in modern populations) and there is always of percentage of people in a population with third molar agenesis where the third molar has simply not formed. This condition can be identified from antemortem tooth loss by seeing if there is a facet on the distal surface of the second molar where the third molar once rested. If that is preent then the third molar was there but was shed before death.

The standard below is widely used – it is Ubelaker's modified version of the Massler and Schour dental chart. What Ubelaker did was broaden the age limits based on his experience of working with Native American remains. So it is often assumed to be more useful for prehistoric populations. There are however a range of dental charts and schedules available e.g.:

The London Atlas – developed from modern cross section of London children.

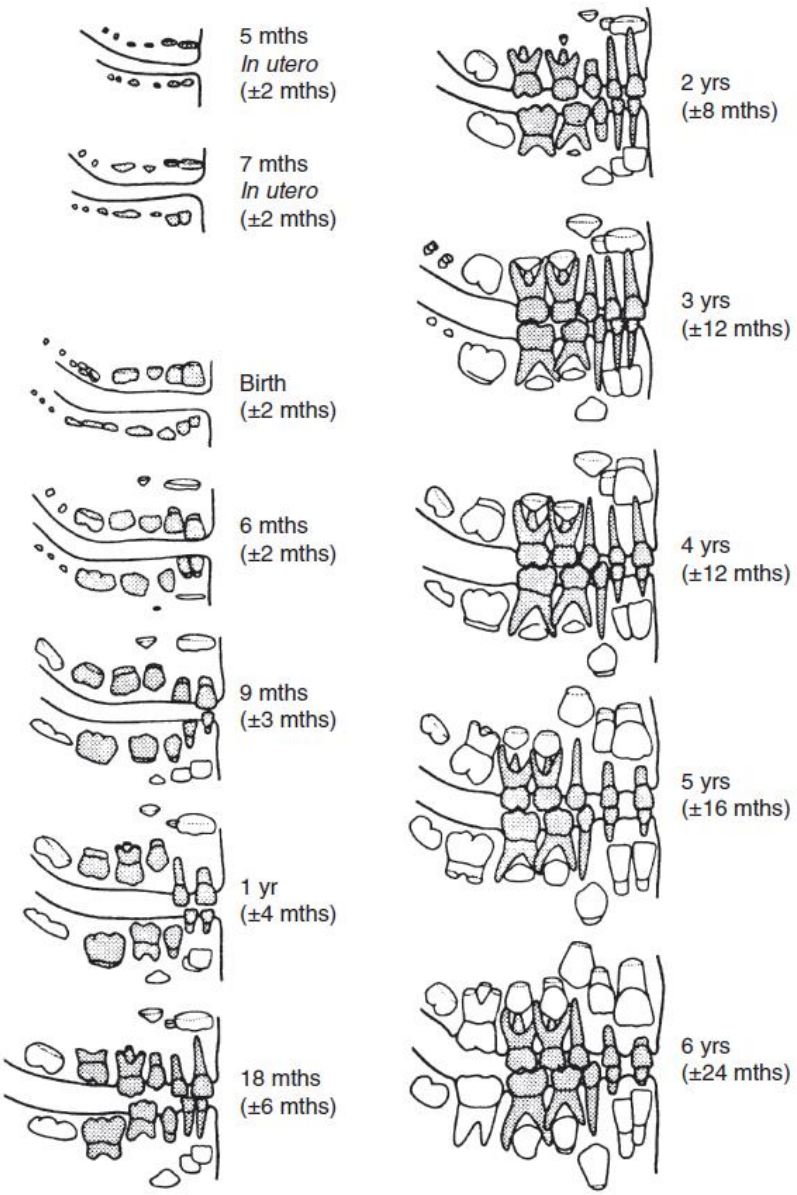
There is a study of dental development among Maori Children and has been one for Australian Aboriginal children as well.

For forensic purposes however it is better to use a chart that is based upon a contemporary multi-ethnic population since this is closest to the population that remains will come from. For archaeological populations it is always worthwhile doing some research to see what is the most appropriate schedule to use.

When setting out to construct a dental age estimate it is important to identify each tooth to type (i.e. position, upper or lower and deciduous/permanent) and then record the state of that tooth. If it is possible to see the whole tooth then the degree of crown and root formation can be recorded (e.g. crown complete, root ¼ etc) otherwise the focus is on is the tooth unerupted (i.e. still in its crypt), erupting (i.e. the bone is perforated and the tooth crown is starting to show) or in occlusion (up to the level of the other teeth). It is possible to tell if a loose tooth is in occlusal by looking at the cusps (the tips of the tooth) and seeing if they are rounded off through contact with an opposing tooth.

Combined Methods

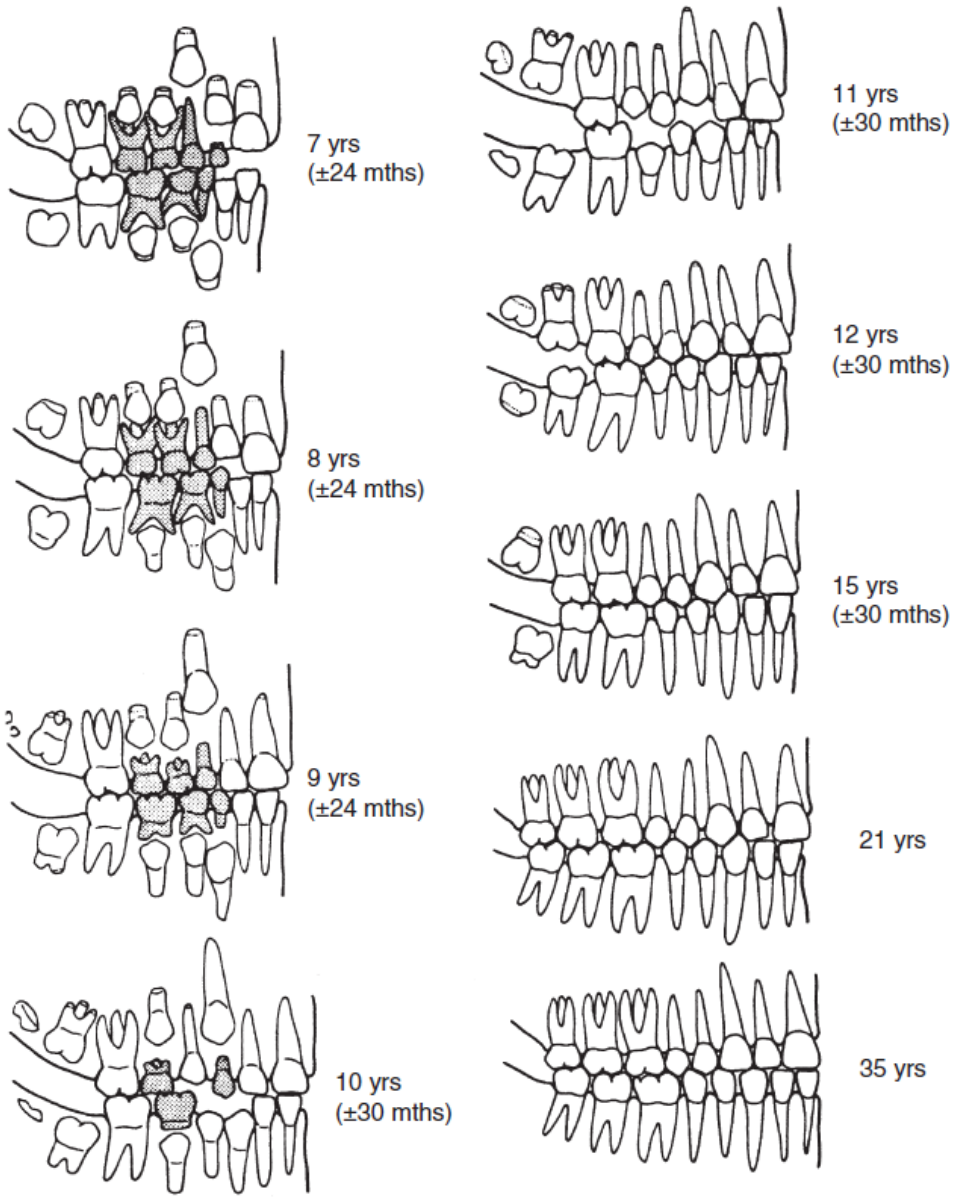
Ubelaker



Source

Compilation of data from multiple sources. Data from the "early" end of the published variation was used in preparing the chart to represent suggested earlier development among Native American Indians.

Figure 4: Dental formation and eruption (Chart from Ubelaker 1989) (a modification of the Schour and Massler chart deemed to be more suitable for prehistoric populations (maybe)).



Development of the teeth from 5 months *in utero* to 35 years

ːs

ːion refers to emergence through the gum, not the alveolar bone.

rence

ker, D.H. (1979). *Human Skeletal Remains: Excavation, Analysis and Interpretation*. Washington, DC: Smithsonian ːtitute Press.

LAB Exercise: Useful tables

Look at your mystery child. Work out what methods of aging can you use (you can do that by doing an inventory first). Then record each specific age indicator. The final age estimate is the range of ages where ALL of those indicators are happening at the same time so you might have a wide range for one indicator but the combination of two indicators can narrow that range down. When you are done you can ask your tutor for the answer and double check how you did.

Epiphyseal closure

Epiphysis	**Unfused (max age)**	**Fused (min. Age)**
Estimated age of child:		

Dental eruption and formation

First up: distinguish deciduous from permanent. Think of these stages: unerupted, erupting, in occlusion. If you can see the tooth then look at crown complete, root half formed, root complete and closed.

MAXILLA								
Pernament	**M3**	**M2**	**M1**	**P2**	**P1**	**C**	**I2**	**I1**
Formation/ Eruption								
Deciduous				**m2**	**m1**	**c**	**i2**	**i1**
Formation/ Eruption								
MANDIBLE:								
Pernament	**M3**	**M2**	**M1**	**P2**	**P1**	**C**	**I2**	**I1**
Formation/ Eruption								
Deciduous				**m2**	**m1**	**c**	**i2**	**i1**
Formation/ Eruption								

EPIPHYSEAL FORMATION

SKELETAL ELEMENT	EPIPHYSIS PRESENT / FUSION OCCURRED	AGE RANGE
E.G. Fontanelle closed and metopic suture fused		**>18 months.**

Diagrams of juvenile skeletons

(useful for inventory)

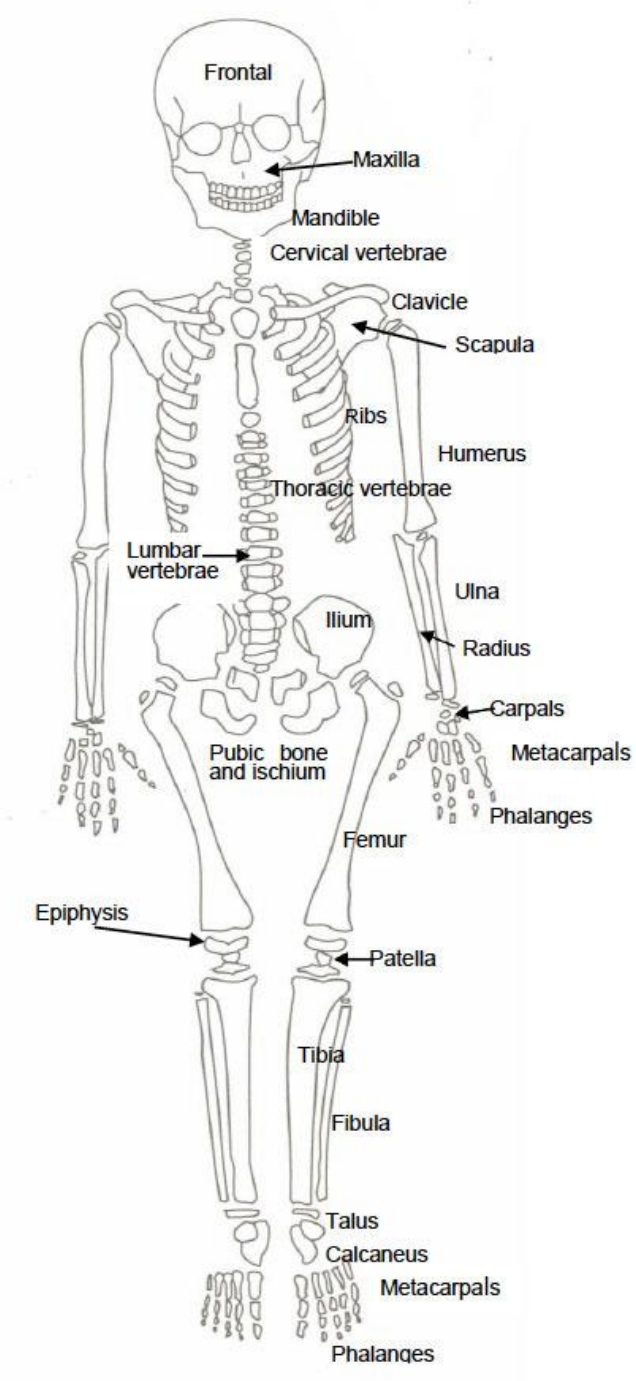
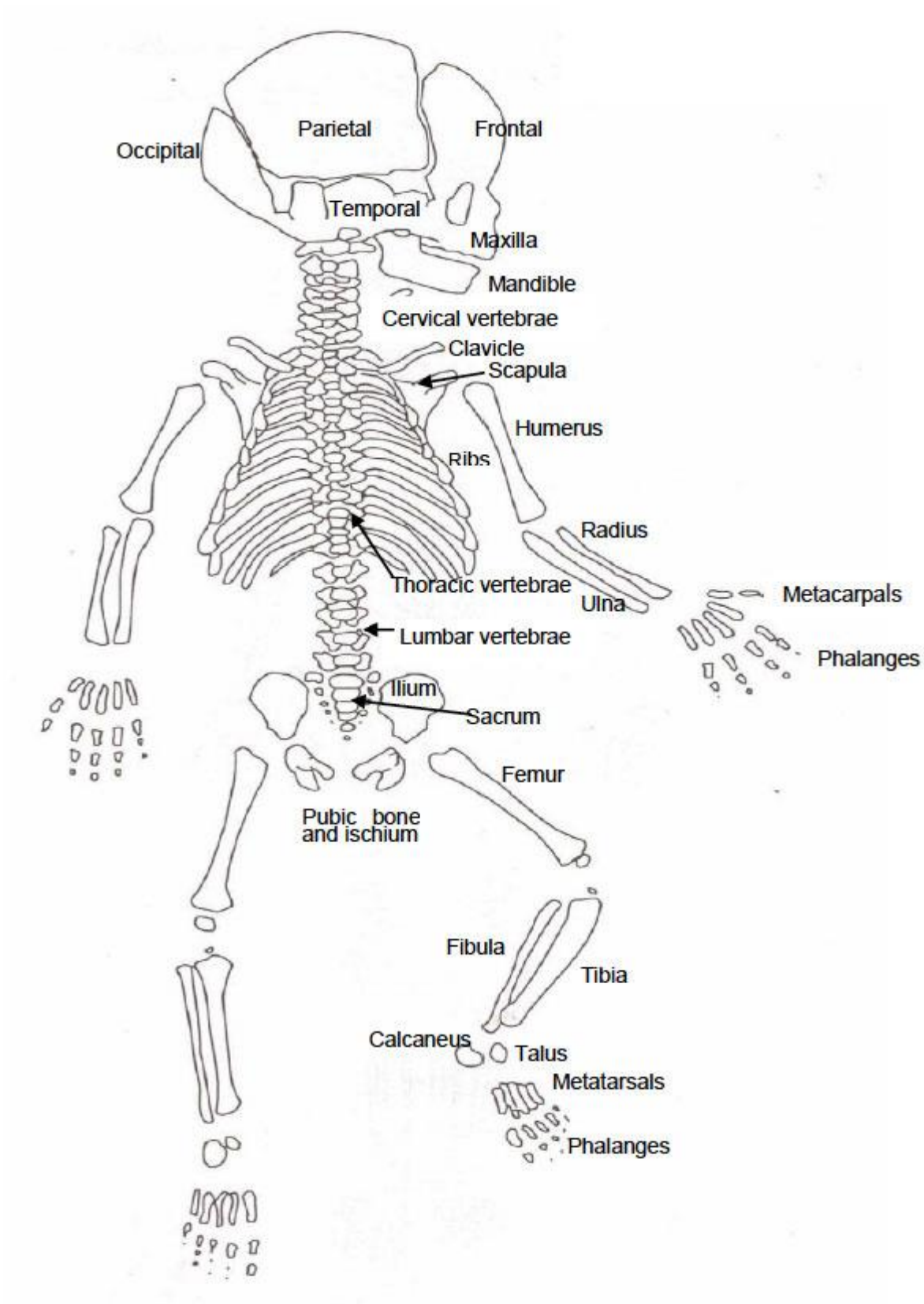


Diagram of infant skeleton



Week 10

Ethics and Codes of Practice

Goal:

This week we are addressing again the issue of ethics and codes of practice in bioarchaeology and in forensic anthropology/archaeology. What we want you to do is to debate the issues surrounding these areas in class and following that discussion begin your last assignment in the class which is to write a code of practice in relation to the Southern Hemisphere.

Assignment:

Assignment 3: A code of practice for bioarchaeology in New Zealand.

Anthro 235

Assignment 3: A code of practice for bioarchaeology

Date Due: 10 October, 3pm (submit onto CANVAS)

In Anthro 235 we have made sure you do different sorts of writing and get a sense of how to produce independent description and research (Assignment 1), use first principles (Assignment 2) and in assignment 3 we are asking you to think practically again – this time preparing guidelines for professionals who work in the field about what to do when you find human remains in New Zealand.

Good guidelines don't just present a recipe book they tell people concrete information and they also explain **why** particular practices must be followed. They are sufficiently open as a set of principles that they can be applied in any situation. At the same time they are pithy and to the point (i.e. we are asking for 3 – 5 pages max.). But what we want you to think about are:

Legal responsibilities
Ethical consideration
Recording of context
Recording of characteristics in the field (what can be said, what can't be said)
When might excavation of remains be recommended and what further analyses might be considered with what provisos.

You are writing this for yourself and for other professionals in the field. You are not writing it for specialists trained in osteology but for a normal archaeologist or police officer who comes across remains in the course of a normal day's work. This means that you can't just make stuff up – references are essential as are explanations of why a particular recommendation is made.

The readings for Week 12 are relevant for this assignment as are these other sources and you could well find others:

Guidelines to the standards for recording human remains. BABAO, Department of Archaeology, University of Southampton, 2004. (Available online)

York Osteoarchaeology has links to some of the British documents: http://www.yorkosteoarch.co.uk/guide.php

British forensic anthropology code of practice www.gov.uk/government/publications/forensic-anthropology-code-of-practice

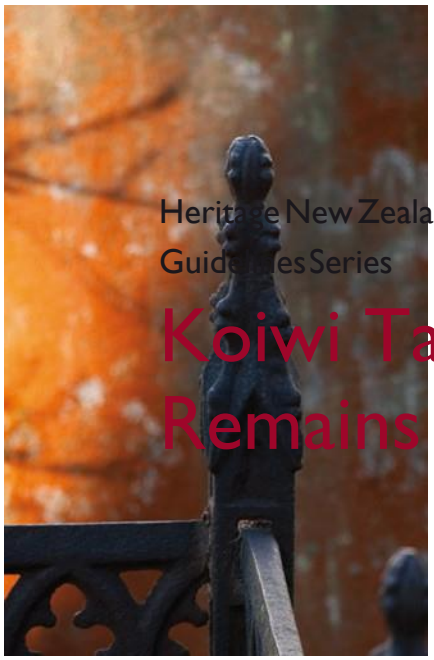
Koiwi tangata Heritage New Zealand Pouhere Taonga Archaeological Guidelines Series. 2014. (attached here)

What we are asking for is not a copy of these documents but a much shorter document that answers the questions above and explains why.

Task

Debate the questions above – work out what might be ethical principles, think about what else should be in this document – debate, talk and get somewhere!

HERITAGE NEW ZEALAND
POUHERE TAONGA



Heritage New Zealand Pouhere Taonga Archaeological Guidelines Series

Koiwi Tangata Human Remains

08

25 August 2014

HERITAGE NEW ZEALAND
POUHERE TAONGA

Contents

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Introduction

The *Koiwi Tangata/Human Remains Guidelines* have been prepared by Heritage New Zealand Pouhere Taonga for use by staff, heritage administrators and consultants, archaeologists, the police, territorial local authorities (TLAs), government departments, project managers, property owners, and the general public. At any time these people may be involved in the discovery, excavation, exhumation, storage, re-interment or repatriation of koiwi tangata/human remains.

Executive summary

The *Koiwi Tangata/Human Remains Guidelines* provide advice for a culturally responsible mechanism for the management of koiwi tangata/human remains that have been either uncovered through accidental discovery or deliberately excavated/exhumed in emergency response situations, or as a result of natural processes e.g. coastal erosion. In the majority of cases it will be found that these koiwi tangata/human remains are Maori in origin, so these Guidelines have a deliberate focus in that direction, and recognise the kaitiaki role that Maori play in determining what happens in the management of the discovery of koiwi tangata/human remains.

Heritage New Zealand is the lead agency for the identification, protection, preservation and conservation of the historical and cultural heritage of New Zealand and makes numerous decisions on heritage matters. The range of decisions in the management of koiwi tangata/human remains is wide and complex, and requires compliance with a range of legislation in New Zealand.

The *Koiwi Tangata/Human Remains Guidelines* provide a process to assist managers and staff of Heritage New Zealand to make decisions that are consistent with New Zealand legislation.

The guidelines are intended to:

- set out best practice procedures for external stakeholders e.g. tangata whenua (at iwi, hapu or whanau level), Government agencies (e.g. DOC, OTS) territorial local authorities, police, the general public, etc
- provide internal direction to Heritage New Zealand staff for the management of koiwi tangata/human remains
- ensure compliance with New Zealand legislation, and
- provide advice and direction on customary practice and protocols (tikanga and kawa), while recognising that individual iwi and hapu will have their own particular practices.

These Guidelines should be read by Heritage New Zealand staff in conjunction with the Heritage New Zealand Koiwi Tangata/Human Remains Policy. The Koiwi Tangata/ Human Remains Policy provides direction for Heritage New Zealand staff in exercising

their responsibilities pursuant to the *Heritage New Zealand Pouhere Taonga Act* 2014 (the Act). The policy also defines protocols for the management of koiwi tangata/human remains and the position of Heritage New Zealand on relevant issues including legislative compliance, stakeholder relationships, and cultural safety.

It is important to stress that these guidelines are not intended to apply to existing cemeteries and urupa (although they are briefly covered in Section 9) – it is to provide advice and assistance for the accidental and unexpected finds of koiwi tangata/human remains.

Definitions

Heritage New Zealand defines koiwi tangata/human remains as koiwi tangata/human remains (particularly bones) that have not been made, or incorporated into an artefact.

'Cultural items' refers to any taonga/artefacts discovered with the koiwi tangata/human remains. Heritage New Zealand does not classify koiwi tangata/humans remains as taonga or artefacts.

'Discovery' of koiwi tangata/human remains usually occurs accidentally (earth moving/ excavating), or through exposure by natural processes such as coastal erosion. During development projects this sometimes can include both individual bones or burials, or larger clusters that may be considered urupa.

'Descendant groups' include any known groups or people that have a genealogical or whakapapa connection to the koiwi tangata/human remains.

Legislative framework

The five main pieces of legislation that have particular relevance to the way in which koiwi tangata/human remains are dealt with in New Zealand include:

Coroners Act 2006

Burial and Cremation Act 1964

Heritage New Zealand Pouhere Taonga Act 2014

Protected Objects Act 1975

Te Ture Whenua Maori Act 1993

Coroners Act 2006

Section 14(1) of the *Coroners Act* 2006 requires that *"a person who finds a body in New Zealand must report that finding to a member of the police as soon as practicable"*.

This requirement means that any discovery of human remains requires notification to the New Zealand Police. It is the responsibility of the police to establish whether or not the site is a crime scene.

Burial and Cremation Act 1964

The *Burial and Cremation Act* 1964 controls the burial, cremation, and exhumation of bodies as well as the management of burial grounds and cemeteries.

Sections 51 and 55 of the *Burial and Cremation Act* 1964 make it an offence to:
…remove any body or the remains of any body buried in any cemetery, Maori burial ground, or other burial ground or place of burial without licence under the hand of the Minister.

The Ministry of Health is responsible for the administration of this legislation and disinterment licences can be applied for through the local Public Health Units (contact details are provided in the Appendix 1). Even when a disinterment licence is not required it is good practice to contact the local Public Health Unit so that they are aware of the situation. Guidance on when a disinterment licence is required is provided in Appendix 2.

Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA)

Heritage New Zealand is responsible for administering the HNZPTA. The purpose of this Act is to identify, preserve, protect and conserve the cultural heritage of New Zealand. The Act contains statutory powers in relation to the protection of archaeological sites.

The HNZPTA defines an archaeological site as:

… any place in New Zealand, including any building or structure (or part of a building or structure), that–

was associated with human activity that occurred before 1900 or
is the site of a wreck of any vessel where that wreck occurred before 1900; and
provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand.

This is a broad definition that encompasses a wide variety of site types of both Maori and European origin and includes burials and cemeteries both in isolation or where they occur with other archaeological evidence.

Section 42 of the HNZPTA provides blanket protection for all archaeological sites such that:

Unless an authority is granted under sections 48, 56(1)b, or 62 in respect of an archaeological site, no person may modify or destroy, or cause to be modified or destroyed, the whole or any part of that site if the person knows, or ought reasonably to have suspected, that the site is an archaeological site.

Part 4 of the HNZPTA requires that Heritage New Zealand maintains a New Zealand Heritage List of historic places, historic areas, wahi tupuna, wahi tapu and wahi tapu areas. The purposes of this list are to inform the public, notify owners and be a source of information for the purposes of the *Resource Management Act* 1991 (the RMA).

Heritage New Zealand has provided previous guidance on the types of places that may be considered to be wahi tapu. These include:

- Burial places
- Rua koiwi – places where koiwi tangata/human remains are kept, rock overhangs, caves, hollow trees etc.
- Places where baptismal rites were performed
- Burial places of placenta, etc.
- Sites where koiwi tangata/human remains were removed unless tapu has been lifted
- Battle grounds where blood was spilt
- Caverns and underwater burial places
- Sources of water for death rites.[1]

The principles of the Treaty of Waitangi are provided for under section 7 of the HNZPTA.

Protected Objects Act 1975

The Protected Objects Act 1975 (POA) is administered by the Ministry for Culture and Heritage and regulates:

- the export of protected New Zealand objects
- the illegal export and import of protected New Zealand and foreign objects, and
- The sale, trade and ownership of taonga tuturu.

Cultural items derived from an archaeological burial site consisting of any object, assemblages, scientific samples and organic remains (especially taonga tuturu) are regulated and controlled by the Ministry for Culture and Heritage pursuant to the POA. The term taonga tuturu includes all finished items made by Maori and those items used by Maori (MCH guidelines give examples such as tekoteko, toki/adze, wakahuia, kaheru/

1 Extract from Maori Heritage Committee Paper no. 1993/2/4, Maori Heritage Committee Meeting, 9 February 1993.

spade, matau/fishhooks, taiaha and patu, and carved firearms from the New Zealand Wars). However, it does not include waste and by-products of manufacturing such as flakes, shells, oven stones and other 'scientific material' unless there is evidence that the object had a secondary use.

Te Ture Whenua Maori Act 1993

The *Te Ture Whenua Maori Act* 1993 provides for the gazettal of urupa – Maori burial grounds. Gazettal occurs in instances where new urupa are created on Maori freehold or general land blocks (section 338 *Te Ture Whenua Maori Act* 1993).

Can more than one Act apply?

More than one Act may apply in discovery of koiwi tangata/human remains. For example, the accidental discovery of human remains requires, pursuant to section 14(1) of the *Coroners Act* 2006, that the police are notified as soon as practicable. If the discovery occurs within an area in which Heritage New Zealand has reasonable cause to suspect that it is an archaeological site, then an authority pursuant to Heritage New Zealand may be required before the remains are removed.

Similarly, if koiwi tangata/human remains are to be exhumed from a known urupa or cemetery a disinterment licence will be required from the Ministry of Health pursuant to sections 51 and 55 of the *Burial and Cremation Act* 1964.

In some instances iwi, hapu or whanau may wish to inter koiwi in an urupa which is within a known archaeological area. If there is reasonable cause to suspect that the area is archaeological Heritage New Zealand at its discretion, may direct that an archaeological authority be obtained.

Heritage New Zealand advises that in all circumstances involving the care and management of koiwi tangata/human remains, that the police, Heritage New Zealand, local public health unit, and tangata whenua are notified in the first instance.

Key agencies – roles and responsibilities

The following are considered to be key agencies and groups that should be involved in koiwi tangata/human remains care and management:

Heritage New Zealand

Heritage New Zealand is the statutory authority and lead agency for the promotion, identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand. Where koiwi tangata/human remains have been discovered as a result of excavation or through natural processes the local office of Heritage New Zealand must be notified immediately. It is the statutory role and function of Heritage New Zealand to determine if the site is archaeological and if so whether an archaeological authority will be required to exhume the remains. Exhumation of koiwi tangata/human remains in an

archaeological context without an archaeological authority or the expressed permission of a Heritage New Zealand archaeologist is potentially an offence under the HNZPTA. Wilful damage and destruction of archaeological sites is a criminal offence in New Zealand and carries fines of up to $300,000.

New Zealand Police

The New Zealand Police are the lead agency responsible for reducing crime and enhancing community safety in New Zealand. The New Zealand Police is a decentralised organisation divided into 12 districts, a National Headquarters, and service centres. Each district has a central station from which subsidiary and suburban stations are managed. In all instances of koiwi tangata/human remains discovery, the central or suburban police station must be notified, as it is the role of the New Zealand Police pursuant to s14(1) of the *Coroners Act* to determine if the site in which the remains have been uncovered is a crime scene. If there is cause to suspect the site may be archaeological, then the Police should seek the advice of a trained archaeologist to confirm this.

The New Zealand Police employ Iwi Liaison Officers who advise on Maori protocol and procedures. These officers are based in central stations and maintain a contact database for iwi, hapu and whanau within the respective areas of jurisdiction. Iwi Liaison Officers can provide advice and guidance on matters relating to iwi involvement in koiwi tangata/ human remains management.

Ministry of Health

The Ministry of Health is a policy advisor to the Minister of Health, an agent of the Minister for monitoring and overseeing District Health Boards, and a provider of regulatory and other functions. The Ministry administers various statutes including the *Burial and Cremations Act* 1964. The Minister has delegated the authority to issue disinterment licences under section 51 of the Act to the Group Manager, Communicable Disease and Environmental Health Policy. Public Health Units located within regions throughout the country determine if a disinterment licence will be required in all cases of discoveries of koiwi tangata/human remains. They should be contacted to determine if a disinterment licence will be required. Contact details of Public Health Units are included in Appendix 1. Any proposal to disinter burials from a cemetery will require a disinterment licence.

Tangata Whenua

Tangata whenua is a Maori term which literally translates as ‘people of the land’ and is often used to describe the indigenous people of New Zealand. Tangata whenua social structure can be divided into three levels of kinship: iwi, hapu and whanau. An iwi is an entity consisting of a collection of interrelated sub-tribal groups – hapu. A hapu comprises closely related whanau groups, and in both a traditional and contemporary context is the authority for local tangata whenua issues. Each hapu has a defined boundary (rohe) but in some instances there are shared areas of jurisdiction.

The majority of cases of discovery of koiwi tangata/human remains are of tangata whenua derivation. It is essential, therefore, that hapu/iwi are contacted immediately following discoveries to ensure cultural protocol is adhered to and decisions for exhumation and reinterment are culturally appropriate.

Other agencies include:

- New Zealand Archaeological Association (NZAA).
- Ministry for Culture and Heritage (MCH).
- Territorial and regional authorities.
- Ministry of Justice – Maori Land Court.
- Department of Conservation (DOC).
- Universities (biological anthropologists).
- Historic Cemeteries Conservation Trust.
- Local and regional museums.

Significance of koiwi tangata/human remains in the New Zealand context

Death and its associated rituals are of great importance to all societies. In most cases places of burial in New Zealand will have some social and historical importance to local communities, particularly due to the cultural traditions and customary practices associated with burials.

Human remains of Maori origin are of special significance to iwi, hapu and whanau. Burial sites either known or recently discovered are in most cases regarded as highly significant to Maori communities.

The handling of koiwi tangata/human remains following discovery needs to be carried out in a sensitive manner and to respect the wishes of any descendants of the deceased individual(s), or those who now hold manawhenua or kaitiaki ahi ka roa.

Koiwi tangata/human remains can be uncovered through a variety of factors. In New Zealand one of the most common causes is through natural processes such as coastal erosion. The other major cause is through the accidental discovery of previously unknown burials on development sites. Both of these situations may contain additional archaeological material.

Heritage New Zealand staff are often one of the first ports of call for advice or guidance following the discovery of koiwi tangata/human remains and one of the major challenges for staff is to deal with the discovery in a manner that is both sensitive to any cultural issues that may be present as well as ensuring a consistency in approach to the application of the necessary legislation.

Burial practices and their importance

Whilst it is possible to distinguish a variety of burial types in New Zealand and make some broad statements about burial customs, such as the predominance of primary burial during the early period and secondary burial in later prehistory, it is impossible to ascribe particular burial practices to a particular time. There appears to have been considerable regional variation within Maoridom in terms of continuity and change in burial ritual, and even within the same burial plot there can be variety in burial types.

It is logical to assume that the Polynesian settlers brought their burial customs with them. Typical Polynesian practice was to emphasise the relationship of the living and the dead by burying individuals in or close to settlements. This assumption is borne out by the archaeological evidence from known early New Zealand sites such as Wairau Bar and the Washpool where burials have been discovered in clusters close to the main settlement area of the site. However, there is variability in the way that individuals were treated, even within the same burial place (Davidson 1984: 173).

These early burials are typically in shallow graves in either prone (face down), flexed or "crouched" positions. Grave goods such as moa eggs and adzes as well as items for personal ornamentation also sometimes occur. Secondary burials are also known from some early period sites. Flexed burials are known throughout the prehistoric period and in some areas are known to occur into the early historic period. Although flexed burials are known from early sites, they are generally considered to be a later style of burial (Trotter and McCullough 1989: 94). Sometimes the skull has been removed in the case of secondary burials, perhaps for the purpose of treasuring or lamenting over a particular relative (Davidson 1984: 178).

Cave burials are another known burial type, the majority of which occurred away from settlement sites. This type of burial tends to be later, although a late 15th/early 16th century example is known from Palliser Bay. Many of these are secondary, where the body appears to have been given an initial ground burial to allow decomposition, after which the bones are removed and placed in a cave. Occasionally the whole body was placed in a cave. The most well-known example of this type of burial is from Mary Island on Lake Hauroko in south Westland. In this particular instance, a woman was wrapped in a cloak of flax and feathers and placed on a bier at the entrance to the cave (Davidson 1984; Trotter and McCullough 1989). The exact reasons for this type of burial practice are unknown; they may have been hidden away for fear of desecration by enemies or possibly due to the dangerous tapu nature of ancestral bones to living descendants (Davidson 1984: 177).

European and historic Maori burial practices tend to be based within a Christian framework of consecrated cemeteries (particularly in urban environments). Most commonly, the body is placed in a supine position within a wooden coffin and the grave marked with some form of marker such as a wooden cross or a headstone. Maori did not universally use coffins – in some places blankets were used until the 1920s. Small family plots are known in more remote farming settlements and isolated graves are also recorded. In areas such as Taranaki, small cemeteries associated with casualties from the New Zealand Wars may be scattered around a district.

Guidelines

Accidental discovery – how to proceed

The incidental or accidental discovery of koiwi tangata/human remains is by far the most common event that most people are likely to encounter.

This scenario can vary from the reporting by a member of the public of the discovery of individual bones, to the discovery of koiwi tangata/human remains during development earthworks. Different responses may be required and each situation will need to be addressed on a case-by-case basis. There are standard procedures that must be followed in each instance.

Heritage New Zealand should be contacted to undertake a preliminary examination of the remains to determine if they are human, and to provide advice on compliance matters pursuant to the HNZPTA. In every situation of discovery, the police must be notified as they need to be satisfied that the remains are not evidence of a crime scene.

Preservation *in situ* of the remains should always be the preferred outcome when previously unknown human remains are encountered. No matter what the final resolution of the situation, any remains need to be handled with respect.

There can be potential conflicts between cultural wishes, scientific goals and the economic purposes of the developer. In these instances it is important to ensure that cultural perspectives are appropriately considered. Scientific analysis of koiwi tangata/human remains should only be pursued through agreement with a mandated representative of the descendant group.

Challenges faced by Heritage New Zealand staff include the on-site relationship with the police and pathologists who are required to establish that the burial does not represent a crime scene.

The discovery of koiwi tangata/human remains can generate particular interest from the media. There will be many occasions where it is simply not appropriate for any discussion to take place with the media. Heritage New Zealand should contact the Media and Communications team so that any media enquiries can be managed and assisted.

Guidelines for the general public

When bone material is encountered that may be human, it is important that the remains are not disturbed. If necessary, cover the bones to prevent further exposure or disturbance.

Contact the police and Heritage New Zealand as soon as possible. If possible, collect information about the exact location of the material to assist in relocation of the site, the

nature of the disturbance (for example, whether the material eroded out naturally), or if there is any other material associated with the bone (such as, clothing, nails, shell etc). Note: if the remains are associated with archaeological deposits, it is not legal to disturb the site, or remove the bone material without an archaeologist present.

Recommended steps to be followed by the general public:

Notify local police

Notify Heritage New Zealand

Contact tangata whenua (iwi authority/tribal runanga/Iwi Resource Management Unit/ local marae). The police or Heritage New Zealand will be able to advise who to contact.

Guidelines for the Police

The New Zealand Police are involved in all cases of koiwi tangata/human remains discovery. Their primary role of the Police is to determine if a crime has been committed.

In most instances of discovery the remains will be within an archaeological context. From an archaeological perspective, the context of material in an archaeological site is extremely important. Therefore, disturbance of such material should be minimised and it is unlawful to disturb archaeological remains without an archaeological authority from Heritage New Zealand.

The following considerations should be taken into account:

- Are the remains associated with shell, stone artefacts, other bones, nails or timber?
- Are the remains in a coastal or inland dune system, cleft or rock shelter?
- Are the burials flexed, that is, laid out flat?
- Is there marked wear of the teeth?
- Is there a complete absence of dental fillings?
- Are the bones completely defleshed and brown?

It is important to be aware that not all prehistoric Maori or historic Maori/non-Maori will have marked wear on the teeth, nor will all forensic skeletons have dental fillings.

Only very recently buried bodies will not be completely defleshed, as skeletonisation occurs within months rather than years in most circumstances. Exceptions are in those cases where mummification may have occurred, such as interments in very dry caves or extreme situations, such as where a death has occurred above the permanent snow line.

Be aware that the colour of the bone can be more reflective of the burial matrix than the passing of time. Soil and climatic conditions such as pH, soil composition, humidity and temperature determine the state of preservation or deterioration of the bones to a much greater extent than the passing of time. In many cases the condition or colour of the bone is not an indication of age.

If there is a likelihood that the remains are archaeological, ensure that no further disturbance occurs to the site and contact the regional Heritage New Zealand archaeologist if they haven't already been notified. Police no longer have jurisdiction over the site once it is established that it is not a crime scene. Police pathologists, therefore, should not remove the remains from the site.

Recommended steps to be followed by New Zealand Police:

Coordinate with Police Maori Liaison Officers.

Contact and collaborate with Heritage New Zealand.

Contact and collaborate with tangata whenua (iwi authority/tribal runanga/Iwi Resource Management Unit/local marae).

Guidelines for developers

When earthworks are undertaken for development, there is a possibility that koiwi tangata/human remains may be encountered. To mitigate risk of accidental discovery contact Heritage New Zealand prior to commencing excavation to determine if works will require an archaeological authority. If they do not, it may be prudent to have an Accidental Discovery Protocol prepared in association with iwi and Heritage New Zealand.

If koiwi tangata/human remains are encountered while undertaking earthworks it is imperative that works in the vicinity of the find cease (approximately 5m radius is seen as adequate to allow for both protection and space for people to work) and that the area is secured. If the work is being undertaken under an archaeological authority then the project archaeologist must be advised immediately following the find. The local police station should also be contacted at the same time. If you are operating without an archaeological authority, notify Heritage New Zealand at the same time that you notify the police. Tangata whenua should also be contacted at this time.

An archaeological authority may be required from Heritage New Zealand before work affecting the site can recommence, particularly if the remains are identified as human and within an archaeological context.

The discovery of human remains can be an emotional experience for all parties but particularly for descendant groups. It is important that the process around decisions about the next step is not rushed. If the remains are of Maori derivation tangata whenua may request time to consult with the whanau, hapu or iwi about the find. Heritage New Zealand Maori Heritage Advisors/Pouarahi can provide assistance with this process.

The following issues relate to discoveries of koiwi tangata/human remains:

- Whether the remains should stay where they are.
- Whether a disinterment licence is required from the local Public Health Unit.
- What protocols will be required for their removal if *in situ* preservation is not possible.
- The final location of the remains.
- The level of recording of the remains and any further scientific analysis.

- Who will remove the remains?

Heritage New Zealand will expect to know the results of this consultation to inform the next step(s) to resolve the matter.

Recommended steps to be followed by developers:

Contact project archaeologist (if working under an archaeological authority).

Contact local police.

Contact Heritage New Zealand.

Contact tangata whenua (iwi authority/tribal runanga/Iwi Resource Management Unit/ local marae).

Guidelines for consultant archaeologists

Consultant archaeologists are often the first to be notified of the discovery of koiwi tangata/human remains as a result of developments, especially if they are present in a professional role. Equally, koiwi tangata/human remains can be uncovered during the research excavations – something that was very common in the 1960s. It is therefore essential that the contract archaeologist contacts all stakeholders as soon as practicable. This will include Heritage New Zealand, police, tangata whenua and the local Public Health Unit.

The police will need to be satisfied that the remains are not part of a crime scene. Heritage New Zealand and tangata whenua will need to establish whether it will be possible to leave the remains *in situ* and, if not, the appropriate methods and protocols to remove the remains. If removal is the preferred option, the professional advice of an experienced bioarchaeologist should be sought (see Appendix 1) if iwi believe it is appropriate that the remains should be retained for analysis/study. They will be able to ensure that standard recording of material *in situ* takes place and that any exhumation is conducted in a manner which meets professional standards.

The following issues should be discussed:

- Whether the remains should stay where they are.
- What protocols will be required for their removal if *in situ* preservation is not possible.
- The level of recording of the remains and any further scientific analysis.
- Who will remove the remains? Ideally this should be done by a bioarchaeologist.
- The final location of the remains.

All work involving koiwi tangata/human remains must be undertaken mindful of the NZAA Code of Ethics. There will also usually be specific protocols identified by tangata whenua around the exhumation of a burial, which may include the following:

- Appropriate containers for removing remains.
- Use of appropriate field equipment (that is, not home garden tools).
- Restrictions on consumption of food or drink near the site.

- No smoking.
- Use of water for cleansing by rinsing the hands.

For more information refer to the cultural safety section of these guidelines (Section 12).

If the material to be removed is not going to be immediately reburied, it is important that a repository for the remains is identified prior to their removal. This repository should be acceptable to descendant groups. Appropriate repositories may include the local morgue, undertaker, church or museum. The back of the car or garage is not considered to be appropriate.

Guidelines for Department of Conservation staff

Koiwi are frequently found on public conservation lands, and in these instances Department of Conservation (DOC) staff will be often be the first to be notified. Finds of koiwi may result from natural processes (such as coastal erosion), be reported by staff or the general public, or may be the result of earthworks (undertaken by staff, contractors, or volunteers working on conservation lands). The Department has developed internal procedures for the discovery of koiwi which are consistent with these guidelines.

The find should be reported to the relevant Area Manager, and a site visit must be undertaken by DOC historic staff as soon as possible following notification of the discovery of human remains. If the historic staff member is inexperienced in identifying human remains they may wish to arrange for a suitably qualified consultant to accompany them, or undertake the site visit on their behalf.

If the find is a result of earthworks then any machinery working in the area should cease and the site secured until a resolution is reached. If the find is exposed as a result of natural processes then the site should be appropriately secured, and any practical steps taken to prevent further loss. The DOC historic staff member should confirm that all appropriate notifications to Heritage New Zealand, police and tangata whenua have been made. It is the responsibility of the historic staff member to notify the local Public Health Unit of the find following formal identification of the remains as human.

DOC staff involved in handling human remains should do so in accordance with the Department's *Koiwi Policy* and any protocols identified by tangata whenua.

Steps to be followed by DOC staff:

Ensure site is secured. Koiwi should not be otherwise interfered with.

If discovery is by staff, record location, time of discovery, detailed description of the site and if possible document with photographs.

If discovery is by non-DOC staff, request details of location and circumstance of discovery.

Advise Area Manager, Pou Kura Taiao manager and historic staff.

Historic staff to ensure that Heritage New Zealand, police, Public Health Unit and

tangata whenua have been advised of the discovery.

Guidelines for Heritage New Zealand staff (archaeologists and pouarahi)

Heritage New Zealand archaeological staff are notified of the discovery of human remains in a number of different contexts. In the past there has been an ad hoc approach to how these are dealt with. It is the purpose of these guidelines to standardise the Heritage New Zealand response.

A site visit must be undertaken as soon as possible following notification of the discovery of human remains, particularly in situations where no archaeological authority has been granted. If a Heritage New Zealand archaeologist is unable to make the visit for any reason, a professional archaeologist may be approached to undertake the visit on Heritage New Zealand's behalf. The consultant may invoice Heritage New Zealand for this visit. Additionally, if the Heritage New Zealand archaeologist is inexperienced in identifying human remains, it is recommended that they seek an experienced bioarchaeologist to accompany them on the site visit.

On arriving at the discovery site the Heritage New Zealand archaeologist needs to ensure that all machinery working in the area has ceased and that the site has been secured until a resolution is reached. Heritage New Zealand must confirm that all appropriate notifications to the police and tangata whenua have been made. It is the responsibility of Heritage New Zealand to notify the local Public Health Unit of the find as well as following formal identification of the remains as human.

The Heritage New Zealand archaeologist needs to make a decision about whether an archaeological authority will be required (if not already granted) for removal, if it is not possible to preserve the remains *in situ*. As a standard guide, if the koiwi tangata/human remains are on their own and not associated with any remaining archaeological material, then an archaeological authority may not be required to exhume the remains, provided that detailed recording occurs.

It may be necessary to decide whether the expertise of a bioarchaeologist is required to record and remove the human remains. A bioarchaeologist should always be consulted, even if this involves them sending images and descriptions of the finds.

The Heritage New Zealand archaeologist will endeavour to ensure that the project manager has advised iwi, hapu and whanau of the incident. Heritage New Zealand staff handling human remains will do so in accordance with Heritage New Zealand *Koiwi Tangata/Human Remains Policy* and any protocols identified by tangata whenua.

Steps to be followed by Heritage New Zealand staff:

Secure site.

Ensure police, Public Health Unit and tangata whenua have been advised of the discovery.

Ensure compliance with Part 1 of the HNZPTA, and with the *Koiwi Tangata/Human*

Remains Policy.

Guidelines for tangata whenua (iwi, hapu and whanau)

Iwi, hapu and whanau play an important role as kaitiaki in the care and management of koiwi tangata/human remains following discovery. As stated earlier, the majority of these remains discovered are of Maori derivation. Therefore, it is essential that iwi, hapu and whanau can immediately and effectively deal with the various and often unexpected issues associated with their accidental discovery.

In situations where tangata whenua are first on the scene it is important that they are aware of the many possible questions they may have to consider: should the koiwi tangata/human remains be removed or not, where should they be taken, who should handle the koiwi tangata/human remains, which kaumatua should be contacted, should any analysis be permitted.

Recommended steps to be followed by tangata whenua:

Contact kaumatua.

Contact New Zealand Police.

Contact Heritage New Zealand Regional or Area Archaeologist and Maori Heritage Advisor.

Contact the local Public Health Unit.

In response to various requests throughout the country, Heritage New Zealand is available to assist iwi, hapu and whanau develop accidental find protocols.

Minimum standards for recording and recovery

(Contributed by Dr Nancy Tayles, Dr Hallie Buckley and Dr Judith Littleton)

Determining whether bones are human is the first task. This may be straightforward in cases involving whole bones, particularly where they are articulated. Identification of fragmented, degraded or disarticulated bones is very much more difficult and requires a very detailed knowledge of human koiwi tangata/human anatomy and experience with human burials. Particularly where the skeleton is buried flexed or has been disturbed, the bones can appear very different from standard textbook descriptions. Infant and child skeletons and even the small bones of adult hands and feet can easily be confused with animal bones. Best practice would therefore have an experienced bioarchaeologist present from the first examination of the bones *in situ* to confirm the bones as human.

Clearly, given the few bioarchaeologists in the country, this may not be practical in all cases. Detailed photographs, including a scale, can always be shown or sent to a bioarchaeologist, doctor or pathologist for an opinion. Depending on the quantity and location of the bones and whether or not they are in danger if not immediately removed, the decision should be made as follows:

In the case of fragmented, disarticulated or individual bones, it may be necessary to send them to a bioarchaeologist for identification as human. If this is not possible, they could photographed in as much detail as possible and these images assessed by a bioarchaeologist. This would allow a considered identification in many cases. There may be little to be learned from such remains but alternatives 1 or 2a overleaf could be offered to iwi or other interested parties.

Where there are complete articulated bones and the archaeologist is confident they are human, immediate consideration must be given to whether the remains could be forensic rather than archaeological. If they are possibly forensic, the police and/ or coroner are responsible for making any records they require and for any remains they remove from the site. For bones deemed to be archaeological and where recovery is imperative because of potential loss, ideally a bioarchaeologist should direct the operation.

Once the bones are identified as both human and archaeological, the next stage is the exposure of the remains to ensure that all koiwi tangata/human elements are recovered. This is particularly difficult where bones are poorly preserved or disturbed. The bones of infants and children are more complex and fragile than those of adults and could be easily missed. Foetal bones *in situ* also could be easily missed. It is important for the recording and reconstruction of the burial (and further assessments of whether there are likely to be more burials in the same area) to keep a detailed photographic record and notes of the excavation and removal. An example of a field record form is given in Appendix 4.

To determine how many individuals are present requires detailed knowledge of human anatomy and experience in working with human remains, particularly where they are fragmented.

Once the koiwi tangata/human remains are fully exposed, the next stage is determination of whether they may be koiwi tangata or the historic burial(s) of non-Maori. This requires a detailed knowledge of the koiwi tangata/human characteristics of Maori and non-Maori.
While it is acknowledged that these are described in publications, the descriptions are of stereotypes and few individuals will conform in all respects to this stereotypical
description. Recognition of the subtleties of variation among Maori remains, as with other populations, requires experience beyond that accessible in any text.

The next issue is whether the burial is pre- or post-European. This often relies upon consideration of the grave style and artefacts as well as the human remains. Prehistoric Maori human remains may have a characteristic pattern of dental pathology, with very worn teeth, 'fern-root' plane wear on the molars, loss of teeth during life and multiple sites of inflammation or infection in the supporting bone of the jaws but this is not a universal pattern and the absence of such a pattern is not indicative of a non-Maori burial. Historic burials are likely to contain metal artefacts that immediately confirm the time period of interment but not the ancestry (Maori or non-Maori) of the individual(s) represented.

Once remains are identified as koiwi tangata, either historic or prehistoric, the local runanga should be offered the option of a bioarchaeological examination of the bones. These remains have lain anonymously since burial and since they are now to be disturbed, the option of 'reading' from the bones should be offered, to allow the person or people represented to tell their story. There is the possibility, where preservation is good, of addressing questions such as "what was this person's life like?"

There are osteologists at both the University of Otago (Bioarchaeology Group) and the University of Auckland (Anthropology Department) who have the expertise and are willing to provide this service for iwi. Consultants may also employ a trained bioarchaeologist.

There are several ways in which this could be approached. These are all dependent on the quality and quantity of preservation of the koiwi remains:

A bioarchaeologist attending the excavation could give a minimal on-the-spot report. This could identify the individual or individuals represented, transforming them from human remains into a person or people. The number of individuals represented, estimates of age at death, sex, and observations on muscularity, body size and height, and any disease present are possible, depending on the state of preservation and the time available.

A second option is for the koiwi to be taken temporarily to a university for analysis. The time period involved would be discussed with the iwi but would normally be very brief, perhaps days or weeks. Both universities have dedicated research laboratories, with strictly controlled access, where the koiwi are treated with the dignity and respect, following appropriate tikanga. There are several levels of analysis that could be performed.

The most basic would be an extension of the individual identification in 1 above. The ability to examine the bones with proper lighting, space to lay them out, and a lack of time pressure would ensure that the findings were more accurate as well as allowing further analysis of the circumstances of the burial. If agreed by the iwi, the bones would

be gently cleaned to enable better observation of details. This option would be purely for observation and completely non-destructive.

The next level of analysis would provide more detailed information through further non-destructive analysis such as detailed analysis of teeth, x-rays of the bones, in particular to confirm diagnosis of any disease but also to identify the characteristics reflecting relationships among individuals. Facilities vary by university but both have extra levels of analysis.

A third level of analysis would provide even more detail about the lives of the individuals by determining characteristics of their diet, whether they had migrated from elsewhere to the region where they were buried. This would involve the removal and destructive analysis of a small sample of bone (less than a 10cm length for all analyses) or individual teeth. These samples could be processed for characteristics of bone chemistry (stable isotopes), DNA or dating. There could be significant expenses involved in this analysis. It may be possible to fund small samples from a grant.

When an iwi chooses to accept analysis of the koiwi, a plain English report would be prepared for presentation to the iwi, both orally and in writing, detailing the findings along with a full technical description for iwi and involved authorities. Further, where an iwi is willing, the specialists involved would keep a copy of the findings to incorporate into work aimed at understanding the lives of prehistoric and historic Maori, based on the stories held in koiwi. Any publication resulting from this work would need to be discussed with the relevant groups. This ultimately could provide Maori with a deeper understanding of the detail of the lives of their tupuna, complementing that provided by oral history and archaeology.

Deliberate excavation of known burials (cemeteries, urupa etc)

New Zealand archaeologists do not deliberately excavate known burials for research purposes only. However, there are occasions when archaeological intervention is required or requested, although this should always be regarded as a last resort and only if other options have been exhausted.

A Disinterment Licence will be required from the Ministry of Health prior to the exhumation of a known burial. The Ministry application guidelines are attached as Appendix 2. Generally, the Ministry will require a written application which outlines the reason for it and the consent of the next of kin as well as a death certificate. In the case of historical burials the Ministry acknowledges that there may be difficulty in tracking down descendants and that the cause of death may not be known. There is a small fee charged for the processing of disinterment licences and generally, if all of the documentation is present, the licence can be processed within three days of submission of the application.

Extensive community consultation may be required prior to the exhumation of known burials. Where a cemetery is involved, it is important to attempt to contact the descendants of those interred in the cemetery to obtain their permission to undertake the

exhumation.

An archaeological authority will be required for the disinterment of any human remains that predate 1900. The application will require an archaeological assessment as well as evidence of consultation with tangata whenua if it is a Maori cemetery or urupa, or with the descendants of the deceased (where they can be identified).

Heritage New Zealand is likely to require the involvement of a biological anthropologist to ensure that standard recording of material *in situ* takes place and that any exhumation is conducted in a manner which meets standard professional criteria.

A final repository for the remains must be identified prior to the commencement of the work.

Repository

Temporary repositories for koiwi tangata/human remains may include museums, churches, mortuaries, marae, pathologists' laboratories, or elsewhere on-site if it is deemed to be secure. Generally, it is considered culturally inappropriate to store koiwi tangata/human remains in vehicles, offices or homes, or any container associated with food. Usually, tangata whenua will expect to be consulted on the location for repository. If in doubt, consult with Heritage New Zealand Maori Heritage Advisers and archaeologists for advice on where best to store the remains. It is essential that Heritage New Zealand staff members involved in this process maintain accurate records (file notes) for the temporary relocation of koiwi tangata/human remains.

Re-interment

The preferred practice for interment of koiwi tangata/human remains is within the original context. However, this is not always possible or appropriate, particularly where the find site is within an area designated for development, that is, rural/residential subdivision, public works, recreational reserves etc.

Re-interment of Koiwi tangata/human remains of Maori origin

The preferred practice for tangata whenua is to re-inter within, or within close proximity to, the original site. If the remains have been uncovered as a result of development works and it is deemed inappropriate to re-inter in the original find site, a gazetted urupa should be considered. If this happens to be an urupa within an archaeological area, an archaeological authority under the HNZPTA may be required. This is at the discretion of Heritage New Zealand Area or Regional Archaeologists. In all cases, appropriate time should be provided to tangata whenua to allow them to fulfil customary practices and protocols.

Re-interment of koiwi tangata/human remains of non-Maori origin

Best practice for the interment of non-Maori human remains is within the original burial site. If this is not a viable option it is recommended that an alternative location is identified in consultation with the descendant group. If there are no known descendants, the remains may be interred within a public cemetery in consultation with the local Public Health Unit.

Cultural considerations

Application and implementation of cultural safety in practice requires the recognition and respect of cultural beliefs and practices common to a particular group of people. In the context of these guidelines, this includes but is not restricted to ethnic, social, religious/ spiritual and gender groups in New Zealand.

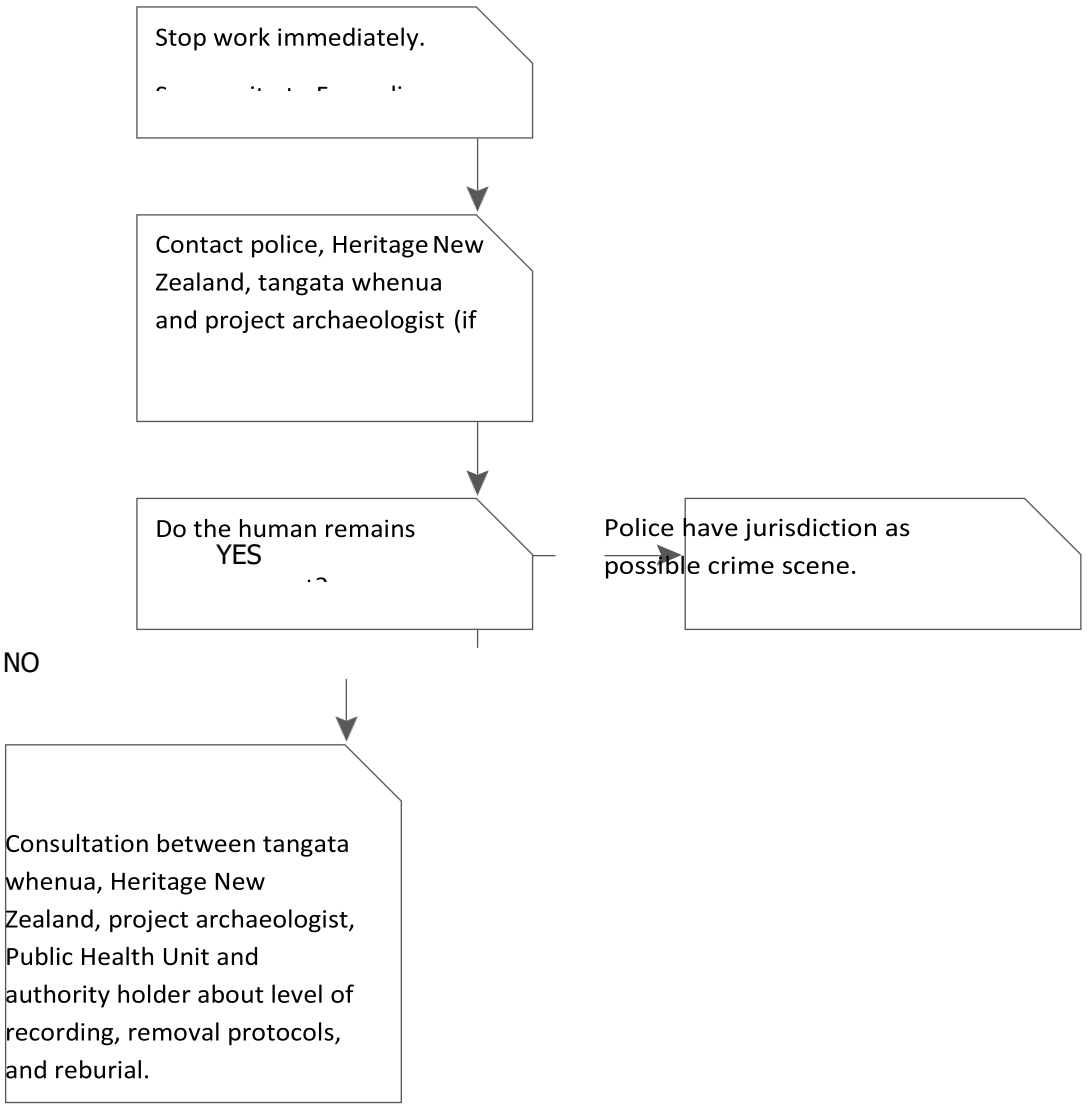
Unsafe practice is that which consists of any action that detracts from, or undermines, the cultural integrity of any individual or group associated with the koiwi tangata/human remains. All cultures disapprove of people intentionally digging up human remains for non-legitimate purposes.

Tikanga Maori should be observed in all cases of koiwi tangata/human remains discoveries of Maori origin. This will require that tangata whenua are advised and actively involved in managing finds in the first instance. These guidelines recognise that tangata whenua have separate protocols for the care and management of koiwi tangata/human remains, and therefore it is up to tangata whenua to advise on appropriate conduct for assessing, exhuming and storing the remains. To assist in this process, interested parties involved in discoveries should allow for:

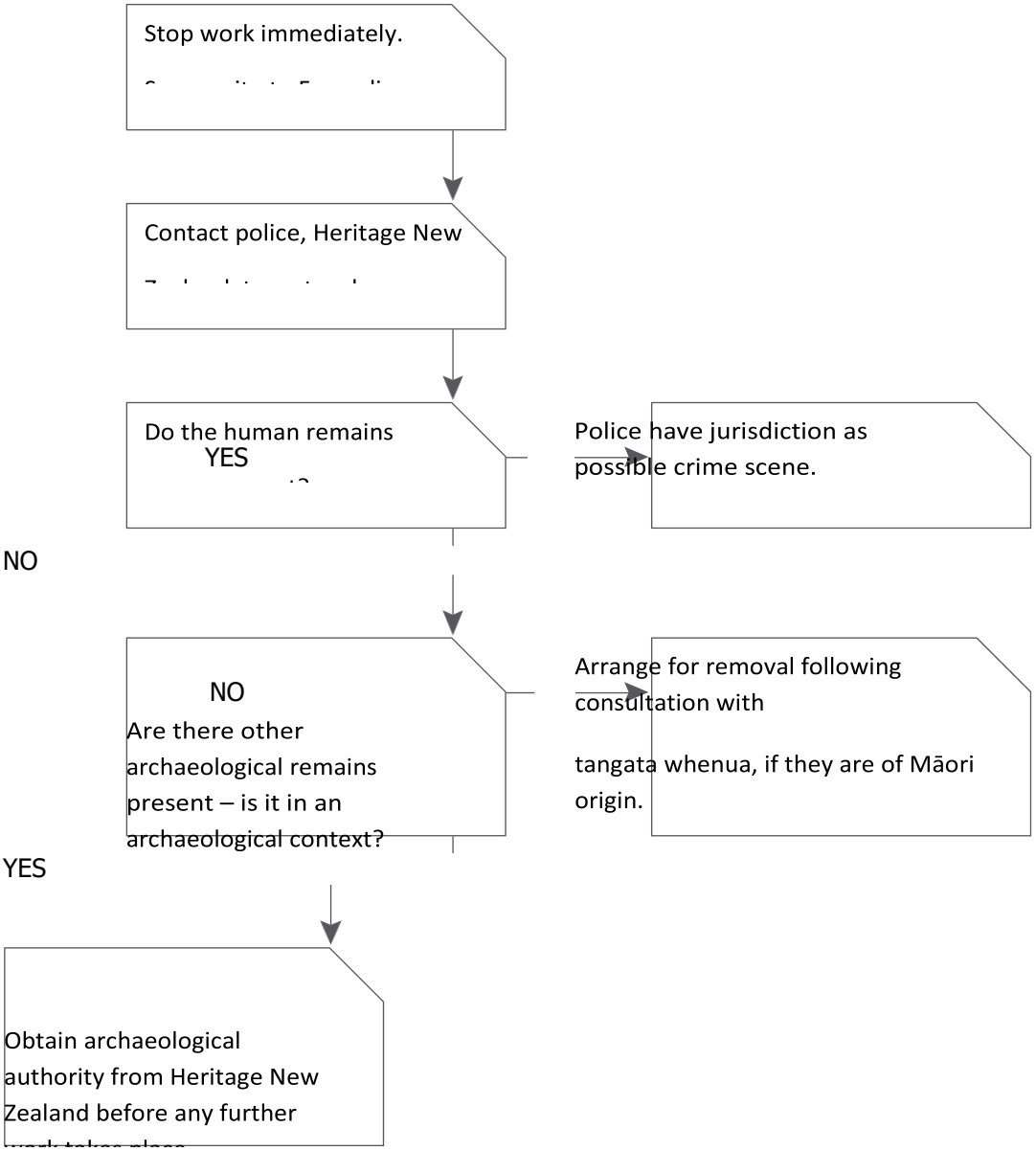
- Sufficient time to be provided for karakia (prayer) and tauparapara (incantations).
- Refraining from eating and carrying food and drink within proximity to works or activities associated with the remains.
- Use of appropriate tools for exhuming remains, that is, not home gardening implements.
- Use of appropriate containers and receptacles, that is, nothing currently or previously used for containing food.
- Provision for a designated repository or an agreed storage facility, that is, not residences or places of work.
- Provision of water on-site for cleansing/tapu removal.

Best practice is to consult with tangata whenua as soon as practicable to ascertain the nature of the cultural safety protocols to be observed as part of the discovery process.

ACCIDENTAL DISCOVERY WHERE ARCHAEOLOGICAL AUTHORITY HAS BEEN GRANTED


Stop work immediately.
Contact police, Heritage New Zealand, tangata whenua and project archaeologist (if
Do the human remains
YES
Police have jurisdiction as possible crime scene.
NO
Consultation between tangata whenua, Heritage New Zealand, project archaeologist, Public Health Unit and authority holder about level of recording, removal protocols, and reburial.

ACCIDENTAL DISCOVERY WHERE NO ARCHAEOLOGICAL AUTHORITY HAS BEEN GRANTED



Glossary

Archaeological authority – authorisation required under the *Heritage New Zealand Pouhere Taonga Act* 2014 prior to the modificatione or destruction of an archaeological site.

Artefact – an object made or modified by humans.

Burial and grave – the term 'grave' relates to the hole dug in the ground for a body or coffin. The term 'burial' relates to the body and/or coffin placed in a grave.

Burial sites – include any natural or physically prepared location (below or above ground) in which koiwi tangata/human remains have been interred. This can include, but is not restricted to, the following: conventional graves, caves, rock overhangs, tree hollows, midden. There is an important distinction that is made between 'cemetery' and 'burial ground', both of which can apply to formal burial sites. A 'cemetery' is for the burial of the dead generally and they are usually managed by TLAs. There are some old private cemeteries that were established prior to the *Burial and Cremation Act* 1964. A 'burial ground' is a burial place for members of a specified denomination, and they are generally called denominational burial grounds and administered by a church or religious group.

Cultural items – as for artefacts.

Disinterment – the removal of human remains from their place of burial. In the New Zealand context exhumation requires a disinterment licence. Also referred to as exhumation.

Excavation – refers to the removal of cultural material or human remains using archaeological techniques and undertaken by professional archaeologists. Excavation in New Zealand requires an archaeological authority from Heritage New Zealand.

Flexed burial – positioned with knees drawn up to the chest, often lying on one side. Also known as "crouched" burials.

Human remains – refers to bones, teeth, skin, muscle, cartilage, tendons, ligaments, organs, hair and nails. Cremated remains, embalmed remains and mummified remains are also human remains.

In situ – literally 'in place'. In the context of these guidelines *in situ* refers to the exact place the remains were found.

Koiwi tangata – human remains of Maori origin.

Prone burial – lying in an extended position, face down.

Reinterment – reburial.

Repatriation – the return of human remains, generally speaking from overseas, to a descendent group. This situation arises when human remains have been held in museum or other collections and/or have undergone scientific study.

Secondary burial – a burial where the bones are disarticulated, having been left exposed for the flesh to decay or previously buried elsewhere. In some cases the skull may be absent.

Supine burial – lying in an extended position, face up.

Tangata whenua – local tribal group.

Taonga – artefacts of Maori origin.

Taonga tuturu – is defined in the *Protected Objects Act* 1975 as an object that:

Relates to Maori culture, history or society; and

Was, or appears to have been:

manufactured or modified in New Zealand by Maori;

brought into New Zealand by Maori; or

used by Maori; and

Is more than 50 years old.

Tapu – sacred.

Tikanga – customs, traditions.

Urupa – Maori burial ground.

Wahi tapu – a place sacred to Maori in the traditional, spiritual, religious, ritual or mythological sense.

Appendix 1 – Contacts

Heritage New Zealand contacts

Northland Area Office
(Northland) PO Box 836
KERIKERI 0245
tel: (09) 407 0470
fax: (09) 407 3454

Northern Regional Office
(Auckland, Hauraki Thames, Coromandel) PO Box 105-291
AUCKLAND 1143
tel: (09) 307 9920
fax: (09) 303 4428

Lower Northern Area Office
(Bay of Plenty, Waikato, Gisborne) PO Box 13339
TAURANGA 3141
tel: (07) 577 4530
fax: (07) 578 1141

Central Regional Office
(lower North Island, Nelson/Tasman, Marlborough)
PO Box 19173
WELLINGTON 6149
tel: (04) 494 8320
fax: (04) 802 5180

Southern Regional Office (West Coast, Canterbury) PO Box 4403
CHRISTCHURCH 8140
tel: (03) 357 9629
fax: (03) 374 2433

Dunedin Area Office (Otago/Southland) PO Box 5467
DUNEDIN 9058
tel: (03) 477 9850
fax: (03) 477 3893

Public Health Unit contacts

Northland District Health Board
PO Box 742
WHANGAREI 0140
tel: (09) 430 4100
026 366 1725 (after hours)
fax: (09) 430 4124

Auckland Regional Public Health Service (South Auckland, Central Auckland and North/West Auckland districts)
Private Bag 92605, Symonds Street,
AUCKLAND 1150
tel: (09) 262 1855
(09) 623 4600 (after hours) fax: (09) 630 7431

Health Waikato
(Waikato and northern parts of Ruapehu) PO Box 505
Waikato Mail Centre HAMILTON 3240
tel: (07) 838 2569
021 999 521 (after hours)
fax: (07) 838 2382

Toi Te Ora Public Health (Whakatane) PO Box 241
WHAKATANE 3158
tel: (07) 306 0847
026 111 980 (after hours)
fax: (04) (07) 306 0987

Public Health Unit contacts (continued)

Toi Te Ora Public Health (Tauranga)
PO Box 2121, TAURANGA tel: (07) 571 8975
026 111 980 (after hours)
fax: (07) 578 5485

Toi Te Ora Public Health (Rotorua)
PO Box 1858, ROTORUA 3040
tel: (07) 349 3520
(07) 349 3522 (after hours) fax: (07) 346 0105

Tairawhiti District Health Board
(Hawke's Bay and Chatham Islands)
PO Box 447, NAPIER 4140
tel: (06) 834 1815
(06) 878 8109 (after hours) fax: (06) 878 8109

Taranaki District Health
Private Bag 2016, New Plymouth Central NEW PLYMOUTH 4342

tel: (06) 753 7798
fax: (06) 753 7788

Hawke's Bay District Health Board
(Hawke's Bay and Chatham Islands)
PO Box 447, NAPIER 4140
tel: (06) 834 1815
fax: (06) 878 8109

MidCentral District Health Board
(Palmerston North)
(Manawatu, Whanganui and southern part of Ruapehu)
PO Box 2056, Palmerston North Central PALMERSTON NORTH 4440
tel: (06) 350 9110
(06) 350 9110 (after hours) fax: (06) 350 9111

MidCentral District Health Board
(Whanganui)
(Manawatu, Wanganui and southern part of Ruapehu)
Private Bag 3003, Wanganui Mail Centre WANGANUI 4540
tel: (06) 348 1775
(06) 348 1234 (after hours) fax: (06) 348 1783

Hutt Valley District Health Board
(Lower Hutt)
(Wellington, Hutt and Wairarapa) Private Bag 31907, LOWER HUTT 5040
tel: (04) 570 9002
(04) 570 9007 (after hours) fax: (04) 570 9211

Hutt Valley District Health Board
(Masterton)
(Wellington, Hutt and Wairarapa) Private Box 58, MASTERTON 5840
tel: (06) 370 5020
(06) 946 9800 (after hours) fax: (06) 370 5029

Nelson Marlborough District Health Board (Nelson)
PO Box 647, NELSON 7040
tel: (03) 546 1537
(03 546 1800 (after hours)
fax: (03) 546 1542

Nelson Marlborough District Health Board (Blenheim)
PO Box 46, BLENHEIM 7240
tel: (03) 520 9914
(03) 520 9999 (after hours) fax: (03) 578 9517

Public Health Unit contacts (continued)

Community and Public Health
(Christchurch)
(Canterbury, South Coast and West Coast) PO Box 1475, Christchurch Mail Centre CHRISTCHURCH 8140
tel: (03) 364 1777
026 367 4231 (after hours)
fax:(03) 379 6125

Community and Public Health (Timaru) (Canterbury, South Coast and West Coast)
Private Box 510, TIMARU 7940
tel: (03) 688 6019
0274 975 249 (after hours)
fax:(03) 688 6091

Community and Public Health
(Greymouth)
(Canterbury, South Coast and West Coast)
PO Box 443, GREYMOUTH 7840
tel: (03) 768 1160
(03) 768 0499 (after hours) fax:(03) 768 1169

Public Health South (Dunedin) (Otago and Southland)
PO Box 5144, Moray Place DUNEDIN 9058
tel: (03) 474 1700
(03) 474 0999 (after hours) fax:(03) 474 0221

Public Health South (Invercargill) (Otago and Southland)
PO Box 1601, INVERCARGILL 9840
tel: (03) 211 0900
(03) 211 0900 (after hours) fax:(03) 211 0899

Public Health South (Queenstown) (Otago and Southland)
PO Box 2180, Wakatipu QUEENSTOWN 9349
tel: (03) 442 2500
fax:(03) 442 2505

New Zealand Police contacts

Notifications of koiwi tangata/human remains are responded to by different units depending on the location of the find. Calls should be made to the local police station with a request to be put through to the nearest Comms Centre. The staff there will ensure that the notification is responded to by the correct personnel.

Contact numbers for all police stations can be found on the New Zealand Police website:
http://www.police.govt.nz/district/phonebook.html

Bioarchaeologist contacts

University of Otago
Department of Anatomy and Structural Biology
PO Box 913
DUNEDIN 9054

Dr Nancy Tayles tel: (03) 479 7372
email: nancy.tayles@otago.ac.nz

Dr Hallie Buckley tel: (03) 479 5775
email: hallie.buckley@otago.ac.nz

Dr Sian Halcrow tel: (03) 479 5265
email: sian.halcrow@otago.ac.nz

University of Auckland Department of Anthropology Private Bag 92019
Auckland Mail Centre AUCKLAND 1142

Dr Judith Littleton tel: (09) 373 7599
email: j.littleton@auckland.ac.nz

Consultant (bio)archaeologists

Beatrice Hudson
CFG Heritage Limited
PO Box 10015
Dominion Road AUCKLAND 1024
tel: (09) 309 3436
email: beatrice.h@cfg.heritage.com

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Appendix 2– disinterment application guidelines

GUIDELINES FOR DISINTERMENT LICENCE APPLICATIONS

Introduction

The Minister of Health's powers to issue disinterment licences under section 51, *Burial and Cremation Act* 1964 ("the Act") have been delegated to the Group Manager, Population Health Protection. Section 51 of the Act provides that:
It shall not be lawful to remove from its burial place any body, or the remains of any body, buried in any cemetery, Maori burial ground, or other burial ground, or place of burial, without licence under the hand of the Minister and except in accordance with such conditions as he may prescribe.

Because the Act does not specify an administrative procedure for making an application and for the issue of a licence for disinterment, the Ministry of Health ("the Ministry") has developed the following guidelines to assist in assessing applications consistently and transparently.

Applications for disinterment licences

An application form for the applicants to complete when applying for a licence for disinterment is attached as Appendix 1 to these guidelines. Applications must be in writing and are usually made by:

- person(s) related to the deceased
- the executor of the will of the deceased
- a funeral director acting on behalf of either of the above
- an iwi/Maori authority acting on behalf of the close relatives, or
- a person acting for the family.

Applications should be submitted to the applicant's local District Health Board ("DHB") Public Health Unit addressed to the Health Protection Officer, who will assess the application and forward it, together with a report and recommendations, to the Group Manager, Population Health Protection, Ministry of Health, PO Box 5013, Wellington. If the proposed disinterment is urgent, details of the disinterment may be e-mailed or faxed to the applicant's local DHB Public Health Unit.

The fee (see clause 3.5) and all supporting papers (see clauses 3.1 to 3.4) must accompany the application.

Please note that it is not usual to issue licences between one month and one year after burial because of decomposition during this period. If a body has been embalmed,

this limitation may not apply, depending on the drainage of the site, likely state of the casket and recommendation of the Health Protection Officer. Applications to disinter within one month of interment may be deferred if the deceased died of an infectious disease.

A licence is normally issued three working days after receipt by the Ministry of a complete application. Unless otherwise indicated, the licence is issued to the applicant and copied to the local DHB Public Health Unit Health Protection Officer who reported on the application.

These guidelines are to assist the Ministry, Health Protection Officers and applicants. Application of the guidelines may depend on the circumstances of an individual application.

Disinterment application requirements

Assessment of the application by a Health Protection Officer: The Health Protection Officer will assess the submitted documentation to ensure that it is complete, review the application and prepare a report for the Ministry.

Next of kin of the deceased: Before a disinterment licence is issued, the wishes of all next of kin (for example, spouse, parent(s)' children, sibling(s), guardian(s)) must be confirmed in writing. Each family or whanau member is required to:

- ► indicate their consent (or otherwise), and
- ► note their respective relationship with the deceased.

Any given authority for a person to speak for other next of kin must be specified in writing and signed by the person giving the authority.

The Ministry usually only approves applications for disinterment licences where there is absolute agreement among next of kin. Where there is no absolute agreement, the Ministry will not act as a negotiator.

For Pacific families, an elder may have authority to speak on behalf of the deceased, even though the elder may not be a close relative of the deceased. A representative nominated in writing by the extended family is acceptable.

Reason for the disinterment: The application must state the reason for the disinterment. Examples of reasons may include cultural reasons, burial in the wrong plot, relatives who have moved to another area, or mental anguish. Each reason will be assessed on its own merits. Frivolous reasons will not be accepted.

Cause of death: The original certificate of death or a certified copy (for example, countersigned as a true and accurate copy by a Justice of the Peace or a Health Protection Officer) is required with each application, so that the cause of death and other details can be confirmed to assist with determining the licence application.

In cases where a death certificate cannot be obtained in time to submit with the

application (for example, the certificate has not yet been issued), the Ministry will accept a statement from the cemetery or burial ground authority identifying where the deceased is buried and a statement describing the cause of death.

Licence fee: A $90.00 fee (including GST) is payable to the Ministry for each licence applied for. Usually one licence is required for each body that is to be disinterred, although exceptions would include a common grave. The fee may be waived where special reasons make it appropriate to do so (for example, compassionate or hardship grounds). Any request for a waiver should be supported by documentary evidence of hardship or alternative justification.

Application to be made under oath: The licence application must include a sworn statement from the applicant that the information contained within it is true and correct, and be witnessed by a Justice of the Peace, serving Police Officer or Court official. An example of a statutory declaration is attached as Appendix 2 to these guidelines.

Supervision of Disinterments

Disinterment occurs whenever a casket (or body) is uncovered, even if only partially uncovered. A Health Protection Officer must supervise the disinterment unless that requirement is specifically waived in the issued licence. Supervision of the disinterment by a Health Protection Officer is to ensure that the disinterment is carried out with due respect to the deceased and in a sanitary manner so as to prevent any public health risk arising or any offence being created to the body and any family/next of kin that may be present. The licence will be copied to the Health Protection Officer to whom the application was first lodged.

The person(s) undertaking the disinterment are responsible for ensuring that the disinterment is legally, safely and properly carried out, with decency and due respect to the deceased and adjacent burial sites.

The Department of Labour has published an 'Approved Code of Practice for Safety in Excavations and Shafts for Foundations' and, in particular, the following extract is relevant:

Excavation requirements

Excavations shallower than 1.5m: Excavations shallower than 1.5m have been known to collapse. If an employee is in the trench and bending over at the time of the collapse, he or she may suffer serious injury. Employers are to consider such excavations and determine if special precautions or work methods are necessary.

Excavations 1.5m or deeper: Excavations greater than or equal to 1.5m deep are particularly hazardous and must be shored unless:

The face is cut back to a safe slope and the material in the face will remain stable under all anticipated conditions of work and weather, or

Shoring is impracticable or unreasonable, and safety precautions certified by a registered engineer to be adequate have been taken.

Such work is also notifiable under Regulation 26 of the Health and Safety in Employment Regulations 1995. The Department of Labour has published the notification form required and a list of what is notifiable (refer www.osh.dol.govt.nz/order/catalogue/pdf/form-hazwk.doc).

Registrar to be notified when body removed or disposed of

Where the body is not returned to the same plot, the licence holder must give full details as to where and how the body was disposed of to the Registrar for Births, Deaths, and Marriages at the Department of Internal Affairs (as required by section 51 of the Births, Deaths, Marriages and Relationships Registration Act 1995).

Addendum

Subsequent to the completion of these guidelines, Heritage New Zealand has received further advice from the Ministry of Health on the requirements for obtaining a disinterment licence:

There have, over the years, been a number of applications for disinterments following the accidental discoveries of human remains.

The Ministry of Health have reviewed the application of section 51 of the *Burial and Cremation Act* 1964, particularly as it applies to accidental discovery and uncovering of human remains during archaeological or road site excavations.

The Ministry has now determined that where body or body parts are discovered on a site that is not a burial site, for example, part of an archaeological dig, road works etc, or if the police are searching for a body that is not in a recognised burial site, a disinterment licence is not required.

The practical effect of this is that the Ministry does not require a person to obtain a disinterment license under section 51 of the *Burial and Cremation Act* 1964 unless removal of the body is from a cemetery, urupa, denominational burial ground, private burial ground, burial in a special place, or any burial site that is formally known to be such (for example, burial in a special place, historical burial ground, executed prisoners in prison yards). The person may still be subject to other legal obligations, for example, from the land owner, police, council, Heritage New Zealand or other authorities.

Disinterment licences would not be required where an excavation may inadvertently uncover remains (for example, archaeological dig, roading or building excavations), or, as another example, where the Police may be searching for homicide victims that may have been allegedly buried by the offender.

The Ministry suggests that it would be good practice when human remains are discovered for Heritage New Zealand or an archaeologist to contact the local Public Health Unit to let them know what is happening.

Appendix 3 – An example of a field recording sheet for human remains

ID:	Provenance:	Excavator:	Date:

Burial type (circle):

In grave cut	In other feature (#)	No cut visible
Articulated	Partially articulated	Disarticulated
Notes:		
Bone Condition: Good Fragile Fragmented Burnt Other/describe:		

Position (circle):

Extended	Flexed	Crouched	
Prone	Supine	Right side	Left side
Bundled	Dispersed		
Position sketch and notes (note joints flexed/extended, indicate which parts are articulated, additional loose bone, artefacts):			

Accompanying artefacts:

Notes re grave/feature containing remains (size, shape, fill, relationships):

Long bone measurements (mm)

Femur	L	R	Humerus	L	R
Tibia	L	R	Radius	L	R
Fibula	L	R	Ulna	L	R
Femoral head diameter	L	R			

Position notes (flexed/extended etc)

Shoulder	L	R	Elbow	L	R
Wrist	L	R	Hand/fingers	L	R
Hip	L	R	Knee	L	R
Ankle	L	R	Foot/toes	L	R
Neck:		Torso:		Head/face orientation:	

Sex estimate:

Pelvis

Sciatic notch score	L	R	Subpubic concavity	L	R
Pubis shape			Ventral arc		
Medial I-P ramus			Pre-aur. Sulcus/ dorsal pubis pitting		
Sacrum shape:			Other notes:		

Cranium

Mastoid process	L	R	Supra orbital margin	L	R
Mental eminence					
Nuchal crest:			S.O ridge/ glabella		

Age estimate (adult – for immature remains see extra sheet):

Medial clavicle	L	R	Iliac spine	L	R
Annular rings C/ Th/L			Spheno-occipital		
Auricular surface	L	R	Pubic symph (S/B)	L	R

Notes (eg. cranial shape see NMT sheet; pathology):

Assessment of Ancestry Observer

Characteristic	Polynesian	West European
Back of skull	Pentagonal	Rounded
Cranial form	High rounded, angular	Medium
Cranial base	Flat	Angled
Malar form	Visible from superior view	Not visible from superior view
Temporals	Straight	Rounded
Cheekform	Malars turn back at right-angles to face	Rhomboid
Orbital form	Rhomboid	Narrow
Nasal breadth	Medium	Sharp
Nasal sill	Dull/absent to rounded	Moderate
Nasal profile	Concave/concavo/ convex	Parabolic
Face protrusion	Flat	Oblique-square
Palate form	Hyperbolic	Medium
Mandibular angle	Square	Reduced
Rocker jaw	Rocker, robust	Bilateral form, prominent projection
	Long continuous curve (rocker form), robust	Oriented backwards
Incisors	Tall, broad	Blade, shoveling rare
Femoral torsion	Median projection, Submental arch	<c15 degrees
Tibia	Oriented upwards or forwards	No squatting facets*
Fovea	Blade, some shoveling (c75%)	Circular
Tibia	>25 degrees	Angled
Shafts of long bones	Squatting facets	Straight
Clavicle	Oval	uncommon
	Development of deltoid	

Comments/additional NM traits:

Appendix 4 – International precedents

Many countries have policies and guidelines for the appropriate treatment of human remains. Of most relevance to the New Zealand situation are those countries with indigenous peoples whose ancestors are those most likely to be discovered. No matter the part of the world or whoever the remains may be, the primary principle involved in the treatment of remains is to handle them with respect.

United States

Burials and human remains are protected under legislation at both federal and state levels in the United States.

The *National Historic Preservation Act* 1966 (NHPA) established the National Register of Historic Places and also requires that any Federal project must identify and carry out an assessment of effects on archaeological sites.

The *Archaeological and Historic Preservation Act* 1974 (AHPA) authorises all federal agencies "to fund archaeological investigations, reports, and other kinds of activities to mitigate the impacts of their projects on important archaeological sites" (McManamon 2000a). It authorises the Secretary of the Interior "upon notification that significant historical or archaeological data may be irrevocably lost or destroyed to undertake necessary studies independent of, although with some consultation with, the federal agency responsible for undertaking, funding, or licensing the project" (McManamon 2000a).

The *Archaeological Resources Protection Act* 1979 (ARPA) protects archaeological sites on public and Indian lands. The "main focus of ARPA is on regulation of legitimate archaeological investigation on public lands and the enforcement of penalties against those who loot or vandalise archaeological resources" (McManamon 2000b). It also legislates for federal land managers to establish public awareness programmes as well as undertaking archaeological surveys of federal land.

The *Native American Graves Protection and Repatriation Act* 1990 (NAGPRA) "describes the rights of Native American lineal descendants, Indian tribes and Native Hawaiian organisations with respect to the treatment, repatriation, and disposition of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony … with which they can show a relationship of lineal descent or cultural affiliation" (McManamon 2000c). It is also intended to provide greater protection to Native American burial sites and "more careful control over the removal of Native American human remains, funerary objects, sacred objects, and items of cultural patrimony on federal and tribal lands" (McManamon 2000c) by requiring consultation with Indian tribes or Native Hawaiian organisations prior to any archaeological investigation or following the accidental discovery on federal or tribal land.

Each state also has specific legislation protecting archaeological sites and burials. In Indiana, for example, it is illegal to disturb archaeological sites containing artefacts dating before 11 December 1816, or human remains dating on or before 31 December 1939, without a permit from the Indiana Department of Natural Resources (Indiana Archaeology Law Question and Answer Sheet).

The State of Hawaii's Administrative Rules contain a chapter entitled Rules of Practice and Procedure Relating to *Burial Sites and Human Remains*[2] which:

… governs practice and procedure relating to the proper care and protection of burial sites found in the state before the island burial councils and the department of land and natural resources … The legislature finds that Native Hawaiian burial sites are especially vulnerable and often not afforded the protection of law which assures dignity and freedom from unnecessary disturbance (e.g. Honakahua). In order to avoid future disputes arising from the discovery of human skeletal remains fifty years or older, sections [of Hawaii Revised Statutes] were amended or enacted in part to provide additional protection for Native Hawaiian burial sites of high preservation value such as areas with a concentration of koiwi tangata/human remains, or prehistoric or historic burials associated with important individuals or events, that are within a context of historic properties, or have known lineal descendants. The photographing of human skeletal remains reasonably believed to be Native Hawaiian may take place only after consultation with known lineal descendants and the appropriate council.

These Rules provide for the establishment of Island Burial Councils for each of the Hawaiian Islands which comprise representatives from each geographic region as well as development and large property owner representatives. The responsibility of the councils is to: determine preservation or relocation of previously identified Native Hawaiian burial sites; assist the Department of Land and Natural Resources in the inventory and identification of Native Hawaiian burial sites by providing information obtained from families and other sources; make recommendations to the department about the
management, treatment and protection of Native Hawaiian burial sites; maintain a list of appropriate Hawaiian organisations, agencies and offices to notify regarding the discovery of Native Hawaiian koiwi tangata/human remains, any burial goods and burial sites; deem department records relating to the location and description of Native Hawaiian burial sites sensitive; and to decide whether to recognise claimants as lineal or cultural descendants.

The Rules are highly prescriptive for all aspects of procedures following discovery, including identification of ethnicity, the levels of recording, removal, storage, and reburial or repatriation of human remains. Penalties for unlawfully damaging a burial site include a maximum fine of $10,000 USD for each separate offence, a fine equivalent to the value of the lost or damaged site, seizure and disposition by the State of all equipment used in the damage to the site as well as the vehicle used to transport the offender to and from the site. Additionally, each day in breach of the law constitutes a separate offence.

2 An electronic version of this chapter can be obtained from the website of the Department of Land and Natural Resources State of Hawaii State Historic Preservation Division, www.hawaii.gov/dlnr/hpd/pdfs/barrules.PDF

Australia

Like the US, Australia has both federal and state heritage legislation. The general state legislation, such as the Victorian *Heritage Act* 1995, protects all non-Aboriginal archaeological sites while separate legislation and administrative bodies are responsible for the protection of any Aboriginal sites (Aboriginal Affairs Victoria and the *Aboriginal Heritage Act* 2006). In New South Wales it is the *National Parks and Wildlife Act* 1974 that protects Aboriginal objects and places in the state, while in Queensland the *Aboriginal Cultural Heritage Act* 2003 and the *Torres Strait Islander Cultural Heritage Act* 2003 protect sites of Aboriginal or Torres Strait Islander origin.

The Queensland Department of Natural Resources and Mines has prepared comprehensive guidelines about what to do following the discovery of Aboriginal and Torres Strait Islander human remains. As in New Zealand, the police must be contacted on the discovery of human remains to determine whether a crime may have been committed. Once the police are satisfied on this matter, they contact the Cultural Heritage Coordination Unit of the Department of Natural Resources and Mines who take responsibility for liaising with the appropriate Aboriginal or Torres Strait Islander community to arrange for reburial. Under Queensland legislation Aboriginal or Torres Strait Islander people who have a traditional or familial link with Aboriginal human remains are considered to be the owners of those remains. It is also a requirement that anybody who knows about the location of possible Aboriginal or Torres Strait Islander human remains must notify the Department as soon as practicable following notification to the police. Failure to do so constitutes an offence.

A comprehensive guideline on koiwi tangata/human remains has also been prepared by the New South Wales Heritage Office. If the remains appear to be recent and may be forensic the police must be contacted. If the remains are Aboriginal in origin and are not recent, the *National Parks and Wildlife Act* 1974 applies, while the *Heritage Act* 1977 applies to any non-Aboriginal remains that are more than 50 years old. Both of these latter acts require an excavation permit for the removal of the remains to occur. The *Public Health Act* 1991 and the Public Health Regulation 1991 apply where a member of the public wishes to have a relative exhumed and relocated. Where a burial is over 50 years old both the *Heritage Act* 1977 and the *Public Health Act* 1991 apply (NSW Heritage Office 1998).

United Kingdom and Ireland

The rights and role of indigenous people is not a factor when dealing with archaeological human remains in the United Kingdom. There is a long history of study of koiwi tangata/ human remains and detailed guidelines have been prepared for the recording of material recovered during excavation. There are, however, still statutory requirements that must be fulfilled on the discovery of human remains.

In England, the police must be notified following the discovery of previously unknown human remains. If they are found to be archaeological and removing them is desirable, a coroner's licence is required from the Home Office before they can be legally removed.

Development of disused burial grounds in England requires removal of all burials as well as notification to the general public and any known relatives. If it has been bought by compulsory purchase the Towns and Country Planning Regulations apply. If the land is consecrated the Church of England has jurisdiction and an application for the granting of a faculty is required from the Church to allow the disturbance of human remains. If the land is a recognised burial ground and unconsecrated and the proposed work is not related to the extension of a church or as the result of non-building related work, the *Disused Burial Grounds Act* 1981 applies and direction from the Home Office needs to be sought (Ossa Freelance 2004).

In Ireland an excavation licence is required under the *National Monuments Act* 1930 to "dig or excavate in any land … for the purpose of searching generally for archaeological objects or of searching for, exposing or examining any particular structure or thing of archaeological interest" (O'Sullivan and Killgore 2003). In situations where human remains are encountered, the coroner has initial legal possession of the remains until they are established as archaeological. Additionally, disinterment from a burial ground requires an exhumation licence from the local authority under the *Local Government (Sanitary Services Act)* 1948. An exception to the requirement for an excavation licence exists where "the finder of an archaeological object 'has reasonable cause to believe that it is necessary to remove it so as to preserve it or keep it safe' (e.g. a skeleton eroding out of a beach dune). In cases like this the finder can remove the remains to any safe place with[in] (sic) 30 miles of discovery but must contact the Director of the National Museum within 96 hours" (O'Sullivan and Killgore 2003).

The situation in Scotland is less clear. Notification to the police following the discovery of human remains is required, as elsewhere. However, the 'right of sepulchre' is strongly protected under Scottish law and under civil law disinterment of human remains may
constitute an offence, particularly where living relatives, an interested party (for example, a landowner), or the Court (acting on the deceased's behalf) might object (Historic Scotland 1997: 22). It would appear that currently "archaeologists, while they have the legal right to investigate sites of archaeological interest, do not have any legal right to examine human remains" (Historic Scotland 1997: 8). One example of this situation is a case where the Court was petitioned by Historic Scotland to disinter bodies at Whithorn Priory so that repairs could be carried out on adjacent buildings. The petition was turned down because of local objections (Historic Scotland 1997: 8). Public opinion is therefore highly influential in determining the right to study archaeological human remains.

Week 11

Context

Goal:

The aim of this lab is start you thinking about the whole process of recording human remains from an archaeological site and to think about the interpretation of taphonomic influences.

Essential Background Reading:

There is a bit more reading this week but some of it you are familiar with from Lecture 3. It is at the end of this chapter.

Duday, H., Le Mort, F., & Tillier, A. M. (2014). Archaeothanatology and funeral archaeology. Application to the study of primary single burials. *Anthropologie (1962-)*, *52*(3), 235-246.

Ubelaker, D. H., & Buikstra, J. E. (1994). Standards for data collection from human skeletal remains. *Arkansas Archaeological Survey Research*, *44*, 206. Chapter 5.

Task:

Work in groups. We have given you images and information from a series of burials we have encountered at different time. Your job is to record one of these burials in detail and on the basis of that recording to identify the original position of the body, the mortuary practices involved in the burial, any taphonomic processes that have occurred. We want you to work in teams of three to four. You have 45 minutes to record the burial as fully as possible and then we will all move around the room as you each explain in terms what you have identified.

Things to think about:

Inventory
Evidence of a container
Evidence of the pace of filling (empty space versus infilled)
Evidence of wrapping
Evidence of post-mortem disturbance
Degree of articulation

Etc etc.

CHAPTER9

POSTMORTEM CHANGES: HUMAN TAPHONOMY

A variety of perimortem events and postmortem processes can be inferred through the study of bone color, surface details, and shape. Cremation, scalping, and the creation of amulets from ancestral remains are but a few examples of the many cultural behaviors that are reflected in ancient skeletal samples. Chemical, biological, and physical aspects of the depositional environment also leave diagnostic signatures on archaeologically

recovered bone. Among the most common of these agents are erosive soil conditions and rodent or carnivore gnawing. Such changes may reveal important information concerning perimortem events and mortuary rituals. Corpses exposed on or above the ground prior to burial may, for example, show evidence of carnivore or insect activity, as well as bone color and texture changes.

It is sometimes difficult to distinguish postmortem changes from those that occurred before death. Oval depressions that result from insect activity and soil acidity have frequently been confused with the effects of diseases that cause abnormal bone resorption. Studies of ancient disease must therefore begin by eliminating postdepositional "pseudopathologies" from the diagnostic process.

Systematic observations of bone condition also serve as today's baseline against which future examinations can evaluate the long-term efficacy of alternative preservation strategies. Evaluations of bone condition are also useful in assessing the impact of various depositional environments upon osseous tissues.

In subsequent sections we discuss a variety of ways in which bone may be altered following death, with emphasis upon the changes most commonly observed in North American materials. Our initial presentation describes typical changes in color, surface texture, and shape, and links these altered states with specific causal factors such as heat, exposure to sunlight, and gnawing by animals. The data collection protocol emphasizes observations that reflect culturally significant behaviors.

This approach borrows many concepts from the subdiscipline of taphonomy (Efremov 1940), which is defined as the investigation of processes that affect an organism from its death until the point at which study commences (Behrensmeyer and Hill 1980; Gifford 1981; White and Folkens 1991). Although taphonomy is normally considered a subfield of paleontology, its principles are clearly relevant to a chaeological investigations of human remains (Turner and Morris 1970; Turner 1983; Turner and Turner 1990, 1992).

TYPES OF ALTERATION

Fresh, untreated bone has an ivory color. A variety of agents, including grave inclusions, mortuary rituals, and depositional environments may cause discoloration. Exposure to heat, whether accidental or as part of an interment procedure, causes systematic color changes that provide information about the heat source and its intensity. Temperature can be estimated from the fact that bone burned at relatively low temperatures assumes a brown or black ("smoked') quality, while at higher temperatures bone becomes blue-gray or white. The brown/black coloration may occur at temperatures as low as 200-300 degrees centigrade. At 800 degrees centigrade, "calcined" white to blue-gray coloration appears (Buikstra and Swegle 1989; Shipman et al. 1984; Van Yark 1980).

Patterning of heat-induced color changes may also provide information about condition of cadavers at the time of burning. Joint surfaces and bones located within thick soft tissues will be shielded from the effects of fire when bodies are burned in an articulated, fleshed state. These "shielded" surfaces will show a less severe degree of burning than unshielded portions of the skeleton. Disarticulated or defleshed elements will present a more uniform burning pattern (Buikstra and Swegle 1989). Examples of bone burned under varying conditions are presented in Figure 66.

Metal objects interred with remains can cause bone stains. Most common in North American materials is a green discoloration due to contact with copper.

Bone often changes color in response to the presence of bacteria, plants, and soil minerals that are present in the depositional environment. Most of these agents will darken bone to tan, red-brown, grey or nearly black. In contrast, exposure to the bleaching effects of sunlight will cause bone to assume a chalky, off-white color.

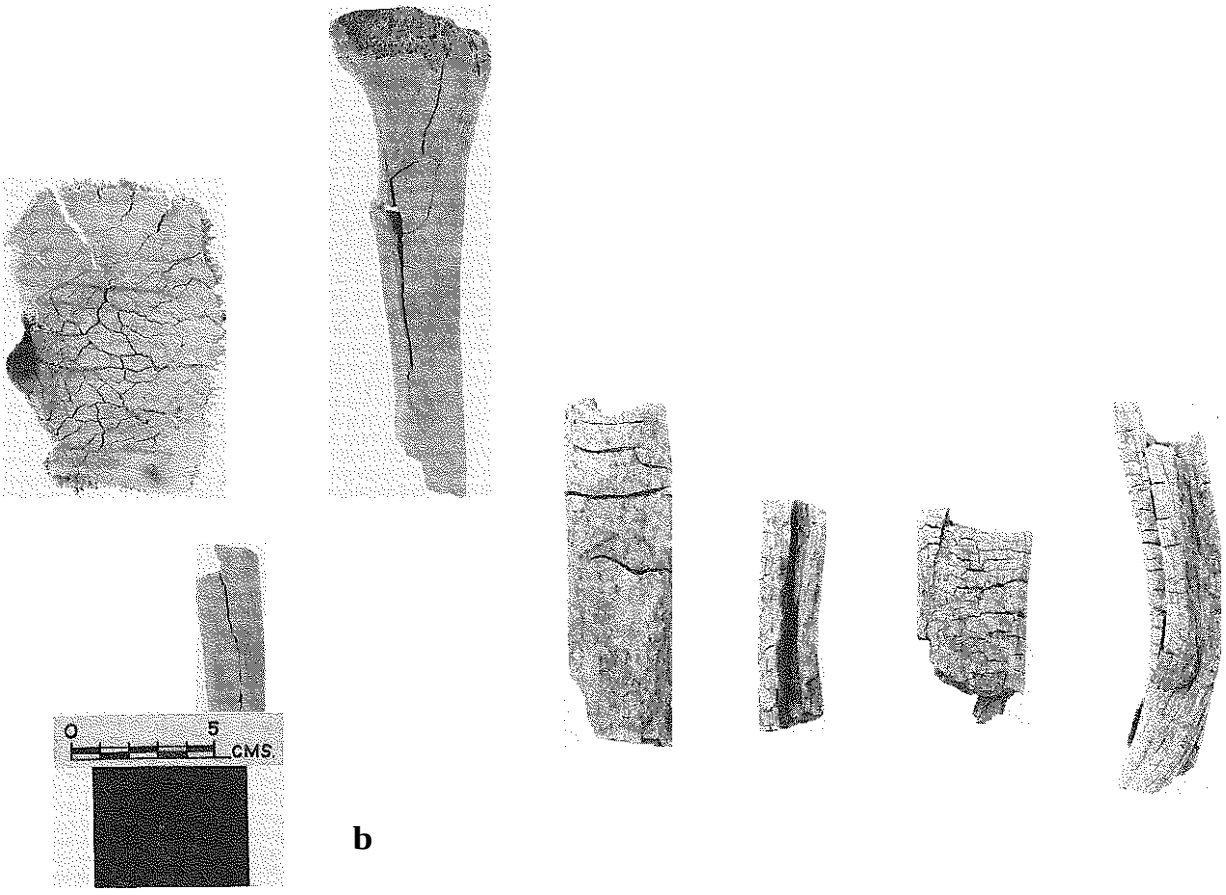

Figure 66a-b. Cremated bone, illustrating various degrees and patterns ofburning. a) Cremated bones showing cracking, checking, and splitting, indicating that they were dry when bumed. b) Cremated bones with transverse and longitudinal checking and splitting and marked warping, indicating that they were "green" or covered with flesh when burned. Previously published as Figures 52 and 53 in Ubelaker (1989a).
Courtesy ofD. H. Ubelaker and Taraxacum Press.

SURFACE CHANGES

Bone surface texture may be altered by heat, plant roots, insects, worms, soil/sediment characteristics, scavengers, and human activity. In order to fully appreciate the nature of surface changes, the observer is encouraged to use a magnifying lens or low-powered dissecting microscope under bright light.

When bones are exposed to heat sufficient to induce calcination, external surfaces are likely to split and crack. If bone containing a significant organic component is burned, surfaces are likely to assume a "checked" appearance due to cracks both perpendicular and parallel to the main axis of the specimen. Such evidence of "green" burning contrasts with bones burned after the organic component has been depleted. As illustrated in Figure 66, the resultant "dry" burning pattern typically presents less extensive surface modification, primarily shallow cracks parallel to the main axis (i.e., bone will be split longitudinally). Observations of modern crematories and experimental stuclies have confirmed this distinction (Baby 1954; Binford 1963; Buikstra and Swegle 1989).

Plant roots in contact with bone can etch dendritic patterns reminiscent of vessel tracks. These root tracks may become discolored through aciclic decalcification (Figure 67). Such grooves should not be misinterpreted as evidence for pathology or cultural activities (White and Folkens 1991).

The effects of insect infestation, along with the impact of other animals such as worms and other burrowing microfauna, commonly produce bone changes that may mimic abnormal bone resorption. Examples of such "pseudopathologies" are well known from many world areas (Buikstra, Baker, and Cook 1993; Ortner and Putschar 1985; Wells 1967). Each possible resorptive disease focus must be carefully observed for evidence

Figure 67. Example of surface erosion due to roots on left frontal. Specimen from Chiribaya Alta, Peru. Photo by Diane Houdek.

of bony response during life. When this key marker is absent, a diagnosis of "pseudopathology" must be considered.

Bone exposed upon the ground surface will weather according to a defined sequence, beginning with superficial cracking and ending in splintering (Table 5 and Figure 68; Behrensmeyer 1978). Although the rate and patterning taken by such changes will reflect local conditions, the sequence is relatively stable and thus provides a standardized means of characterizing weathering changes. These stages are important in defining past depositional environments. Such evaluations also establish a contemporary baseline against which future workers can evaluate the efficacy of alternative preservation regimes.

Table 5
BONE WEATHERING STAGES
After Behrensmeyer (1978). Slightly modified for collections context.

Stage 0: Bone surtace shows no sign of cracking or flaking due to weathering.

Stage 1: Bone shows cracking, normally parallel to the fiber structure (e.g. longitudinal in long bones). Articular surtaces may show mosaic cracking.

Stage 2: Outermost concentric thin layers of bone show flaking, usually associated with cracks, in that the bone edges along the cracks tend to separate and flake first. Long thin flakes, with one or more sides still attached to the bone, are common in the initial part of Stage 2. Deeper and more extensive flaking follows, until most of the outermost bone is gone. Crack edges are usually angular in cross section.

Stage 3: Bone surtace is characterized by patches of rough, homogeneously weathered compact bone, resulting in a fibrous texture. In these patches, all the external, concentric layers of bone have been removed. Gradually the patches extend to cover the entire bone surtace. Weathering does not penetrate deeper than 1.0-1.5 mm at this stage, and bone fibers are still firmly attached to each other. Crack edges usually are rounded in cross section.

Stage 4: The bone surtace is coarsely fibrous and rough in texture; large and small splinters occur and may be loose enough to fall away from the bone if it is moved. Weathering penetrates into inner cavities. Cracks are open and have splintered or rounded edges.

Stage 5: Bone is falling apart, with large splinters. Bone easily broken by moving. Original bone shape may be difficult to determine. Cancellous bone usually exposed, when present, and may outlast all traces of the former more compact, outer parts of the bones.

Tooth marks of both carnivores and herbivores (primarily rodents), are commonly observed on human remains. Carnivores typically attack the trabecular ends of long bones where diagnostic patterns of pitting, scoring, and puncturing can be observed (Figure 69). Ribs are also subject to carnivore gnawing (White and Folkens 1991).

Rodents, such as mice, groundhogs, and porcupines produce pairs of parallel, square-bottomed grooves, frequently located at sites of bony prominences such as the lateral margin of the orbit and the iliac crest (Figure 70). These patterned and regular incisions should not be confused with the effects of human activity (White and Folkens 1991).

Cutmarks may provide evidence of scalping or corpse preparation during the course of a mortuary ritual. Cutmarks produced during defleshing and dismemberment often cluster around specific anatomical features, such as points of attachment for tendons and ligaments. The type of tool used to remove flesh can be inferred through examination of a cross section of the cut. V-shaped cross sections are associated with stone flakes or metal knives. Bifacially flaked tools usually produce broad, shallow outlines. Cuts and scratches introduced

of bony response during life. When this key marker is absent, a diagnosis of "pseudopathology" must be considered.

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Rodents, such as mice, groundhogs, and porcupines produce pairs of parallel, square-bottomed grooves, frequently located at sites of bony prominences such as the lateral margin of the orbit and the iliac crest (Figure 70). These patterned and regular incisions should not be confused with the effects of human activity (White and Folkens 1991).

Cutmarks may provide evidence of scalping or corpse preparation during the course of a mortuary
Cutmarks produced during defleshing and dismemberment often cluster around specific anatomical features, such as points of attachment for tendons and ligaments. The type of tool used to remove flesh can be inferred through examination of a cross section of the cut. V-shaped cross sections are associated with stone flakes or metal knives. Bifacially flaked tools usually produce broad, shallow outlines. Cuts and scratches introduced

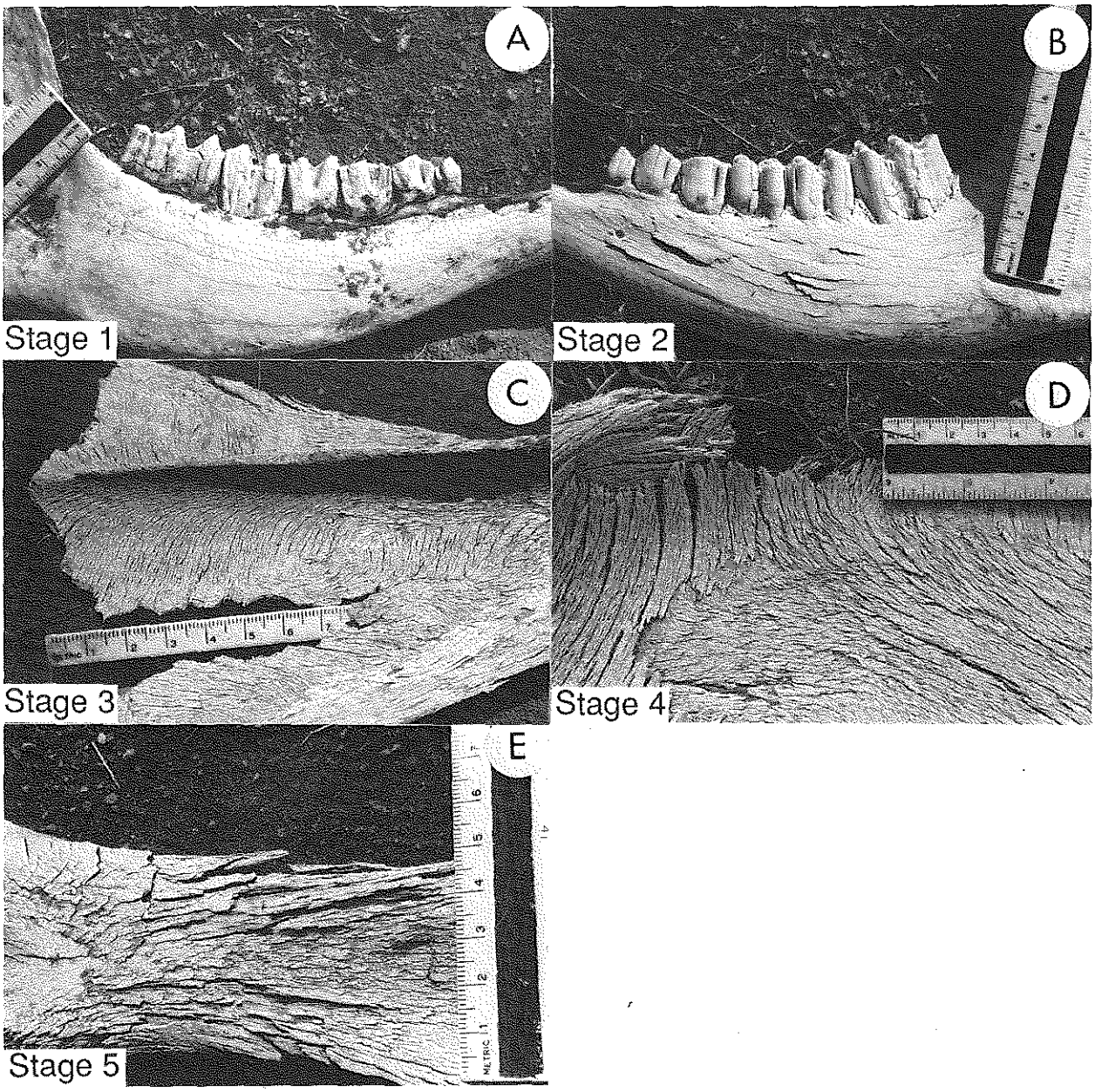


Figure 68. Bone weathering stages. A) Stage 1: cow mandible showing initial cracking parallel to bone fiber stmctnre; B) Stage 2: opposite side of same cow mandible showing flaking of outer bone layers; C) Stage 3: bovid scapula showing fibrous, rough texture and remnants of surface bone near lower right border;
D) Stage 4: part of scapula showing deep cracking and coarse, layered fiber structnre; E) Stage 5: scapula blade showing froal stages of deep cracking and splitting. Previously published as Figure 2 in Behrensmeyer (1978). Courtesy of K. Behrensmeyer.

during excavation or curation can be distinguished from perimortem or immediately postmortem events by inspecting the color of the bone

at the base of the cut. Modern marks will be light in color, while evidence of more ancient behaviors will be stained by the depositional environment and thus match the remainder of the bone. Several examples of cutmarks are illustrated in Figure 71. Included are cutmarks of the postcranial skeleton associated with dismemberment and modifications of the cranial vault suggestive of scalping.

a

b

Figure 69a-b. Carnivore tooth marks. a) Small carnivore (dog or coyote) tooth puncture marks on two distal fibulae. Specimens from Room 59 mass burial, Wupatki Ruin, northeast Arizona. Courtesy of C.G. Turner 11. b) Carnivore tooth puncture marks on a right ilium. Specimen from Burial 200, Norris Farms 36, central Illinois. Previously published as Figure 4 in *American Antiquity* 56(1991):581-603. Courtesy of G. R. Milner and the Society fl>r American Archaeology.

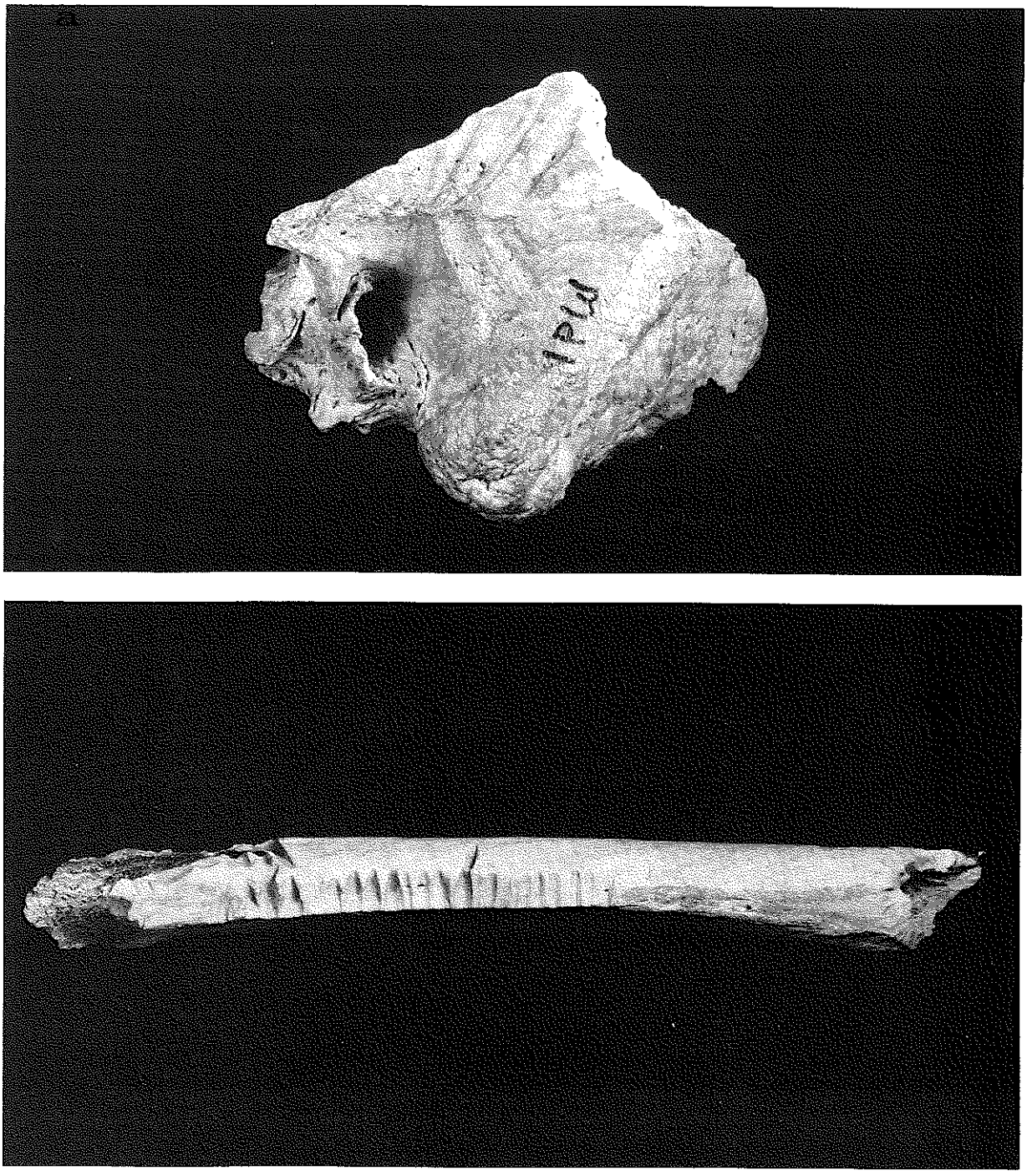


Figure 70a-b. Bones presenting evidence of rodent gnawing. a) Rodent gnaw marks on suprameatal crest, left temporal bone. Specimen from Collins Mound 1, southern Illinois. b) Rodent gnaw marks on linea aspera, right femur. Specimen NPM l8D from Neville Public Museum, Wisconsin. Photos by Diane Houdek.

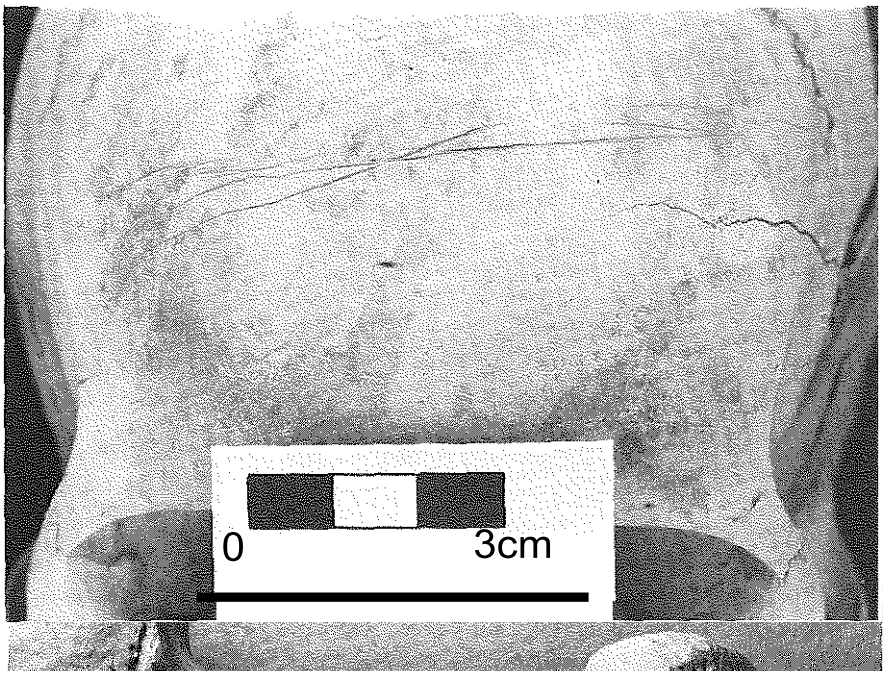


Figure 71a-b. Cutmarks. a) Cntmarks on frontal bone (probably indicative of scalping). Specimen from Burial 72, Norris Farms 36, central Illinois. Previously published as Figure 2 in *American Antiquity* 56(1991):581· 603. Courtesy of G.R. Milner and the Society for American Archaeology. b) Cutmarks on posterior surface of greater trochanter and neck of a right femnr. Specimen from Bumt Mesa, northwest New Mexico. Courtesy of C.G. Tomer II.

SHAPE CHANGES

Various perimortem and postmortem factors may cause changes in bone shape. Soil pressure may induce deformation, which is often especially severe in juvenile crania. Even relatively subtle effects may affect metric observations. Similarly, bone burned "green" at temperatures sufficient to induce calcination commonly becomes warped and may shrink.

Dehydration, salt accumulation, heat, scavengers, ground or ice pressure, and trampling are but a few of the factors that may cause bones to break. While these sources of fragmentation may not be of central interest to skeletal biologists, it *is* important to distinguish between these "natural" agents and breakage caused by humans near the time of death. While spiral fractures (see Chapter 10) can result from either human or nonhuman forces, they *are* indicative of premortem or perimortem events. Breaks occurring long after death, in tissues of low collagen content, typically have squared edges at right angles to the bone surface (Figure 72b), while perimortem fractures tend to form oblique angles (Figure 72a).

The use of tools to break bones is another sign of human activity. Hammer-anvil abrasions, for example, produce faint clusters of parallel scratches that occur when a bone slips when impacted by a hammerstone or other heavy implement that crushes it against an anvil (Figure 73). Conchoidal impact dents and projectile impressions are also clear evidence of human activity.

a

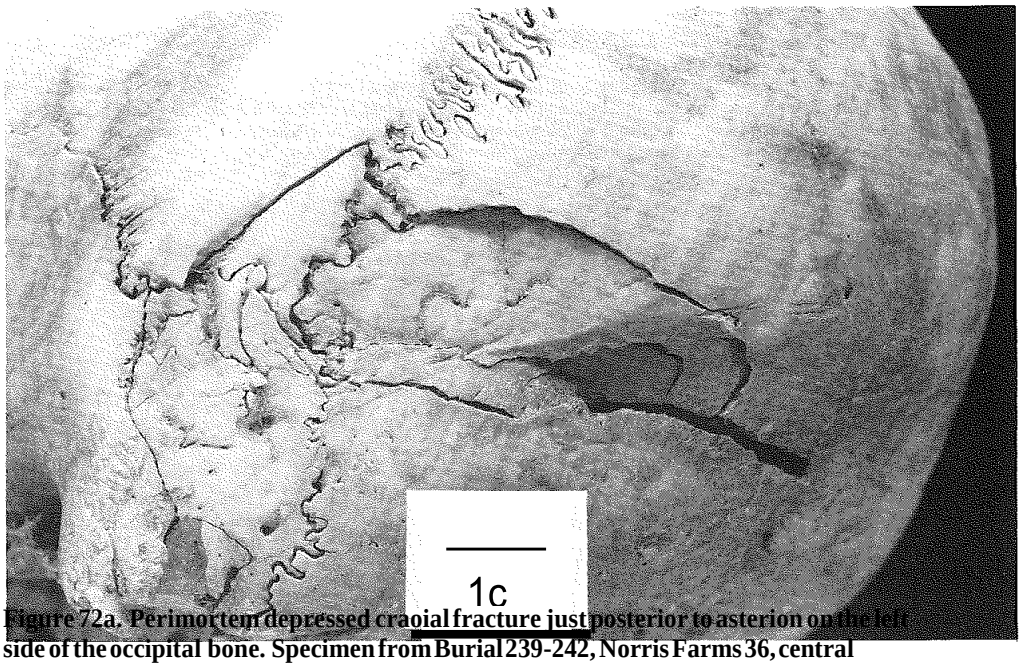


Figure 72a. Perimortem depressed craoial fracture just posterior to asterion on the left side of the occipital bone. Specimen from Burial 239-242, Norris Farms 36, central Illinois. Previously published as Figure 1 in ***American Antiquity*** **56(1991):581-603.**

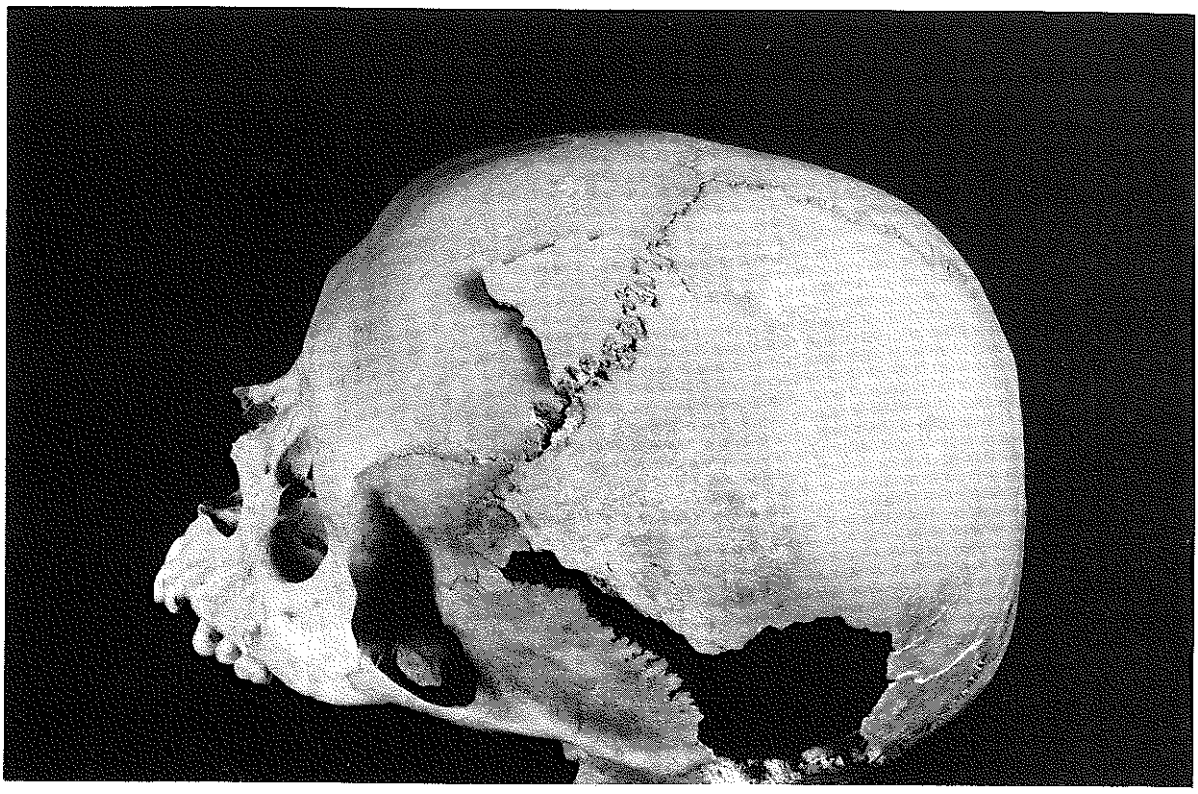
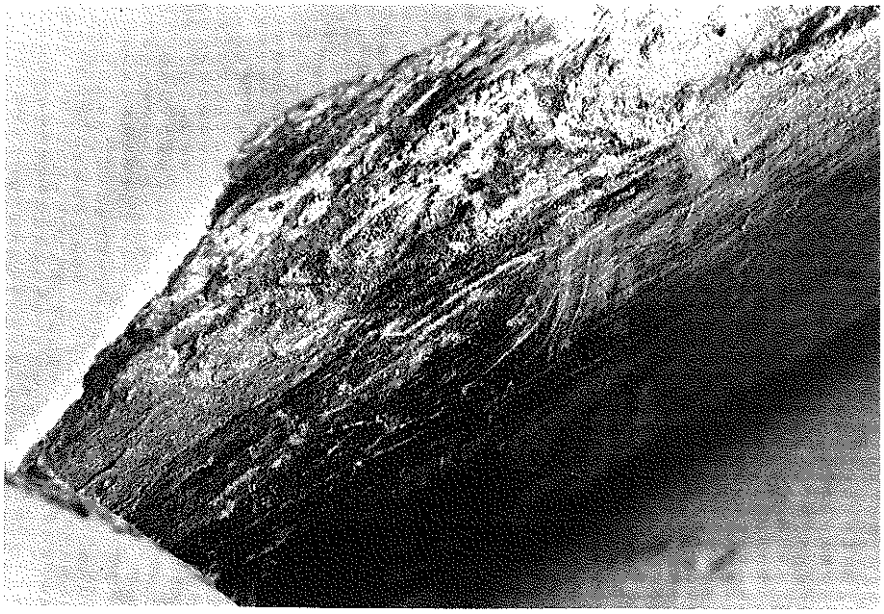


Figure 72b. Postmortem breakage of the left side of the frontal bone adjacent to the coronal suture. Note the sharp edges of the break, and that the broken bone was forced outward from the cranium. Other postmortem breakage of the cranium is visible toward the bottom of the photograph. Specimen from University of Chicago miscellaneous collections. Photograph by Diane Houdek.



northwest New Mexico. Courtesy of C.G. Turner II.

Figure 73. Perimortem anvil abrasions (and burning) on a femur fragment. Specimen from Burnt

Bones may be defleshed and then retained for a period of time, either as complete elements or in modified forms that may be worn as ornaments or used as tools. Skulls and long bones are most commonly decorated by painting and incising, or are modified into masks, pendants, or other forms of ornamentation. Tools such as awls, flutes and cups have also been fashioned from human bones. Postmortem breakage near the foramen magnum or on both sides of the cranial vault, accompanied by signs of weathering, may be evidence that a skull has been placed on a stake or a skull rack.

RECORDING TAPHONOMIC CHANGES

Recording procedures for taphonomic changes focus upon features which enhance interpretations of human behaviors, such as mortuary rituals and violence. Certain other postmortem changes are also important, since they may limit the accuracy of other observations. Deformation due to soil pressure may, for example, render skeletal measurements imprecise. This concern for measurement accuracy is addressed in Chapters 4, 6, and 7, in which we request that the observer identify measurements that have been estimated from incomplete materials or may have been affected by warping. Observation of sometimes subtle taphonomic features, such as cutmarks, requires careful scrutiny of all bone surfaces, under adequate lighting and magnification. A low-powered stereomicroscope and a 75 watt reflector floodlamp is recommended.

Precision in recording *color* should be maintained through the use of Munsell Soil or Plant Tissue Color Charts. Evidence of stains, burning, or "bleaching" due to exposure to sunlight should include Munsell evaluations both for the taphonomically altered bone and for "normal" bone adjacent to the altered section. (The observer need not record chroma, hue, and value for "normal" remains.) Standard Munsell Soil Charts will include colors appropriate for bones altered by heat and sunlight. Painted surfaces or those modified by contact with metals may require acquisition of charts for green or purple hues, either by adding the Soil Chart for gley soils or by purchase of the Munsell Plant Tissue Color Charts. Munsell Charts, including instructions for use, may be purchased from either of the following sources.

Munsell Color
MacBeth Division, Kollmorgen Instruments Corp.
2441 North Calvert Street Baltimore,
Maryland 21218

Forestry Supplies, Inc.
205 W. Rankin St.
P.O. Box 8397
Jackson, Mississippi 39284-8397
Ph: 1-800-647-5368
Fx :1-800-543-4203

Evidence of *burning* should be coded by color, surface texture, warping, and patterning. As noted in Chapter 2, the most efficient recording strategy is for evidence of burning to be recorded in association with the inventory process through the used of the Burned Bone Recording Form (Attachment 23). Color should be reported as Tan, Black (including dark brown), or White (including blue-gray). Heat-altered bone normally presents Munsell chroma of "/0," with the threshold between smoked and calcined remains at a value of approximately "4.5/." If more than one color appears on a single bone, list all appropriate colors and percentage of bone(s) affected. When reporting poorly preserved or highly fragmented materials, weights may be substituted for percentages. A technique for photographically recording color variation in cremated

materials is described in Chapter 2.

Surface texture of cremated remains should be reported as ***L*** Qongitudinally split); ***T*** (transverse and longitudinal checking); and ***C*** (curved cracks). Indicate presence by recording all appropriate codes. Similarly, report deformed (warped) bones as ***Y*** (Present) or ***N*** (Not Present). Observations of surfaces shielded by articular areas or by dense soft tissues should also be recorded as ***Y*** (Present) or ***N*** (Not Present). Space for further description and interpretation is available on the Burned Bone Recording Form (Attachment 23).

Weathering changes should be coded according to the Behrensmeyer categories listed in Table 5. The most advanced stage for a given element should be recorded on Attachment 24. When evaluating a large series

of specimens, the observer may choose to report weathering for selected elements, e.g, all left tibiae and frontal bones.

Other taphonomic changes should be reported and described by location on drawings of skeletons and/or individual bones. Examples of suitable drawings are presented in Chapter 2 as Attachments 3-10. The location of *discolored areas,* such as green stains due to associated copper items, should be indicated on a skeleton drawing, photographed, and described through the use of Munsell Charts. Similarly, regions impacted by *carnivore or herbivore gnawing* should be indicated on a drawing. Because carnivore gnawing frequently indicates access to remains relatively soon after death, it is also advisable to photograph evidence of carnivore activity. Evidence for *cultural modifications* that have created tools, ornaments, or displays such as skull racks should be carefully documented through drawings, photographs, and descriptions. All bone fragments should be examined closely for evidence of *polish.*

Premortem and perimortem fractures, wounds, and abrasions are recorded in Chapter 10, Paleopathology. The documentation of *cutmarks* requires meticulous examination of each bone, with appropriate lighting and magnification. The location of cuts or cut clusters should be indicated on bone drawings, and supplemented by descriptions which include estimates of cut numbers, average (or range) of cut length(s), and cut outline. An effective technique for recording cut outline involves creating replicas of representative marks. Replicas can be made according to the following technique:

Clean the modified area with water, or with an appropriate solvent if the bone has been treated with a preservative. Cover the region with a 3-4 mm thick layer of a silicone-based, dental impression material. After the impression material has set, draw an arrow on the back of the mold to indicate its orientation. An epoxy positive can be made from the mold for long term curation. Be certain to mark the cast to indicate its orientation relative to the original bone. The silicon impression provides a negative of the tool mark that can be sectioned and mounted on a glass microscope slide for analysis of shape.

The Taphonomic Changes Recording Form (Attachment 24) is designed for recording evidence of weathering, discoloration, polishing, cutmarks, rodent or carnivore gnawing, and artifact production. Each entry should begin by specifying the type of alteration, the affected bone, the location of the modification on the bone, and the number of photographs and drawings. Space is then allocated for other information, such as number of cutmarks and the appropriate Munsell designation for metal-staining. The following should be recorded for each type of taphonomic change.

Weathering: (l) Bone identification, (2) photographs of representative samples, (3) degree of weathering (see Table 5).

Discoloration: (l) Bone identification, (2) location (append drawing and photograph), (3) color of discolored bone and "normal" adjacent bone (use Munsell Charts).

Polish: (1) Bone identification, (2) location (append drawing and photograph).

Cutmarl:s: (1) Bone identification, (2) location (append drawing and photograph), (3) number of cuts, (4) average cut length, (5) range of cut lengths, (6) sketch and cast (optional but recommended) of representative cut(s).

Evidence of Rodent and Carnivore Gnawing: (1) Bone identification, (2) location (append drawing and photograph), (3) number of paired grooves or incisions. Evidence of rodent and carnivore gnawing should be recorded separately.

HENRI DUDAY, FRANÇOISE LE MORT, ANNE-MARIE TILLIER

ARCHAEOTHANATOLOGY AND FUNERAL ARCHAEOLOGY. APPLICATION TO THE STUDY OF PRIMARY SINGLE BURIALS

ABSTRACT: In funeral archaeology, to understand a burial is to bear in mind, above all, that skeletons were once corpses. The process by which a corpse is transformed into a skeleton is one of the key questions when excavating burials. Detailed field osteological observations are essential to the restitution of the environment in which the body decay took place. In this paper, special attention is given to primary deposits, with a presentation of few archaeological examples which document distinct characteristics of the space surrounding the corpse. It is through a multiplication of reflections developed on different sites and contexts that archaeothanatology will refine its analytical methods and widen the scope of its contribution.

KEY WORDS: Funerary archaeology – Archaeothanatology – Primary deposit – Body decay – Taphonomy

INTRODUCTION

Generally, articles on burials are written by the archaeologists who excavated them and are rich in information of an archaeological type which relates to their specific training. This may differ from country to country and, even within a single country, among universities. Archaeological education is generally based both on learning to read stratigraphy (the point of departure for all archaeological activity), to recognise layers, stratigraphic units, fills and so on. Archaeologists often lack sufficient training in anatomy to record the data related to the arrangement of human remains, and the deceased is therefore excluded from overall assessment of the tomb. The bones are treated as extraneous elements, often published in appendices and therefore totally dissociated from the archaeological analysis. When reading publications devoted to funerary archaeology, we often face a clear inversion in the hierarchy of importance of the different elements of the burial. The impression is often given that a corpse accompanies the brooch or the vessel, although the most important element of the burial is not the furnishing but the deceased: the brooch is not buried, but the deceased with the brooch. This is an epistemological aberration: the dead body is the *raison d'être* for the tomb and the central element around which, and in function of which, the acts were performed which funerary archaeology aims to reconstruct. The process by which a corpse is transformed into a skeleton is one of the key questions when excavating burials.

The last three decades have seen the development in France of an innovative approach devoted to a better understanding of human deposits, based upon field anthropological observations (Duday 1987, Duday, Masset 1987, Duday *et al.* 1990). This approach was developed when rescue archaeology was being established attempts to reconstruct the attitudes of ancient populations towards death by focusing on the study of the human skeleton and analysing the acts linked to the management and treatment of the corpse. The

use of the term "archaeothanatology", since "thanatology" studies the biological and social components of death, was recently suggested (Boulestin, Duday 2005). The major aim of this methodological approach (Duday 2005, 2009, Duday, Guillon 2006) is to enable valid interpretation by archaeologists and skeletal biologists of the process of decay of the body by close attention to its skeletal remains.

FUNERARY ARCHAEOLOGY AND CORPSE TAPHONOMY

The term "taphonomy" (from the Greek *τάφοσ*, burial and *νόμος*, law) is commonly used in archaeological literature. It usually refers to the modes of preservation – or alteration – of organic elements after burial, but sometimes also refers to the phases before burial (for example traces of butchery in archaeozoology) or to the objects transformed by humans (flint, ceramics, metals, etc.) or to archaeological sites. Funerary archaeology tends to give the term a meaning closer to its etymology: it refers to all the processes that affect human remains after their deposition, the preservation or non- preservation of every skeletal element and its arrangement in relation to others.

To understand a burial is to bear in mind, above all, that skeletons were once corpses. Therefore, the position of the skeleton in excavation may be different from the one which it assumed when deposited. Organic elements, such as clothing, generally decay together with the corpse. Decomposition starts at the very moment of death, but sometimes may begin while the subject is still alive, when necrosis of tissue that is no longer supplied with blood takes place. The decomposition of the corpse takes place because of the action of two general factors, endogenous factors operating inside the corpse and exogenous factors working outside it. The endogenous factors are primarily bacteria, as well as fungi, mostly found along the digestive tract of the deceased. While we are alive our body keeps their proliferation under control but after death these micro-organisms multiply rapidly and attack the body of the individual. There are two immediate consequences, temperature increase and the production of gas. The corpse swells, increasing in volume and some parts become coloured brown and grey by *post mortem* lividity. In an open space, the swollen abdomen can even burst if the temperature is high enough. This phenomenon does not occur if the corpse is buried in the ground.

The intervention of exogenous elements such as animals is directly conditioned by the tomb architecture. In the burials of contemporary Christian Europe, animals able to disturb the deposit are usually very small, since the dead body is placed in a coffin underground or protected by a tomb. The identification of these exogenous animals will provide us indirectly with information on the tomb architecture and on the protection, if any, of the corpse.

Funerary archaeology is aimed above all at reconstructing the initial burial deposit, starting from the excavated remains and working backward through the transformations undergone by the corpse. It is important therefore that the archaeologist should not only know the bones, but also the various stages of decomposition, since these may significantly modify the original situation, i.e. as desired by those who created the burial.

DIFFERENT CATEGORIES OF FUNERARY DEPOSITS

Archaeothanatology is an essential part of the archaeological analysis of funerary complexes, both for the study of burial practices and for establishing the internal chronology of deposition. To work following the methodological pointers of forensic medicine may not only help to explain some anomalies and to create a body of reference knowledge on which to base comparisons, but also helps to reconstruct the original arrangement of the burial, and thus to identify different categories of funerary deposits (e.g. Duday 2009, Duday *et al.* 1990).

Primary and secondary burials

There are different types of funerary deposits. A first distinction can be drawn between primary and secondary burials (Leclerc 1990). A primary burial corresponds to what anthropologists and sociologists of death call the "simple funeral". It consists of a single ceremony during which the manipulation of the remains takes place. The body, still in a state of anatomical integrity, is then placed in its final tomb. Decomposition happens almost entirely at the place of burial.

A secondary burial corresponds instead to what anthropologists call the "double funeral". The human remains are manipulated at two different stages. First the corpse is put in a temporary burial where decomposition takes place. Afterwards the bones are transferred to a tomb. The final burial happens away from the place of decomposition. It is not therefore possible to observe the diagenesis of the corpse in the place of final deposition since the decomposition products were not created there.

From a practical point of view, it is not always easy to distinguish primary from secondary burials. Here we need to distinguish two levels of analysis. The first concerns the demonstration of the primary or secondary character of the deposit ("deposit" is a neutral term here that does not necessary imply human action, as in the case of a sedimentary or alluvial deposit, for example). It is an issue of distinguishing whether the subject was a corpse (primary deposit) or loose bones (secondary deposit) when it arrived at the place in which its remains were found. The second level of analysis concerns the demonstration that we are considering a burial proper, whether primary or secondary. It is necessary to prove that the manipulation of dry bones had been planned from the start. This notion of pre-planning is indispensable for defining a secondary burial, since it distinguishes it from other later handling of dry bones, for example in the case of "reduction".

Single (individual), multiple and collective funerary deposits

Another distinction can be drawn between individual burials, containing the remains of a single individual, and funerary complexes containing a number of corpses (Leclerc, Tarrete 1988). Within these categories further distinctions can be made. When the complex comprises many burials (usually individual), each with its own structure, it may be called a "necropolis" or cemetery. A multiple burial comprises dead bodies which have been deposited in the same place simultaneously. This generally represents evidence for catastrophic events, massacres, plagues, floods, etc., which have caused a mortality crisis. The minimum form of multiple burial, containing only two individuals deposited at the same time, is double.

Finally, burials are collective where the corpses have been deposited at different times and where the structure has been built to allow for reopening for further depositions. While the term "individual burial" is commonly accepted, we must admit that the other types of burials do not benefit from a commonly accepted definition by archaeologists and historians.

At this point in the presentation, our purpose is to focus on the identification of primary burials, and to deal with individual burials.

IDENTIFYING A PRIMARY BURIAL

As mentioned before, a primary deposit is one in which the corpse is laid in its final place of burial where decomposition takes place. It is necessary to demonstrate the elements on the basis of which a burial can be argued to be a primary deposit. It is well known to archaeologists that primary burials can be recognised from the presence of anatomical connections, and that the presence of these connections allows us to reconstruct the original position of a corpse, even when some decomposition-related changes have occurred (Duday 1987, 2009, Duday *et al.* 1990).

Where a body is buried in temperate and relatively humid environments the joints that break down more rapidly are those of the hand (carpals, metacarpals and phalanges), the distal part of the foot (metatarsal-phalangeal and interphalangeal joints), and the cervical vertebrae. The muscle masses between the scapula and rib cage also break down quickly. The more persistent joints are generally those, which bear the heavier weights, such as the lumbar, lumbo-sacral (between the fifth lumbar vertebra and the sacrum) vertebrae and sacro-iliac joint, the knee, ankle, tarsal and metatarsal. However although they bear the weight of the body, hip joints break down more rapidly because the head of the femur is inserted so perfectly into the

acetabulum that powerful structures to retain it are not needed: the ligaments are formed of fibrous strands that surround the joint capsule.

Observation, recording and studying of the spatial organisation of the human remains are essential steps of fieldwork. The skeleton of an infant which was excavated at Sallèles d'Aude near Narbonne in France (Duday *et al.* 1995) allows us to explain the recording process (*Figure 1*). In this Gallo-Roman potter's workshop of the first century AD, a room measuring seven meters long and four metres wide which was used for drying vessels and amphorae contained several infant

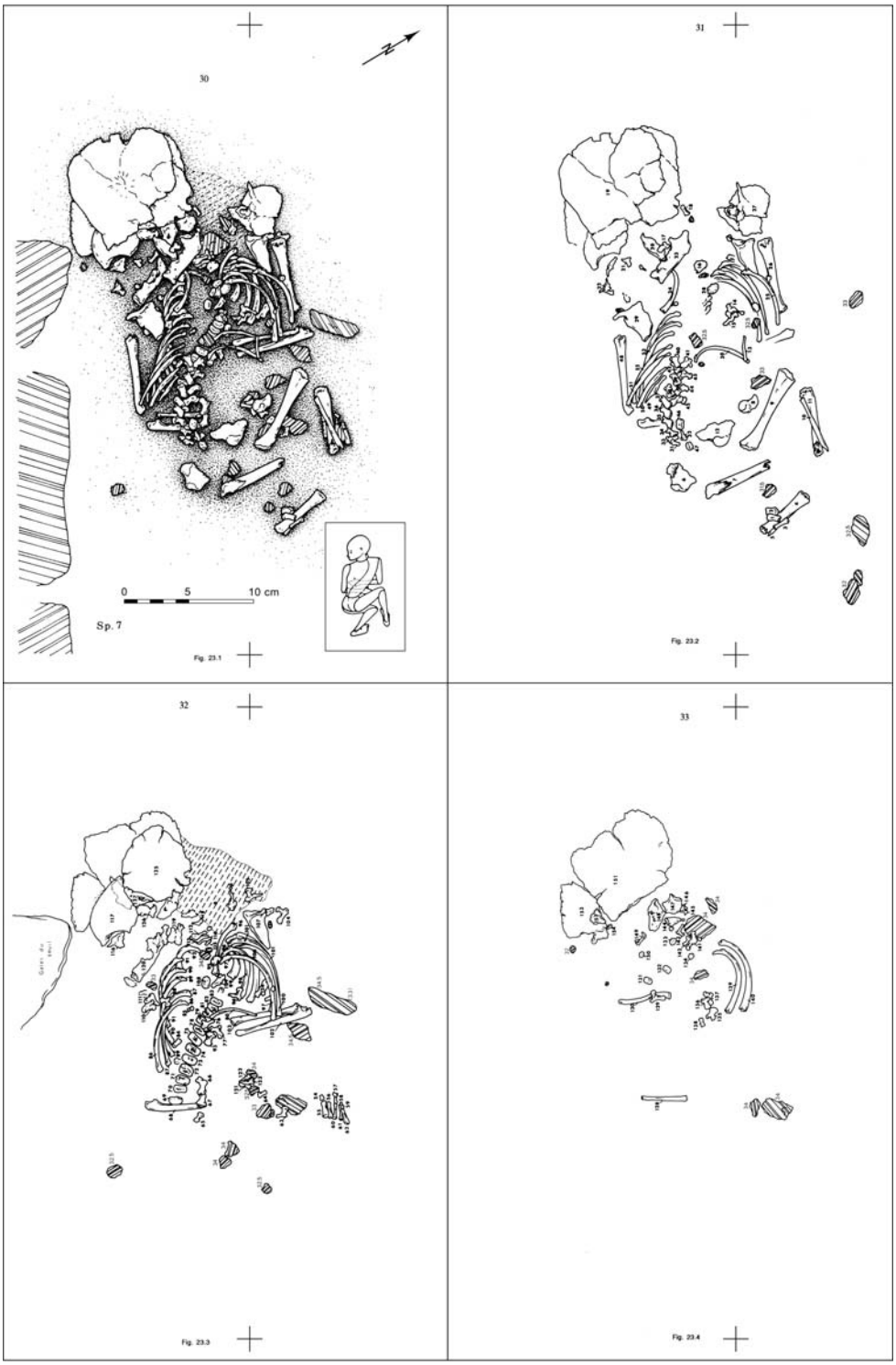


FIGURE 1. The neonate grave, no. 7, discovered in the Roman pottery workshop at Sallèles d'Aude (Aude, France). The synthetic drawing with restitution of the original position of the body has been obtained by the superposition of the three successive drawings of the three excavation levels. Drawing by H. Duday.

burials along its walls. To carry out the excavation of the burial, the diggers worked from platforms supported by metal scaffolding. To remove the soil

small vacuum pumps, like those of dentists, were used. Plans were made at a scale of 1:2 or 1:1. Drawings (and photographs) were taken immediately after each stage of clearing. Each bone was numbered and its anatomical orientation and depth were recorded: *Figure 1* shows the plans of three successive excavation layers of the burial and the composite image which was created from these partial views. The infant who died in the perinatal period is prone and the arrangement of the ribs allows us to read the position of the thorax directly. If the person is laid on his back, the first rib lies on the second, the second on the third, and so on. If the person instead is laid on his stomach, the lower ribs rest on the upper. Within the pit an alignment can be seen, with the right foot folded under the right leg.

Contrary to what is often seen in the archaeological literature, the absence of connections does not constitute sufficient proof of the secondary character of the deposit. This absence of connections can be caused by disturbances linked, for example, to the circulation of animals or water, or to collapses of the tomb: it is generally enough for these re-workings, whatever their cause (including human intervention), to happen a long time after deposition when all the ligaments have disappeared. In the infant burial from Sallèles d'Aude previously mentioned (*Figure 1*), a small zone of disturbance caused by an animal's passage was detected nearby the head (hatched zone in drawing 2 and composite image) on the field and resulted in displacement of the bones away form their original position.

BODY DECOMPOSITION IN AN ORIGINAL VOID

An observation on the relationships between the internal and external environments of the corpse can provide us with useful information about the cadaver environment within a primary burial. Archaeothanatology allows clues to be identified related to the presence of a void at the moment of burial. Archaeological observations, for example of traces of wood, nails or differences in fill would probably clarify what type of structure might have caused this void, coffin, burial chamber, wooden framework, etc. However, a void can also be detected in the absence of architectonic elements. There are cases of individuals buried under covers of leather, a thick and rigid material that creates a void around the corpse, seen in the displacement of bones away from the space originally occupied by the body, since the cover decayed long after the corpse did.

A middle Neolithic burial excavated at Villeneuve-Tolosane on the outskirts of Toulouse (southern France) provides a good example of earth grave belonging to the middle *Chasséen*. The individual is lying in a pit on his left side in a crouched position (*Figure 2*), wild boar canines and a vessel are present as offerings. Since the connections that break down more rapidly are still preserved, this is a primary individual deposit. The right ribs have fallen into the thoracic-abdominal cavity left free by the decomposition of the internal organs, while the left ribs have remained in their original position at the bottom of the pit. The vertebral column is slightly displaced: when excavated, it is generally found to be divided in segments (most commonly from two to five) of three or four vertebrae in strict connection. Between those segments, it is possible to observe a shift, rotation or change of angle at one of the inter-vertebral spaces. Save where the body is laid perfectly symmetrically on soft sediment, the vertebral column is subject to forces which exercise a double torsion. As long as ligaments hold, these forces do not generate any movement, but when the linkages break, one of the three types of displacements described above occurs in the space where the ligaments first yield. This movement absorbs the action of the forces on the vertebral column, unless another should happen a little further away at the inter- vertebral space which gives up second, and so on. At this point in front of the vertebral column is the transverse

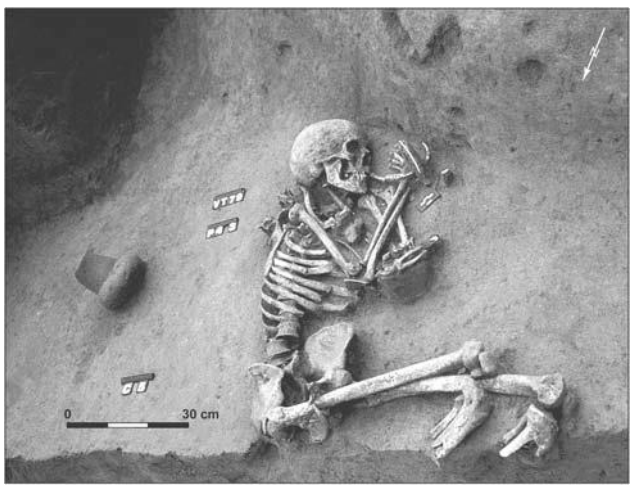


FIGURE 2. Adult burial P4-3 dated to Middle Neolithic (*Chasséen* Culture) at Villeneuve-Tolosane (Haute Garonne, France).

colon, containing faecal matter and bacteria which have been proliferating since the moment of death. These attack tissues and rapidly cause a zone of precocious destruction.
The *Figure 2* further shows that the sacrum has fallen, dragging with it the fourth and fifth lumbar vertebrae (L4 and L5), causing a very clear rupture at the space between the third and fourth vertebrae. When the ligaments of the sacro-iliac joint came apart, the ligaments of L4-L5 and L5-first sacral vertebra (S1) still held, whereas those of L3-L4 had already decayed. Here we see how excavation data may give us important information on the chronology of joint breakdown.
A few cervical and upper thoracic vertebrae have moved away from the space originally occupied by the corpse. There must have been a void since a vertebra obviously cannot move in the earth by itself. Many animal holes have been observed in the sides of the pit and although none have been found by the neck, a burrowing animal might have caused a disturbance. However even if a hole constitutes a void, this is of no archaeological interest because it does not provide us with any relevant information about the original structure of the tomb.
The upper part of the right upper limb is still in connection, while on the left, of the hand only the thumb and little finger remain in place, partly covered by the face. The central part of the carpal and the second, third and fourth metacarpals are connected, but away from the space originally occupied by the body, near the elbow. Since these joints break down more rapidly, the displacement should have taken place soon after deposition. During the initial phase of decomposition, there would have been a void around the corpse.
In conclusion, the displacement of skeletal elements proves the existence of an original void, and the causes of displacement are quite simple to explain. The upper part of the body leans slightly upwards on the side of the pit and, during decay, the cranial skeleton has slipped downwards towards the rib cage. It seems that the skeleton "has no neck" (it is clear that at the same time the cervical and thoracic vertebrae shifted backwards). Moreover part of the left hand has slipped along the forearm bones during decomposition. Putrefaction in fact produces a rather viscous mass that may slide under the force of gravity. Since this void provides information on the structure of the tomb and on the environment within the grave, it is necessary to demonstrate its existence at the initial phase of decomposition. This excludes the possibility of later re-working not related to burial practices.

BODY DECOMPOSITION IN A FILLED SPACE

A corpse ready to be buried still has internal organs and muscles. The "soft parts" which characterise the primary deposit disappear and are replaced by the fill which is found when the burial is excavated. It is important to examine this "transubstantiation", the apparent transformation of flesh into fill, which clearly constitutes the main difference between the time of burial and of excavation. Paradoxically the archaeological literature seems to overlook this process completely. When does the filling of the internal volume of the corpse occur and what are its causes?
Three mechanisms have been identified in the process of filling. The first is the force of gravity: the sediment that has built up above the corpse falls into the spaces left empty by the disappearance of the soft tissue. The second is the increase in volume of clay sediment when wet: decomposition fluids from the corpse soak the sediment and, if clay, this expands to fill the empty spaces. The third is disturbance caused by the actions of small animals, particularly earthworms. While digging tunnels they swallow the soil and later expel it. Such animals particularly seek out humid areas where the sediment is rich in organic matter, like those near burials.

The middle Neolithic burial from Berriac (Aude, southern France)

In this primary burial (*Figure 3*), the adult individual laid prone, the head turned to the left and the right hand holding the right knee. The hand bones are connected and the distal phalanges of the fingers are pushed straight into the ground, against the upper part of the right tibia.

Generally, if a bone is in potential disequilibrium in relation to the space occupied by the body, it will fall into this space when decay of the soft tissue frees it. If this does not happen, something has prevented its fall. This would demonstrate the existence of an obstacle that provides some support. The archaeological observations may allow us to identify that element, which could be: the edge of the pit (not the case here); a border in perishable material in contact with the corpse at some distance from the edge of the pit (but in this burial the effect caused by the obstacle can be observed at a distance from the line that joins the outermost points of the skeleton, the face, the left shoulder and the left foot); the pit fill (the bones are

prevented from falling beyond the space occupied by the corpse because this space is already filled). In this case, it is likely that the earth was in contact with the corpse and served as an obstacle to prevent the bones from falling. This would then be a burial in a filled space.

The Pre-Pottery Neolithic A burial H03 from Hatoula (Shepela region, Israel)

This primary burial contained the badly preserved skeleton of an adult individual (*Figure 4*). Nevertheless, it was possible to determine the initial position of the body which was lying on the back in a highly contracted position (Le Mort 1989, 1994). The clavicles were parallel

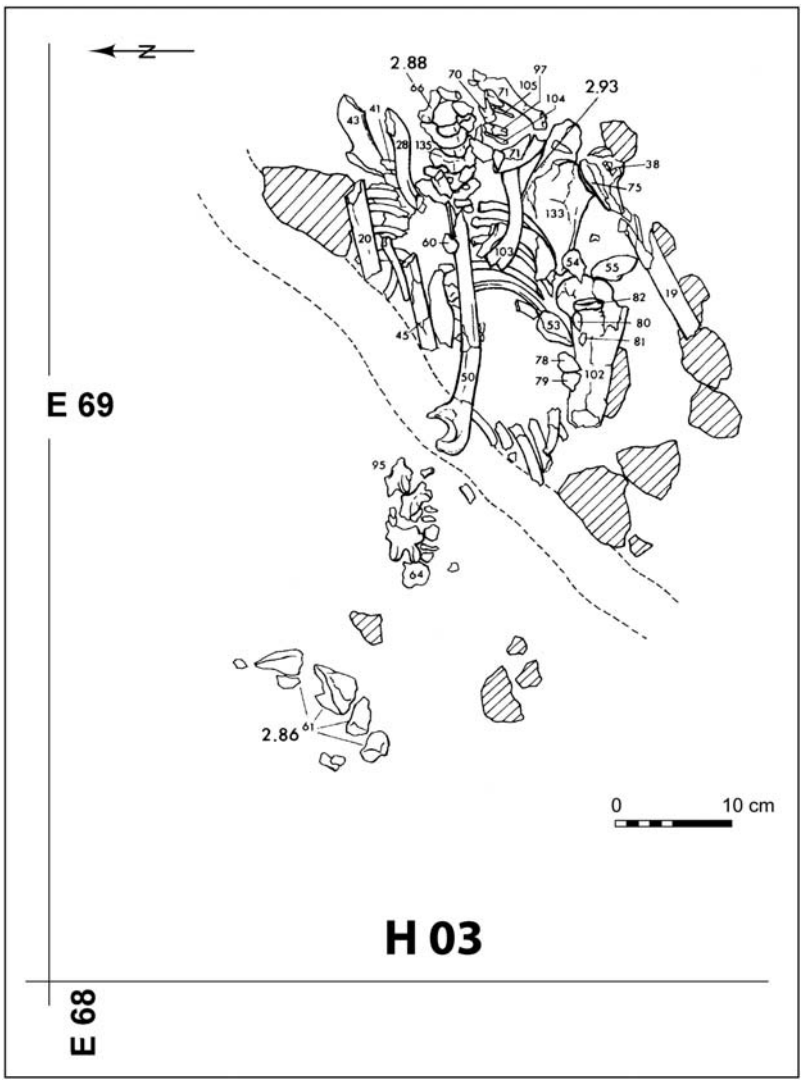


FIGURE 4. Pre-Pottery Neolithic A adult burial H03 from Hatoula (Shepela region, Israel). Drawing by

to the spine, indicating a constriction of the shoulders. The right arm (n°20) was in adduction and the forearm (n°45–50) tightly flexed on it, the elbow resting on the trunk. Regarding the left upper limb, only the position of the arm (n°19), which was in slight abduction, is known. Only small fragments of the pelvis (n°61) were uncovered. Two small fragments of the distal epiphysis of the right femur (n°78–79), the distal end of the left femur (n°54–102), the patellae (n°53–55) and some pieces of the proximal epiphysis of the left tibia (n°80–82) were also found. We can deduce from the position of these fragments that the lower limbs were tightly flexed, the knees resting in front of the lateral side of the left thoracic region. The body is so strongly contracted that it was very likely forced into this position. Most of the preserved bones are still in connection which means that the filling of the pit occurred very quickly after the corpse was put inside.

CHRONOLOGY OF FILLING THE VOLUME FREED BY THE DECAY OF SOFT TISSUES

Delayed filling

Generally, the filling is staggered over time, as the various examples discussed earlier testify, in particular the flattening of the rib cage or the separation at the inter- vertebral spaces. The decay of the thoracic (lungs, heart)

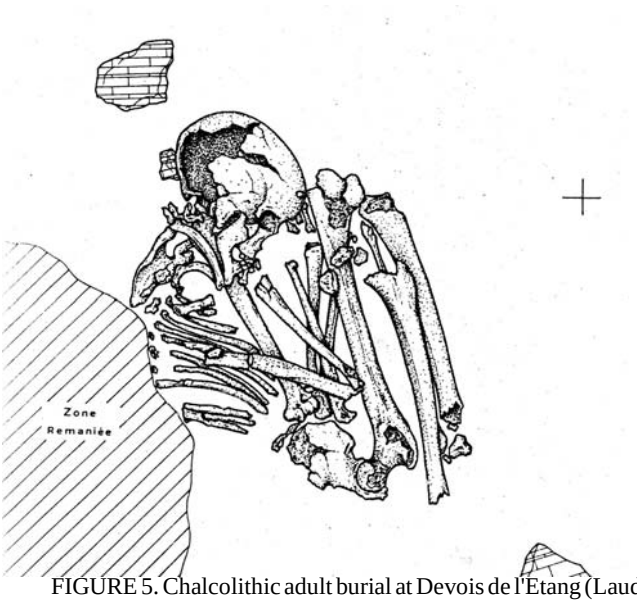


FIGURE 5. Chalcolithic adult burial at Devois de l'Etang (Laudun, Gard, France). The hatched zone indicates altered sediment. Drawing by H. Duday.

and abdominal organs (liver, spleen, stomach, and bowels) frees a space which lasts for a certain time. The bones are subject to various forces (for example gravity, torsion of the vertebral column, etc.) and when freed by the breakdown of ligaments, move under the action of these forces. The sediments later invade the interstitial spaces and block the bones in their new position. They will only be freed by further disturbance, for example excavation.

A little known consequence of the delayed filling of the volume freed by the decay of soft tissue is the closing of the intersegmental angles of the body, i.e. the angles which are created by the different segments of the limbs, like the arm and forearm (elbow) or thigh and leg (knee). For example, in the Chalcolithic burial

chamber of Devois de l'Etang in the lower valley of the Rhône (France), a corpse was found crouched in a particularly contracted position (*Figure 5*). Many archaeologists interpret skeletons in this position as evidence for corpses having been buried in bags or tightly bound. This is possible but difficult to prove. When a corpse is buried in the earth, the sediment around it exerts pressure and gradually, as muscles and ligaments progressively decay, closes the intersegmental angles between the bones. Obviously this phenomenon does not occur when the joints are extended or lightly flexed.

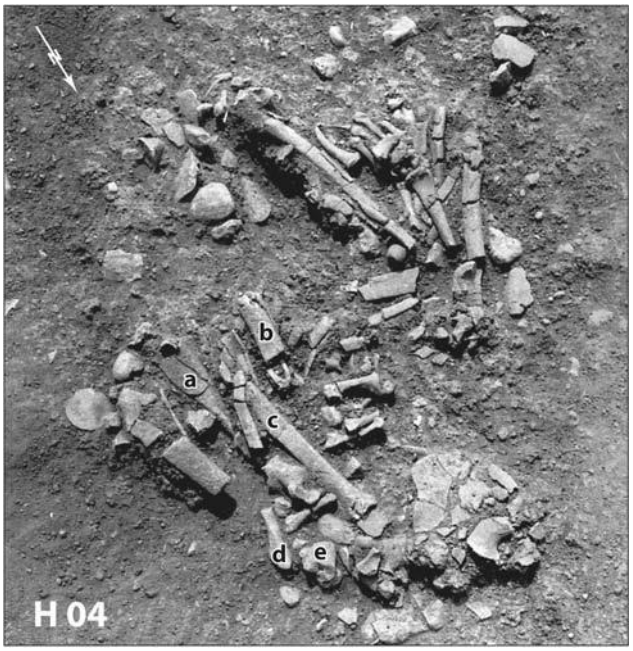


FIGURE 6. Pre-Pottery Neolithic A adult burial H04 from Hatoula (Shepela region, Israel). Photo CFRJ.s.

Another example of this phenomenon is seen in the Pre-Pottery Neolithic A burial H04 from Hatoula (Le Mort 1989, 1994) (*Figure 6*). The skeleton was lying on the face in a flexed position. The lower limbs are tightly flexed on the left side of the trunk. There is an angle of 35 degrees between the right femur (a) and the axis of the trunk and of 20 degrees between the left femur (b) and the axis of the trunk. The left tibia (c), which is seen from behind, is parallel with the right femur and placed against it. This is incompatible with the position of the left femur: the angle between the two bones is less than zero degrees. After the natural defleshing of the right thigh, the left tibia very likely slid near the right femur. The position of the left fibula, which forms an angle of 10 degrees with the left femur, confirms this hypothesis. Its distal epiphysis (d) and some parts of its shaft which rest on the right femur and on the left tibia are preserved. The position of the left talus (e) near the distal epiphysis of the fibula also indicates the initial position of the leg, which was tightly flexed, resting on the right thigh.

Progressive filling

A first example is given by a child primary burial of a fifth century BC found at Coteau de Montigné, in the west of France (*Figure 7*). Two small fragments of the base of the cranium of the child (eight to ten year old at death) have been displaced from the space originally occupied by the corpse, but they cannot be considered proof that decomposition has taken place in a void, since a burrowing animal has made a hole beneath the head. The rib cage has partly retained its original volume.

A difference of four to seven centimetres in depth was measured between the anterior-lateral and posterior extremity of the ribs. Flattening of the pelvis was also not noted. At this age, the pelvis bone comprises three independent bones, ilium, ischium and pubis, linked by cartilage that naturally decays during decomposition of the corpse, when each of these bones would go its own way. In child burials these bones usually fall within the pelvic basin, but in our example they have been found in their original

position (the pubic symphysis is still tightly connected). The hands, too, are in their original position. The right hand lies at a level which corresponds to the forward part of the abdomen, where it had been laid when the body was buried. The left hand lies in a place corresponding to the super-lateral part of the left hip, with the first two fingers passing forward and inside the anterior-super iliac crest. Although these bones were potentially in disequilibrium with respect to the internal space of the corpse, they maintained their original position exactly. This occurred because the volume left

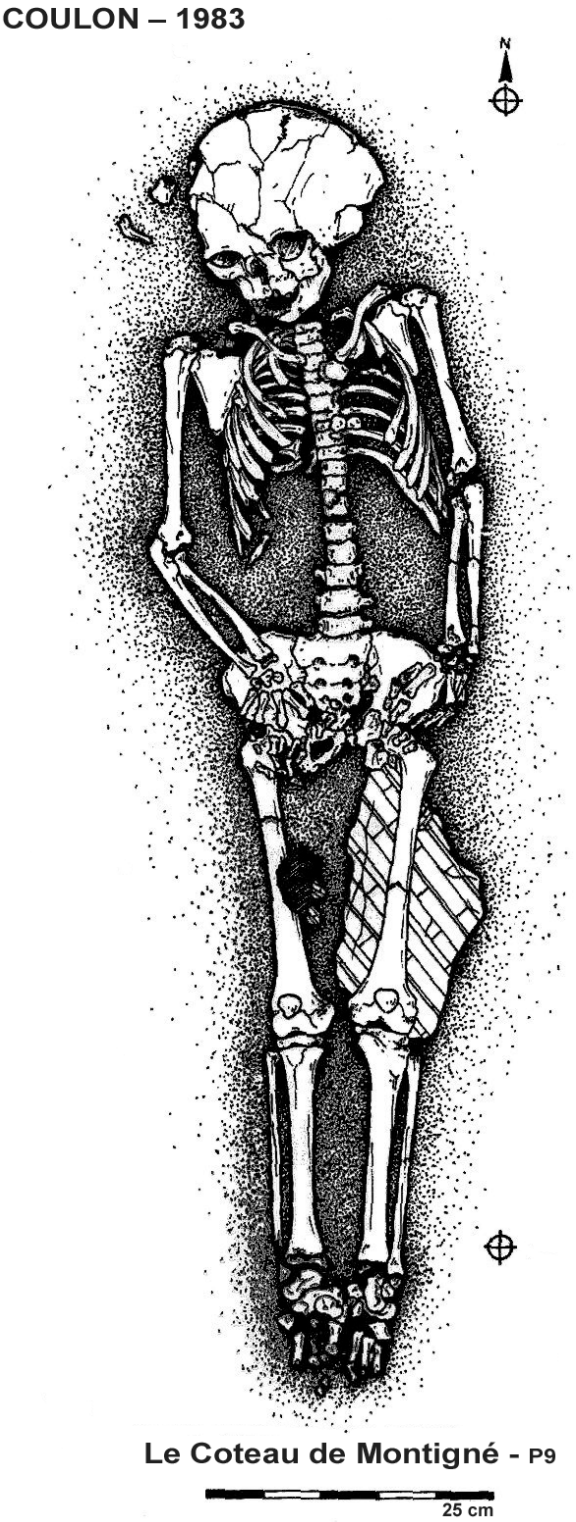


FIGURE 7. Child burial P9 from the fifth century BC at Coteau de Montigné (Coulon, Deux-Sèvres, France). Drawing by H. Duday.

by decay of the soft tissue had been progressively filled with sediment.

A Middle Palaeolithic adult burial at Kebara, on the Mount Carmel in northern Israel, provides another example. It is a primary burial dated to 59,900 ± 3500 BP, which was found in 1983 (Arensburg *et al.* 1985, Tillier *et al.* 1991) and partly damaged by an old sounding made in 1964. The skeletonised body (*Figure 8*) was lying on his back, with the upper limbs crossed on the chest, while from the lower limbs, only the proximal half of the left femur was preserved. The right arm and forearm were still in connection and there was no dissociation of the right sacro-iliac joint, both elements suggesting that the right side of the body was originally lying against the steep north-eastern side of the pit.

Osteological observations help to understand the burial and to characterise the decay environment. Most of the skeletal elements were still in their anatomical position even those related to looser ligamentous connections that disarticulated earlier in body decomposition (e.g. hyoid and hand bones). The body and the large horns of the hyoid bone were linked and indeed found *in situ*. There was no evidence for the

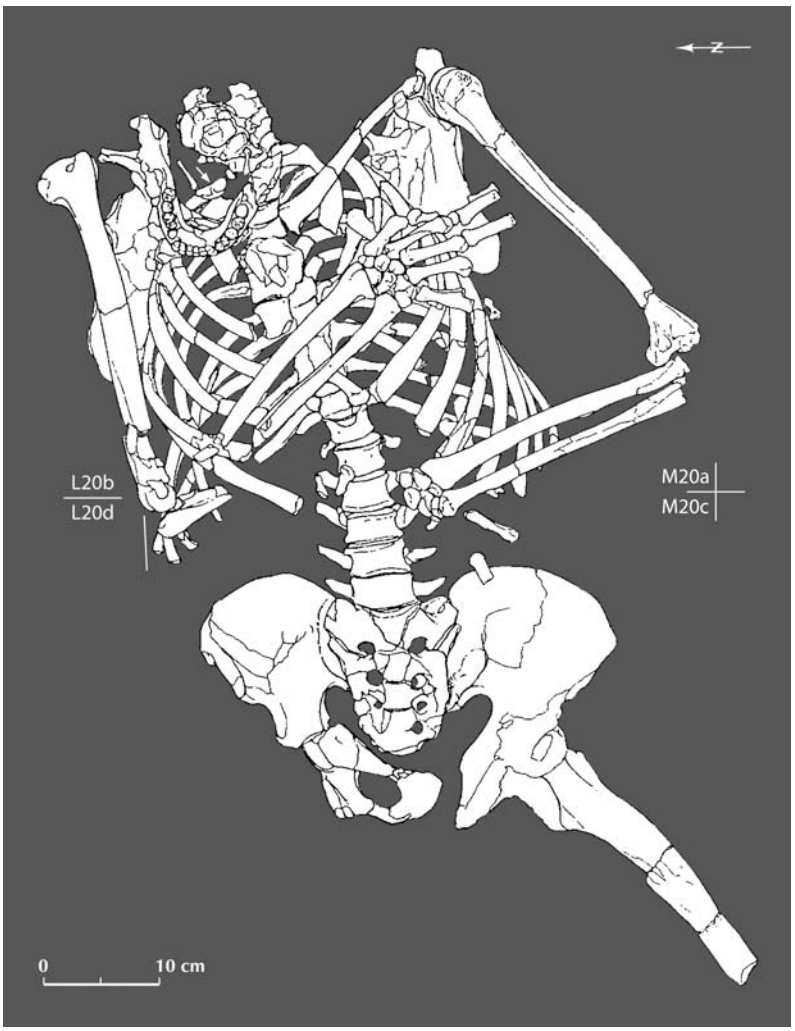


FIGURE 8. Middle Palaeolithic adult burial KMH2 from Kebara (Mount Carmel, Israel). The white arrow indicates the location of the hyoid bone in front of the atlas and between the two mandibular ramus. Drawing by D. Ladiray, after Arensburg *et al.* (1985), modified by G. Devilder.

collapse of the thoracic cavity after decomposition of the soft tissues and the original thoracic volume was practically kept. No major displacements of the disarticulated right hand bones on the chest were noticed. The left hand was lying at the level of the abdomen when the body was buried. The fingers could have been potentially in disequilibrium when the decomposition of the abdominal organs had left a void. Archaeological evidence of a small burrowing animal might also explain the displacement of metacarpals and phalanges. The body decomposition occurred in a filled space in which the volume occupied by the corpse was progressively filled with fine sediment after the decay of soft tissue.

The Kebara 2 burial is also of interest for what has happened to the head (Tillier 2009, Tillier *et al.* 1991). The orientation of the mandible resting on its base, the position of the hyoid bone *in situ*, the complete preservation of the sequence of cervical vertebrae and finally the isolated right upper third molar sitting next to the right lower one, suggested that the cranium was removed following the complete decay of the cranio- cervical ligaments (prone to disarticulate later in decomposition), including those between the atlas and the skull. No evidence of bone fragmentation and disturbance by external agents was detected in the area. Such observations enabled us to postulate the possibility of

later human manipulation rather than an animal scavenging signature. Yet it cannot be proved that this manipulation has been planed for a secondary deposit, in the lack of documentation.

CONCLUSIONS

As a biological discipline, archaeothanatology is obliged to establish its foundations at the same time as it contributes to the understanding of funerary complexes. Fieldwork replaces laboratory study and excavation replaces experimentation. Field archaeological observations are essential in the restitution of the original position of the body and in characterisation of the space surrounding the corpse. An element that might have little interest for the understanding of the individual site might be of fundamental importance for the global understanding of the decomposition process and thus for making sense of other funerary deposits.

As we have seen, the objectives and methods of archaeothanatology are fundamentally independent of chronological and cultural divisions. It is through a multiplication of reflections developed on each site that it will refine its analytical methods and widen the scope of its contribution. It is therefore essential to create everywhere a specific category of researchers who are trained in general archaeological methods and who also possess a developed knowledge of human osteology. Only thus can the understanding of ancient burials make progress: archaeothanatology is still defining its methods and developing the precision of its methodology. However, its systematic application to large funerary contexts is bearing fruit in the publication of its first syntheses, so that this newly born science can truly acquire its full historical dimension.

ACKNOWLEDGEMENTS

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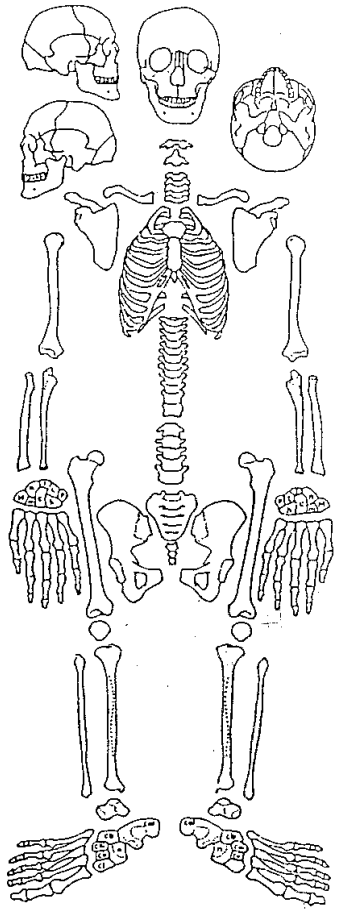
SKELETAL BIOLOGY SITE RECORDING FORM

Locality:
Site:
ID #:
grid reference:

Date of observation:
Cross reference to:
site plan
metrics
non-metrics
Photos:

body orientation °
head faces °
burial type: extended
flexed
cremation
bundle
face up or down
grave goods:
no yes (see notes)



Colour in bones or large sections present. For a scatter of bone fragments on the surface that are not readily identifiable, cross hatch (eg. cranial or leg pieces). Note the number of teeth separately if not identifiable.

Personal age:
Sex: FF F? ?? ?M MM
Pathology (see field notes if necessary):

DENTAL ATTRITION

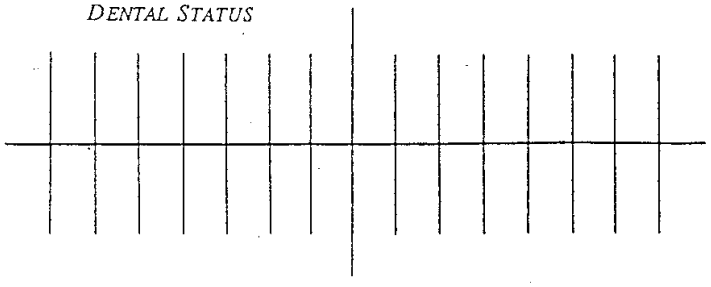
	left			right		
	M3	M2	M1	M1	M2	M3
upper						
lower						

STAGES OF DENTAL ATTRITION

These are stages of wear of molar teeth. The first three are details of eruption sequence and timing.

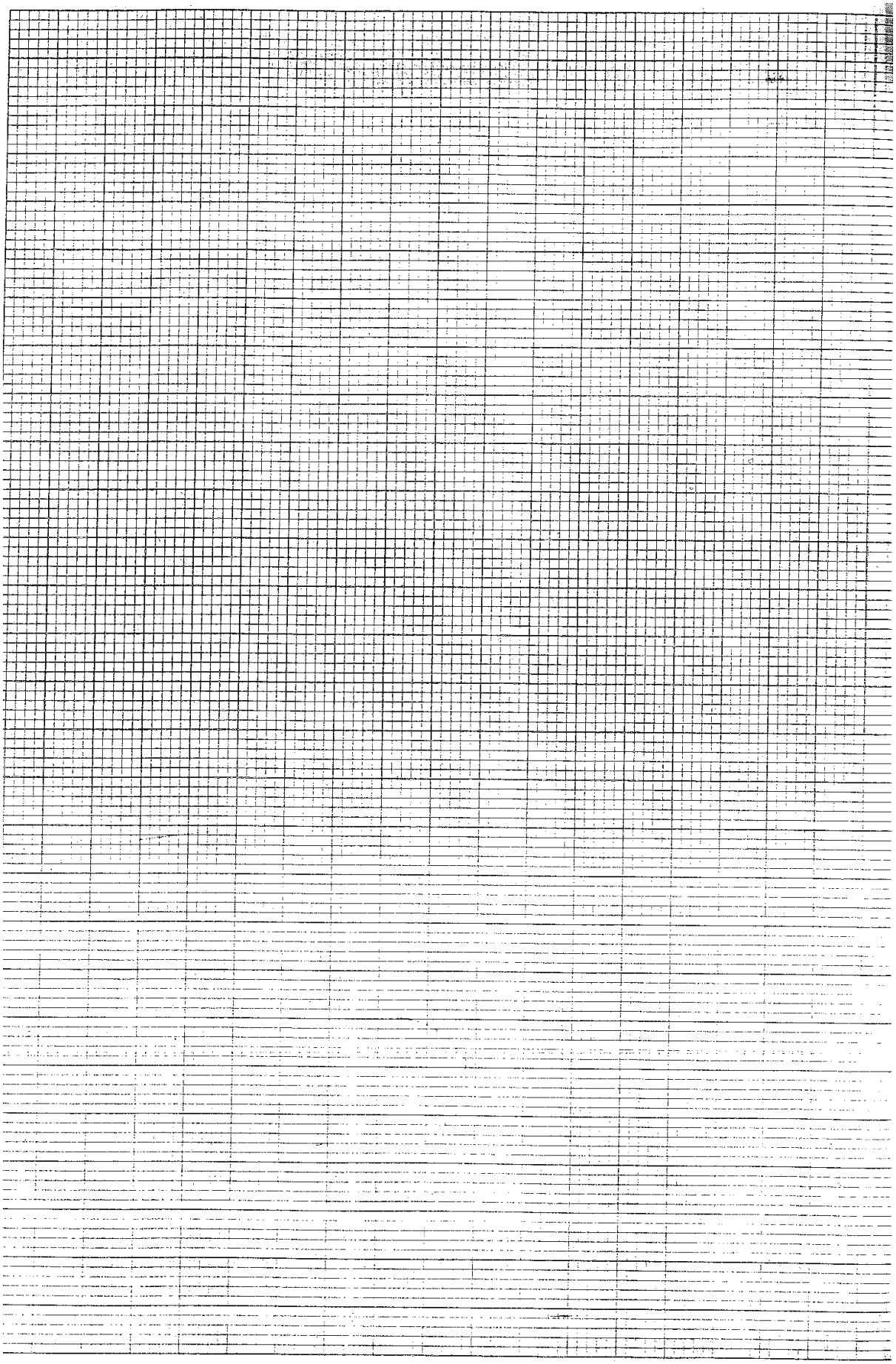
A = *unerupted*. Tooth crown is below alveolus. There may be a fenestration or window.
B = *erupting*. The crown is above the alveolus and below the occlusal plane.
C = *erupted*. The crown is level with the occlusal plane, but there are no wear facets.
D = *wear facets* are clearly visible on the cusps. No dentine is exposed.
E = cusps are *worn flat* but fissures between cusps may still be clearly visible.
F = *flat cuspal surface*. One to four islands of dentine exposed, but none of the islands are conjoined.
G = conjoined *islands* of dentine present. Some islands may not be exposed yet.
H = dentine exposed over entire surface of tooth surrounded by an *enamel ring*. Isolated fragments of surface enamel may be present.
I = *exposed pulp chamber*
J = *functional roots*

DENTAL STATUS



DENTAL STATUS

1-8 = permanent dentition
a-e = deciduous dentition
blank = jaw missing or damaged
O = unerupted (below alveolus)
U = erupting above alveolus
(write in mm. below occlusal surface)
/ = missing ante-mortem
X = missing post-mortem
Av = tooth avulsed (note infection)
= apical abscess



The end!