Introduction to Archaeology

Fall 2024
Lecture 13 (10/22)

Week 8

Telling Time

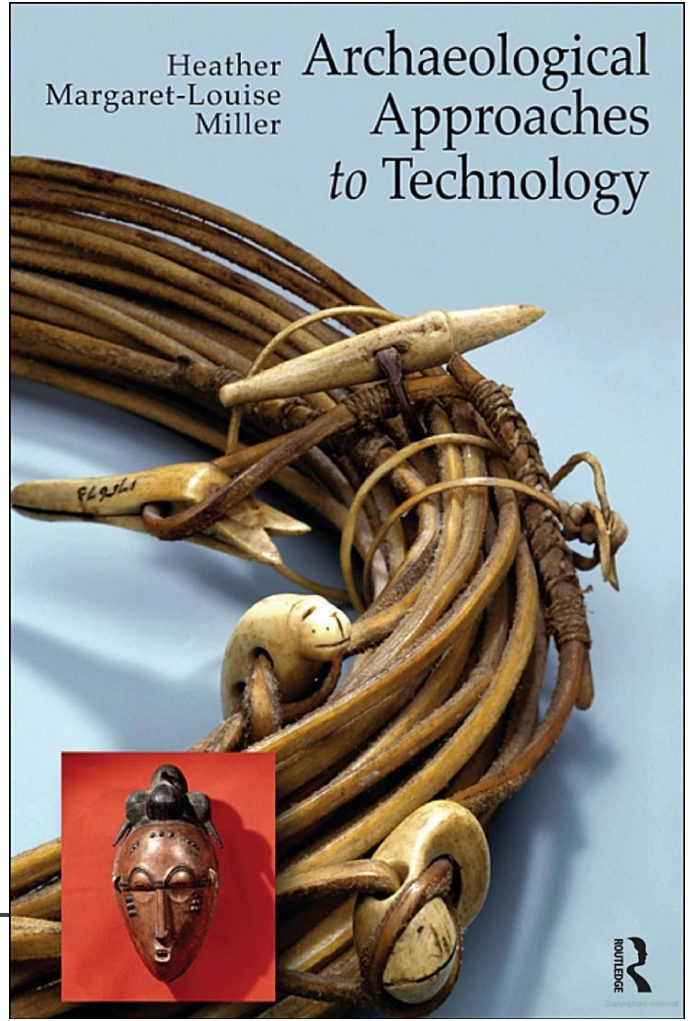
- Catch up...
  - Studying Technology (Pottery)
  - Assign 2: Methods Review Essay
- This week!
  - Absolute & Relative Dating
  - Alternative Approaches to Time

How do we study technology???

Image: Ancient Brick Kilns Inherit Traditional Firing Techniques in N China

"I think of **technology** in the context of an outwardly expanding, nested set of actions and relationships: from the **production** itself, to the **organization of the production** process, to the entire **cultural system** of processes and practices associated with production and consumption" (Miller 2007: 4-5)

[Google Books]



Introduction: Key Terms (Miller 2007, Ch1)

Production: the actual process of fabrication or creation, including both the material objects involved and the techniques or gestures used.

Organization of production: the organizational arrangement within which production takes place. This may refer to one artisan working on an object from start to finish, or it may refer to a system of specialist workers, managers, and materials procurers.

Technological systems (or just technology): refer to the active system of interconnections between people and objects during the creation of an object, its distribution, and to some extent its use and disposal. In other words, technology or technological systems can be roughly described as the processes and practices associated with production and consumption, from design to discard.

Introduction: Key Terms (Miller 2007, Ch1)

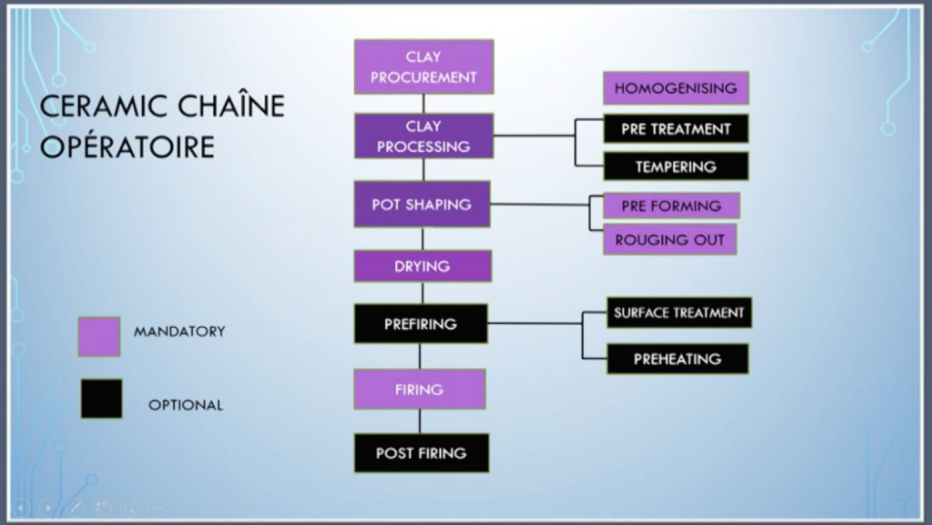
~ In contrast with the process-oriented focus of technology, I use the term **material culture** to refer to the interactions between people and objects (usually finished products). This includes both the ways in which people perceive objects and react to their culturally prescribed meanings, as well as the ways in which people give meaning to objects.

~ The discussions of the sequence of stages by which objects are produced (**production sequence or chaîne opératoire**) relate to both production and the organization of production as well as the life-histories of objects.

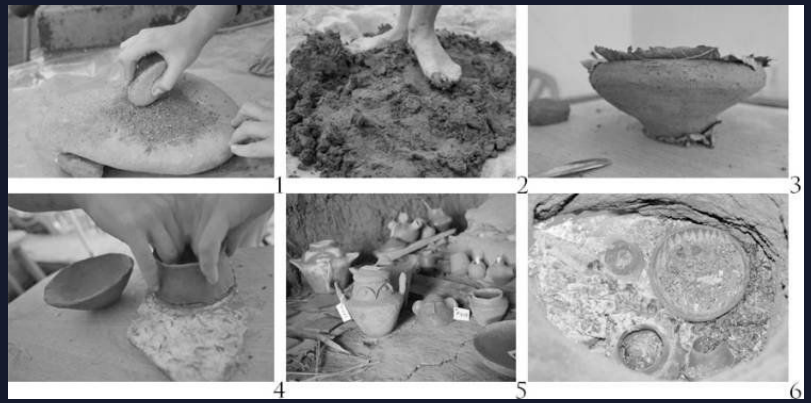
Methodology: Key Terms (Miller 2007, Ch2)

- Field techniques (survey & excavation)
- Artifact examination/analysis (simple & complex methods)
  - Qualitative vs. quantitative
- Data organization (typologies)
  - Functional? Chronological?
- Model building/expectations through analogies (e.g. **Chaîne Opératoire**)
  - Experimental archaeology
  - Ethnographic, historical & ethnoarchaeological sources

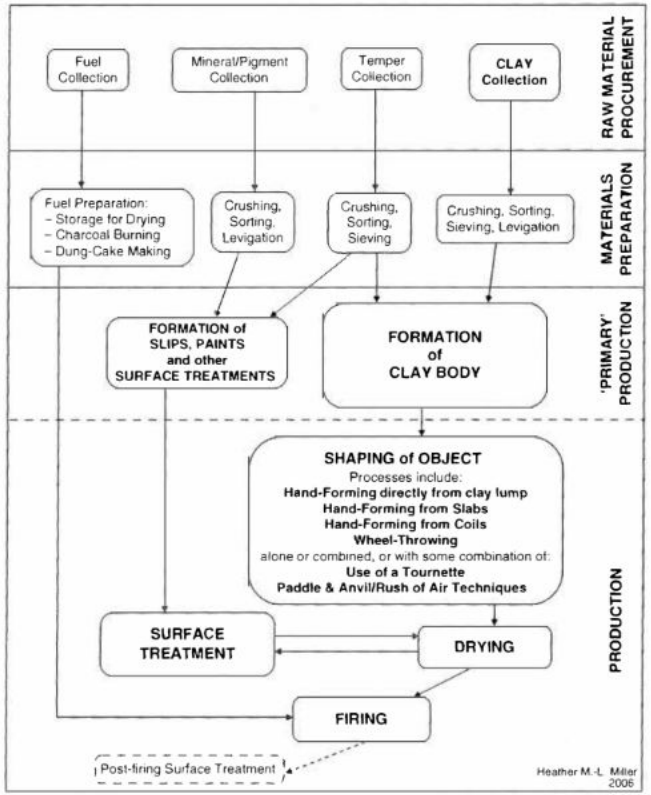
CERAMIC CHAÎNE OPÉRATOIRE



Gosselain, O. (2018) 'Pottery Chaînes Opératoire as Historical documents. Oxford Research Encyclopedia of African History

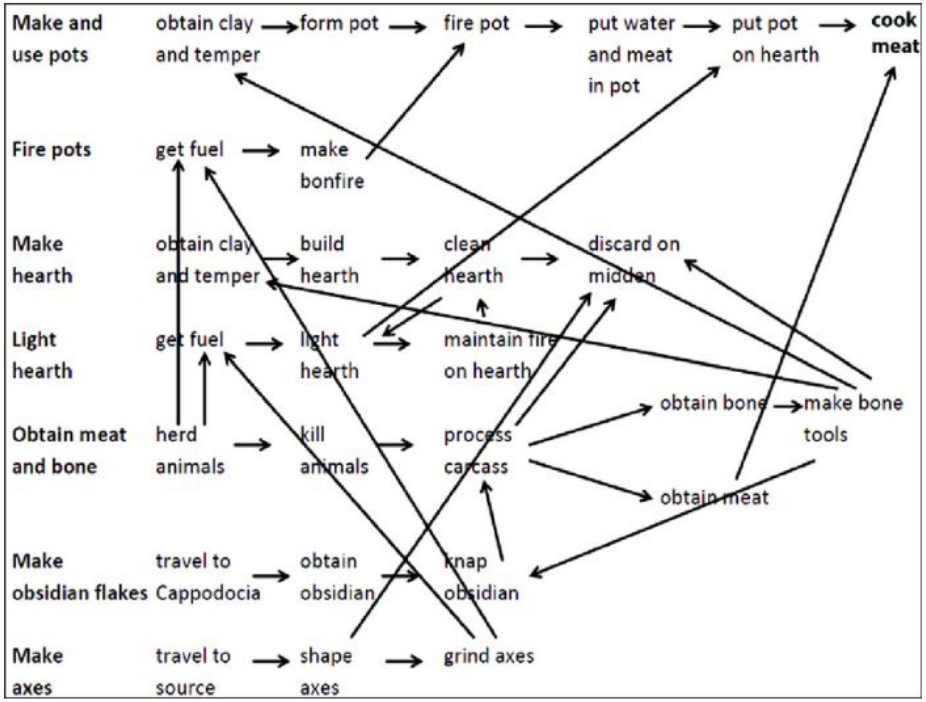


https://www.researchgate.net/publication/326324696_Identifying_the_chaine_operatoire_of_prehistoric_clay_figurines_using_experimental_archeology_and_imaging_methods



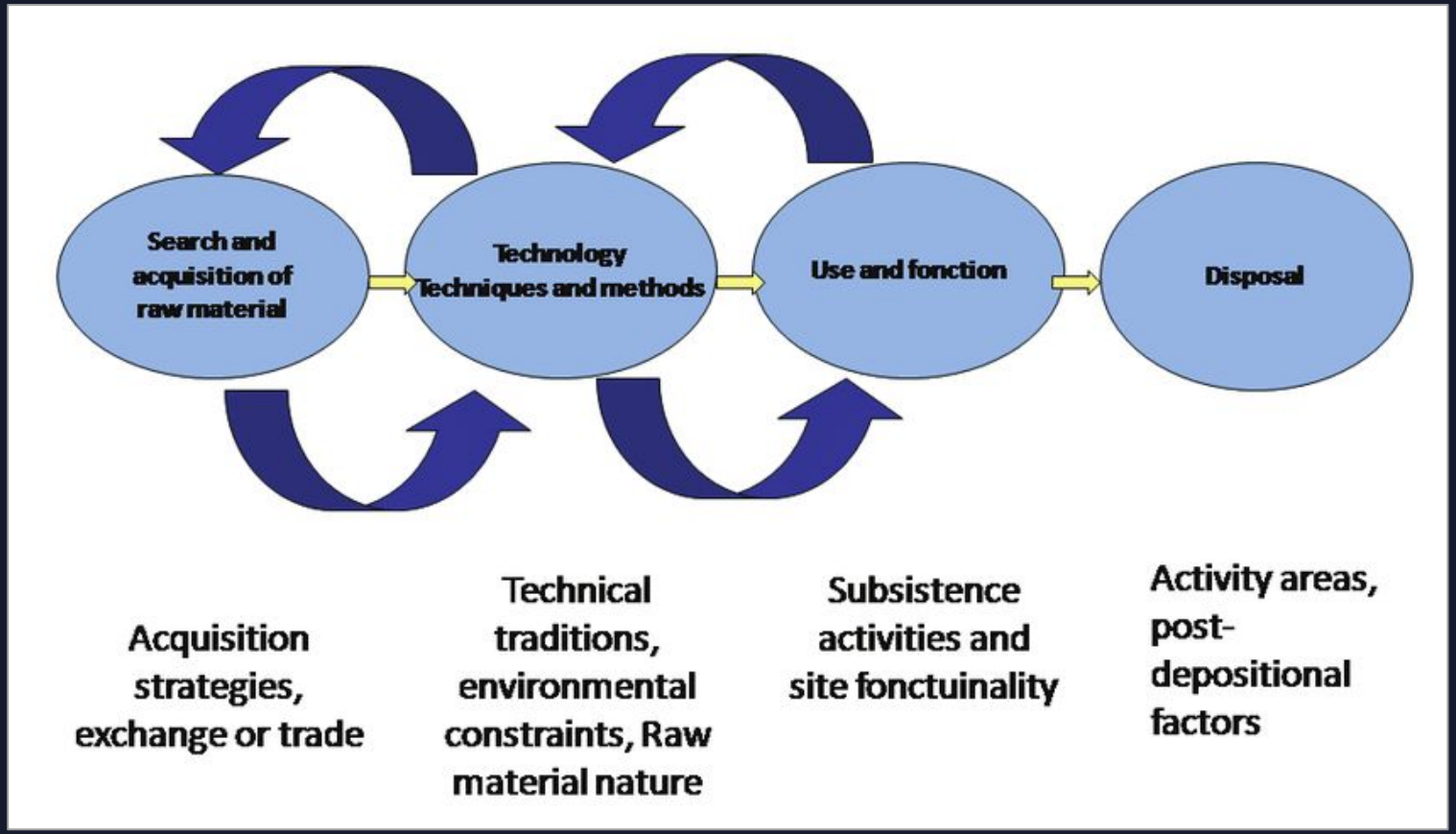
PRODUCTION PROCESS DIAGRAM FOR FIRED CLAY (pottery)

FIGURE 4.3 Generalized production process diagram for fired clay, focused on pottery (greatly simplified).



7. Operational chains for cooking pottery and their cross-connections.

https://www.researchgate.net/figure/Operational-chains-for-cooking-pottery-and-their-cross-connections_fig22_297459200



https://www.researchgate.net/publication/336374653_BREVES_APONTAMENTOS_SOBRE_O_ESTUDO_DE_INDUSTRIAS_LITICAS_TECNOLOGIA_E_CONCEITO_DE_CADEIA_OPERATORIA

https://rfamfound1.org/proj43find.html

Assignment 2: Methods Review Essay (link)

~ Crown, P. L. 2007. Life Histories of Pots and Potters: Situating the Individual in Archaeology.

~ Sillar, B. 2000. Dung By Preference: The Choice of Fuel as an Example of How Andean Pottery Production is Embedded within Wider Technical, Social, and Economic Practices.

~ Song, X., Zhang, R., & Kennet, D. 2023. The organization of Chinese ceramic production from the Tang to the Ming periods: archaeological evidence from ceramic workshops.

~ Wang, J., R. Friedman, and M.Baba. 2021. Predynastic beer production, distribution, and consumption at Hierakonpolis, Egypt.

Week 8

Telling Time

- Absolute & Relative Dating
  - Telling Stories about Time (Ch 3)
  - Scientific Sorcery (Nash 2020)
  - See website Resources too!
- Alternative Approaches to Time
  - Indigenous Perspectives in Chronology Building (Acabado lecture)
  - Indigenous Cultures have Archaeology Too (Urwin 2020)

Discuss...

“Time is complicated,

and so our temporal narratives are too”

“Time is complicated, and so our temporal narratives are too. This complexity is a key source of uncertainty in the archaeological record, but it is also a major locus of inspiration: since our chronologies are multiple rather than singular, we can experiment with them, applying different techniques, models, or data to explore the possibilities of the archaeological record and the sequences of human action it preserves” (Frieman 2023: 45)

Numerical / Absolute Dating

Archaeometry (syn. archaeological science) is a formal field of study whose practitioners apply techniques and approaches from the physical, chemical, biological, and earth sciences and engineering to address archaeological questions and problems.

- BC/ AD (Birth of Christ/ Year of the Lord)
- BCE/ CE (secular, same calendar... Common Era)
- BP (Before Present, or 1950)
  - Primarily for older dates (e.g. 40,000 BP)
  - Convert more recent dates to BC/AD or BCE/CE [or cal BCE/CE]

Important Terms & Concepts

- **Relative dates**
  - Stratigraphy
  - Cross-dating
  - Seriation (contextual & frequency)

- **Numerical dates** (absolute dates)
  - radiometric dating (C14)
  - chemical alteration dating
  - magnetism dating
  - trapped charge dating
  - layer counting (dendrochronology)

- Terminus post & ante quem
- Oral narratives
- Dating & Calibration
  - margins of error
  - Bayesian statistical methods
  - BP & cal BCE/CE
- Temporality- “the flow of time”

Basic Concepts (More Dating!)

Terminology

- *Chronometry:* the physics of dating (e.g. C14 dating)
- *Chronology:* the tasks involved in constructing the relationship between the age estimate & its archaeological significance
- *Relative* and *absolute* dating

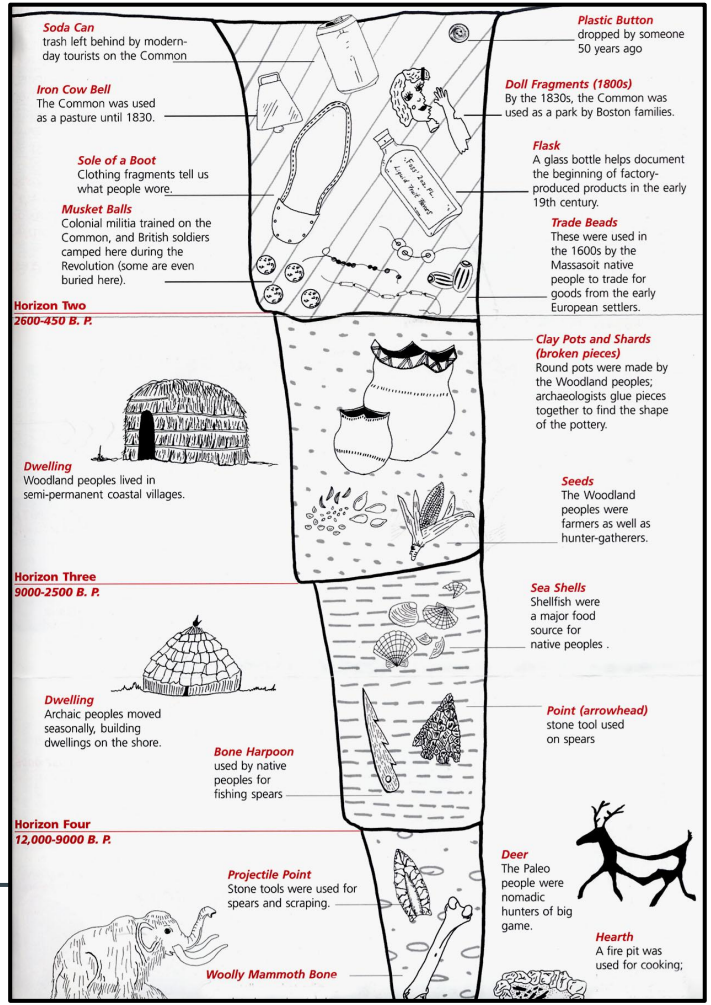
Big Questions:

1. How old it is?
2. How long does it go on?
3. How fast does it change?

Relative Dating: (1) Stratigraphy

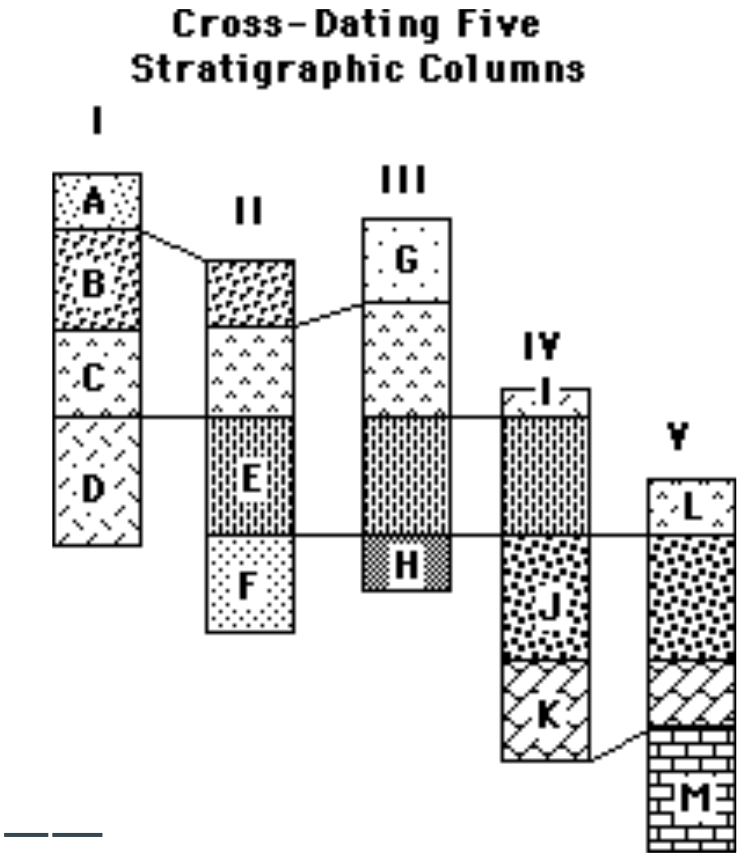
The study of layers of soil (strata)

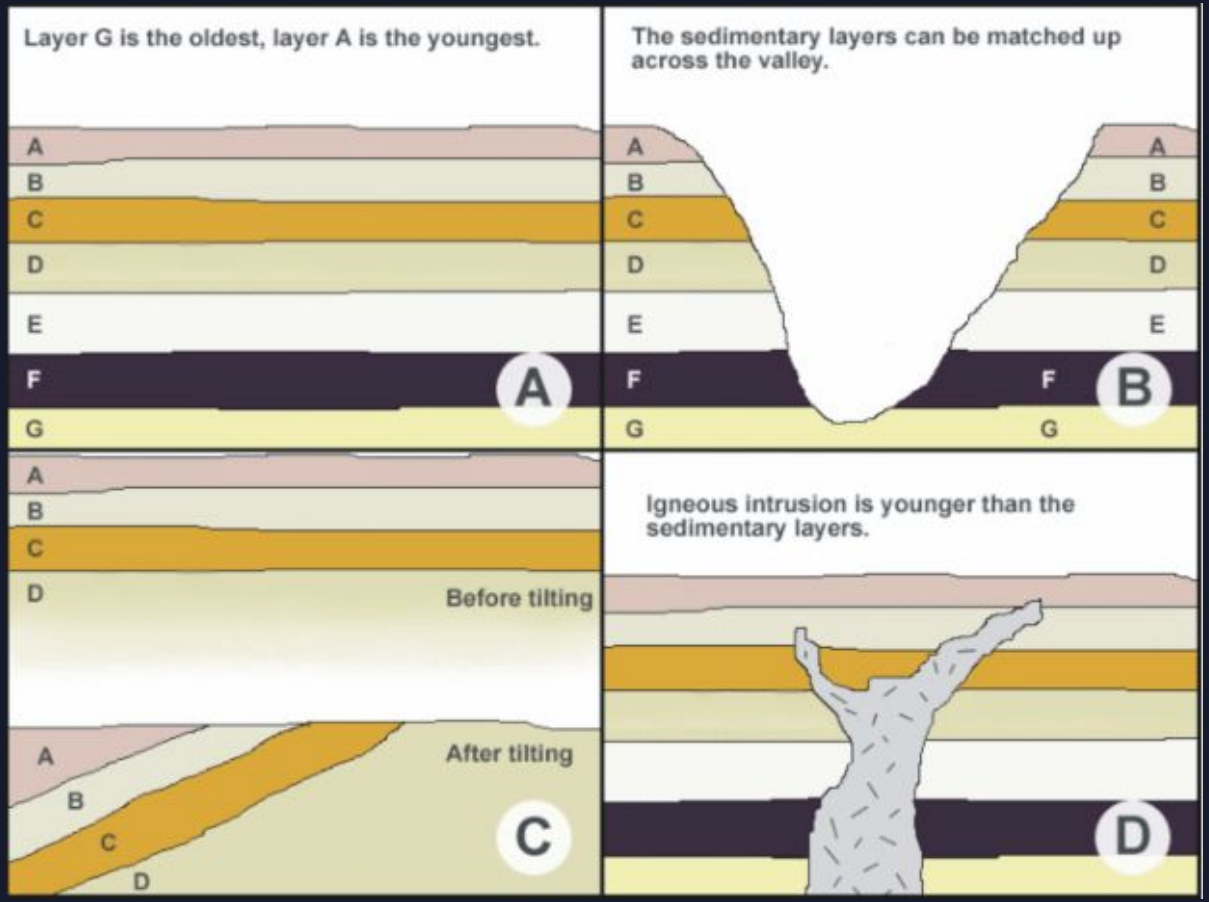
- Law of superposition
- Law of association by contents



Relative Dating: (2) Cross-dating

Technique used to take advantage of consistencies in stratigraphy between parts of a site or different sites, and objects or strata with a known relative chronology.





https://www.researchgate.net/publication/320853360_Disturbance_of_Geological_and_Anthropological_Evidence_Protection_of_Artifacts_and_Excavation_Sites

Relative Dating: (3) Seriation

- Style! “Like with like”
  - Characteristic of a time & place
- Change is gradual, evolutionary
  - Objects go in & out of style

Artifact Seriation

Seriation refers to the chronological ordering of artifacts of a particular class—but of different styles. The best artifacts are those whose styles changed at a relatively rapid rate and that are found in contexts that can be independently dated using chronometric dating.

Of all the artifacts made by Pueblo farmers in the ancient Southwest, pottery is the most sensitive for purposes of seriation dating. The styles are distinctive and they continually changed over time. Pottery is also abundant in ancient Pueblo sites, and its occurrence in many tree-ring-dated contexts has allowed archaeologists to determine fairly precisely when different styles were made.

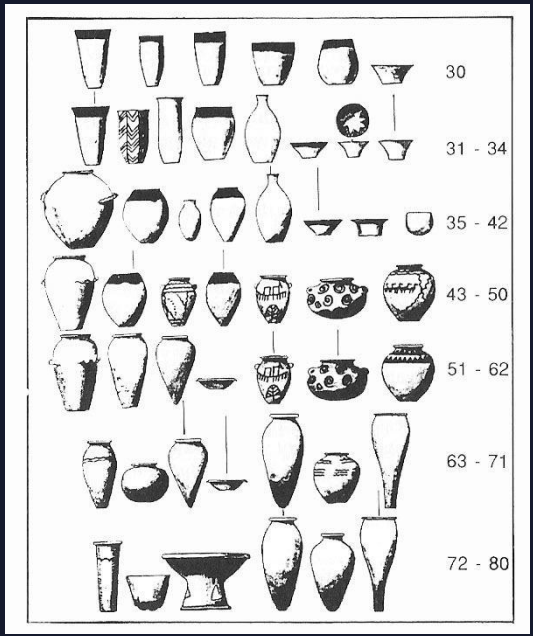
Bureau of Land Management–Anasazi Heritage Center collections; Mark Montgomery, photographer

Because the date ranges for various ancient pottery types are so firmly established, archaeologists can use the mere presence of a particular type of pottery to determine the general time period of occupation of a site, even in the absence of other dating evidence.

Seriation= comparing *assemblages* of objects, order in succession

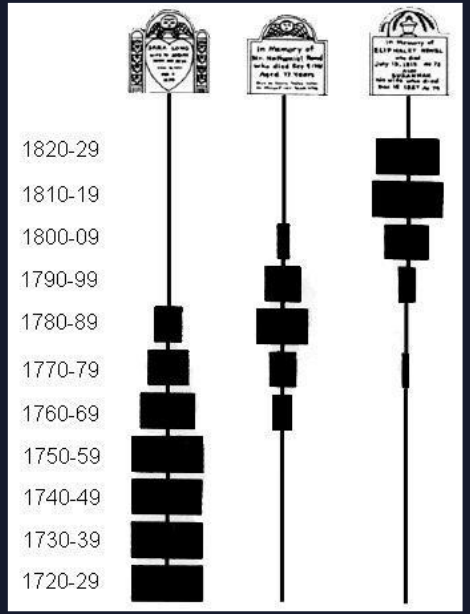
Contextual Seriation

Duration of different artifact styles (types) governs the seriation



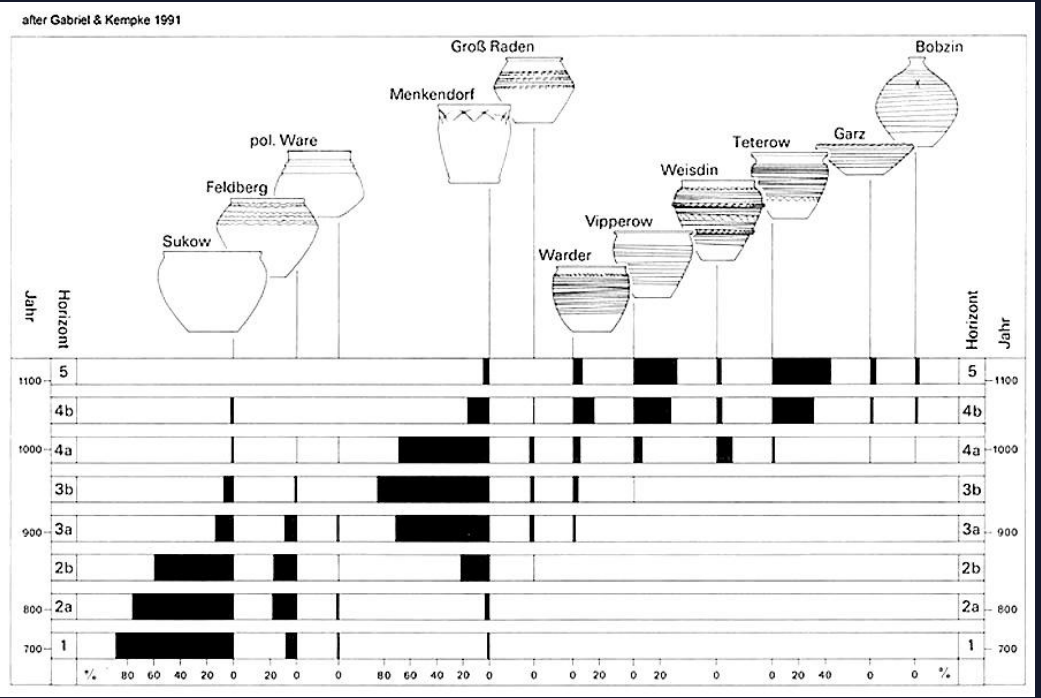
Frequency Seriation

Measuring changes in the relative abundance governs the seriation

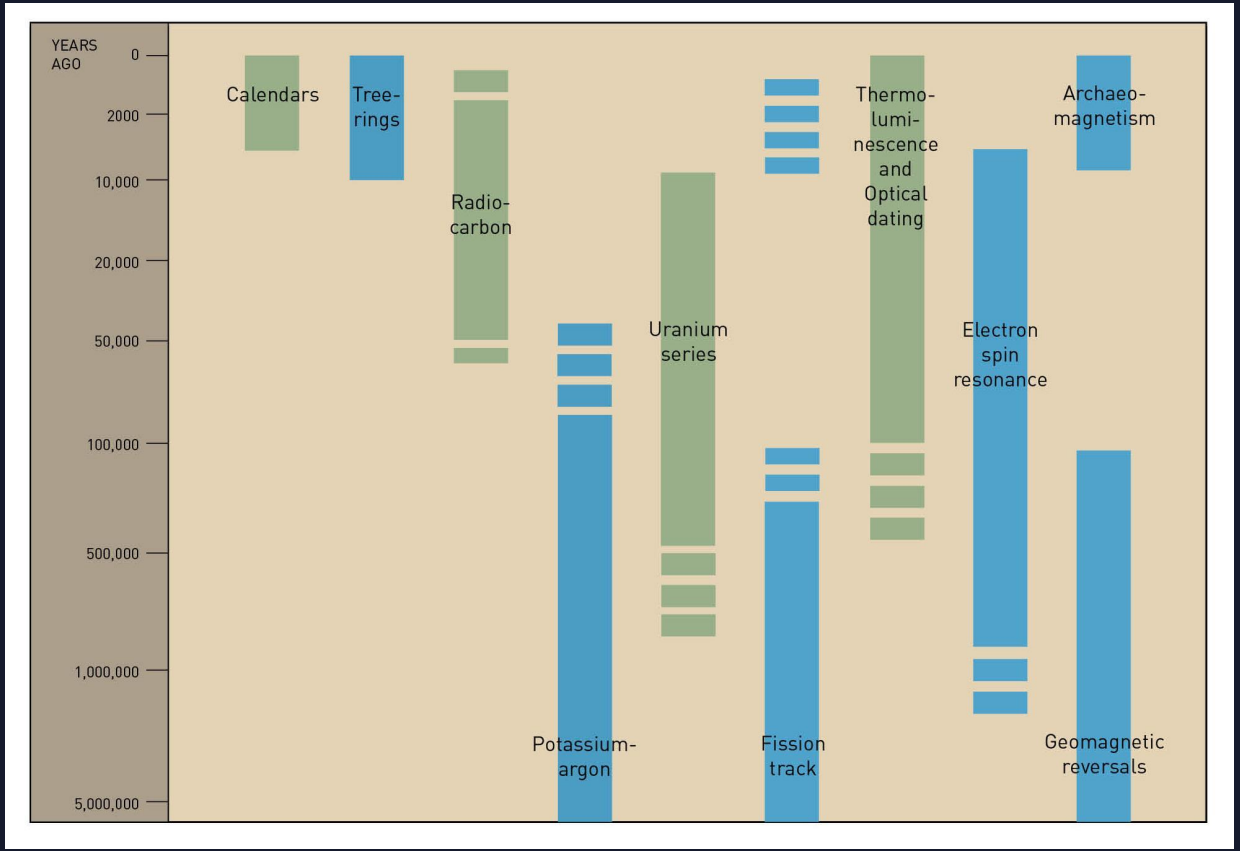


Why use pottery for stylistic chronologies?

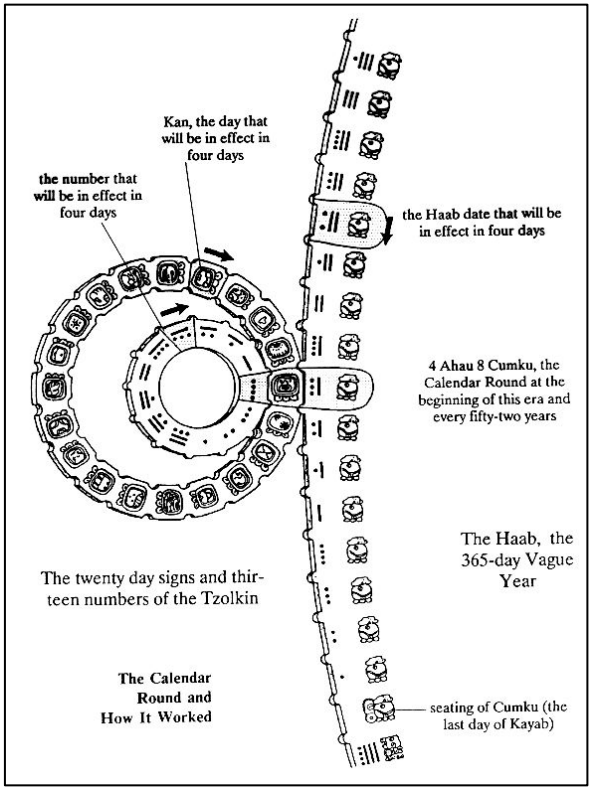
- Often decorated
- Breakable
- Durable
- Ubiquitous

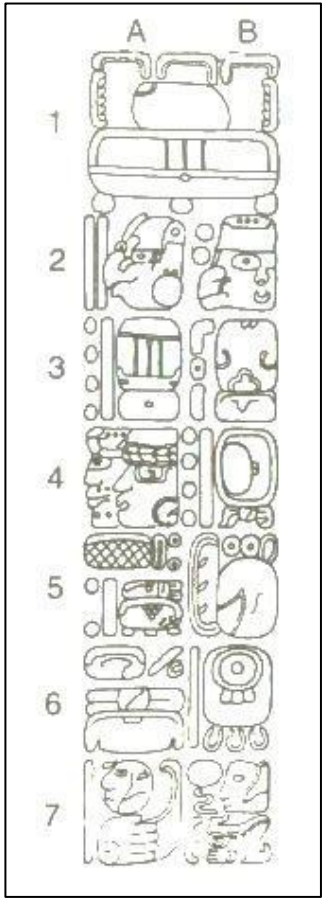


Absolute Methods



Absolute Dating: (1) Calendars





Maya Calendar Converter (today!)

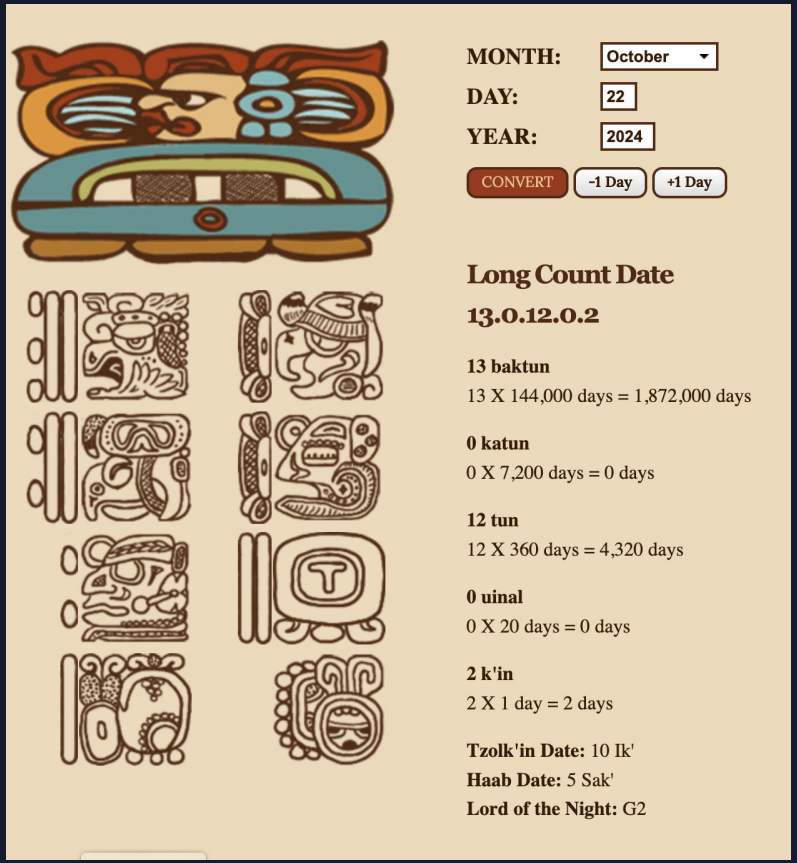
Tzolk'in Date (Sacred Calendar)

- 20 day signs, 13 numbers

Haab Date (Civil Calendar)

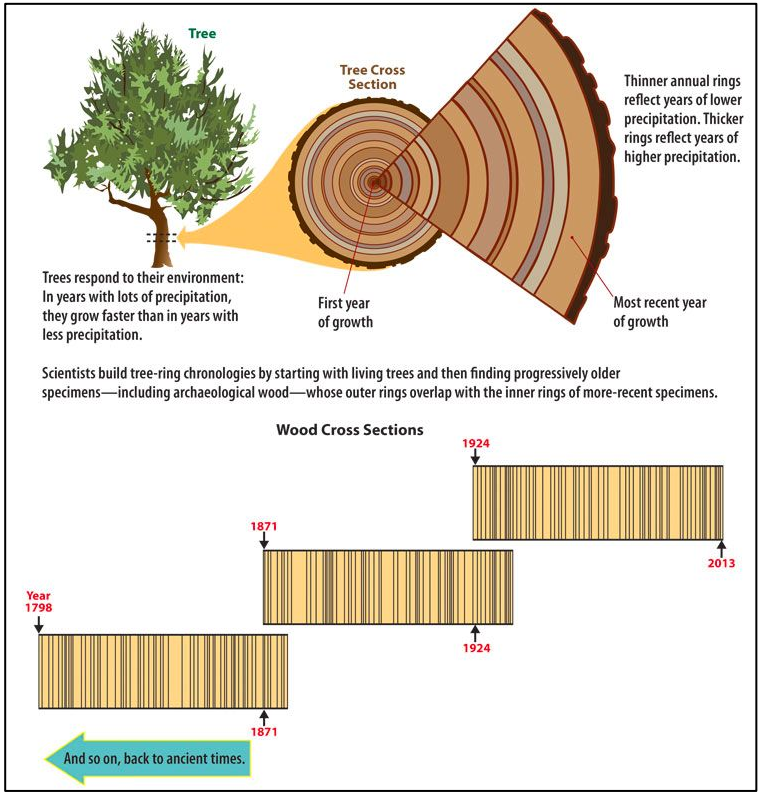
- 365 days

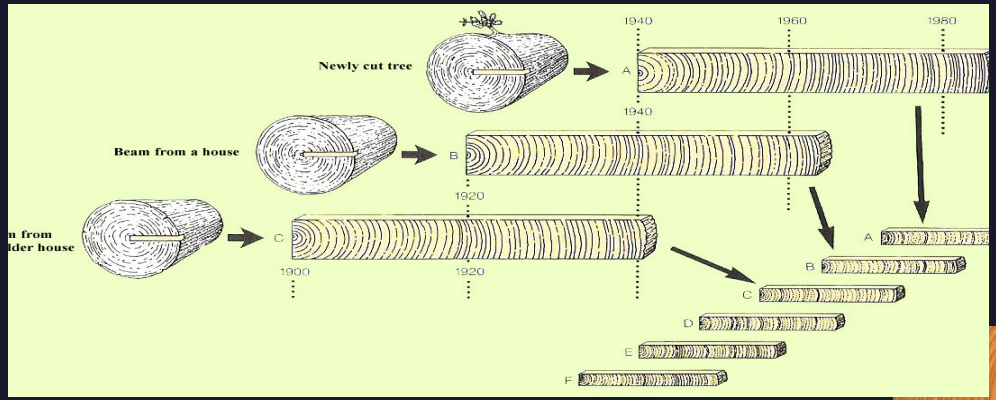
More on the Maya Calendar

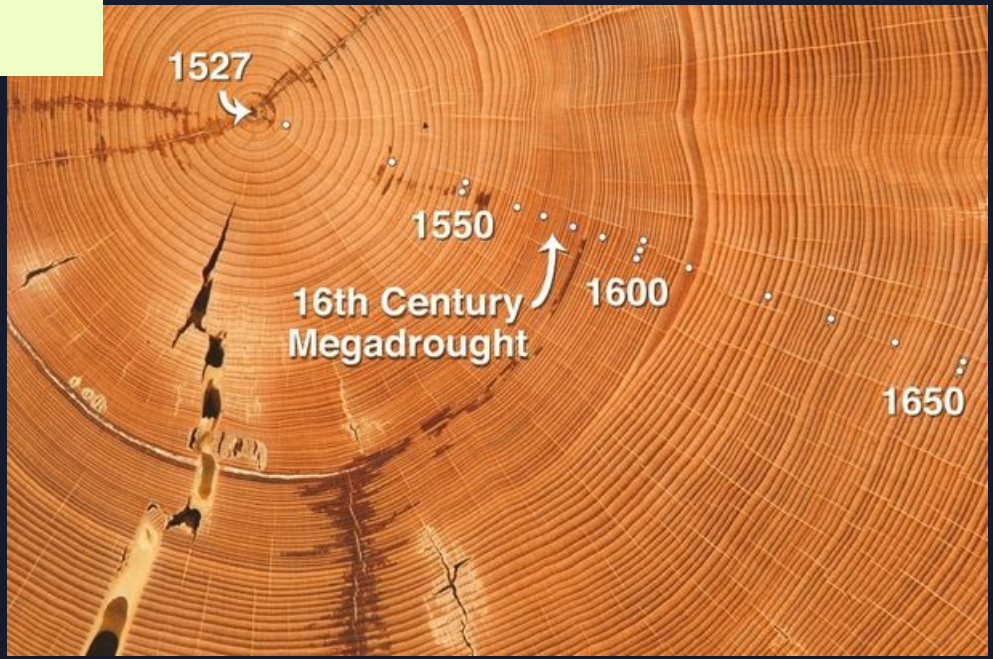


Absolute Dating: (2) Tree-Rings

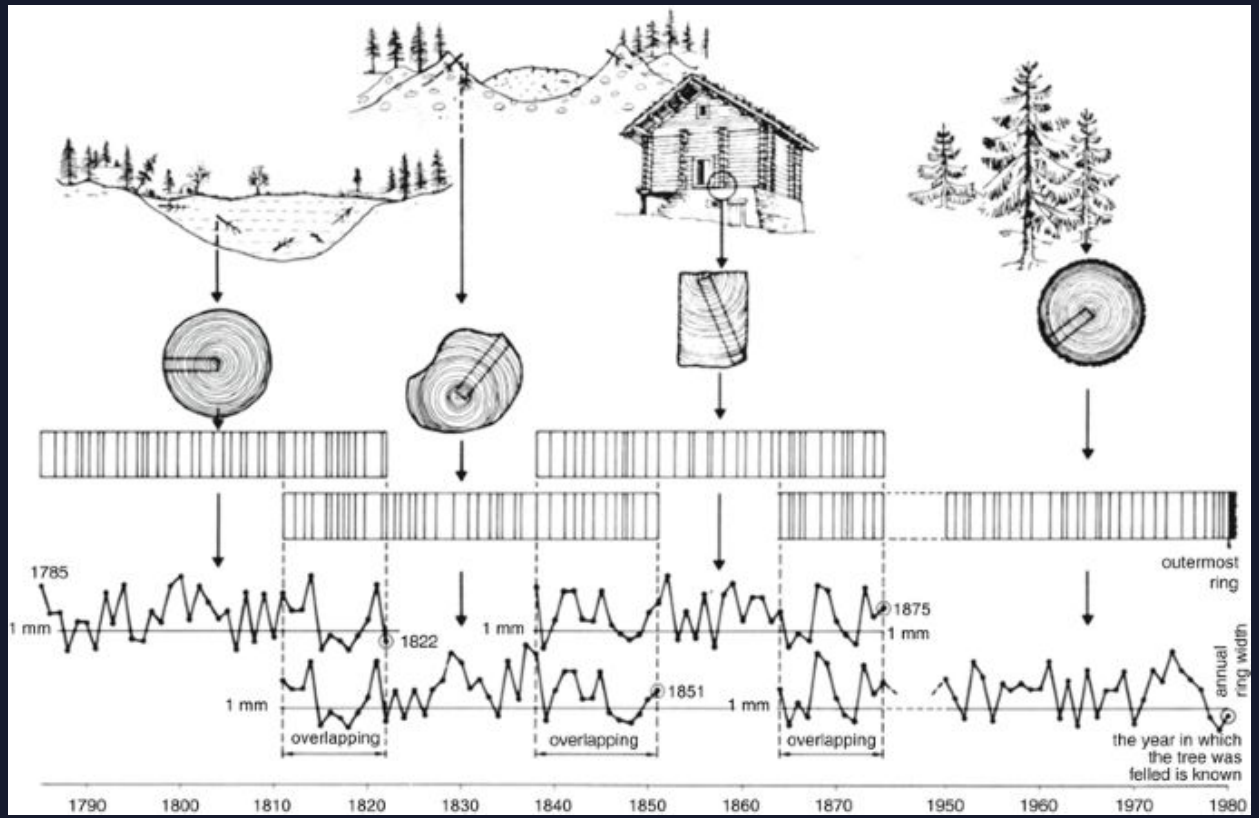
- Absolute dating method
- Calibrate/correct C14 dates





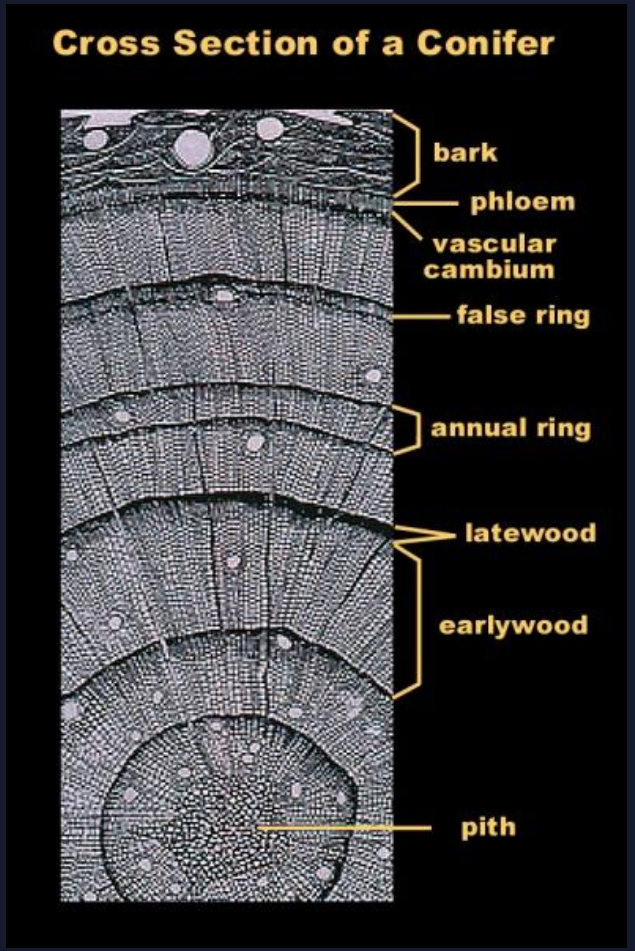


- Dendrochronology (12 mins, 2022)
- Dendrochronology @ the National Gallery (3 mins)
- Crow Canyon video w/Steve Nash (2020)


1785
1 mm
1822
1 mm
1875
1 mm
1 mm
1851
1 mm
overlapping
overlapping
overlapping
outermost ring
annual ring width
the year in which the tree was felled is known
1790
1800
1810
1820
1830
1840
1850
1860
1870
1950
1960
1970
1980

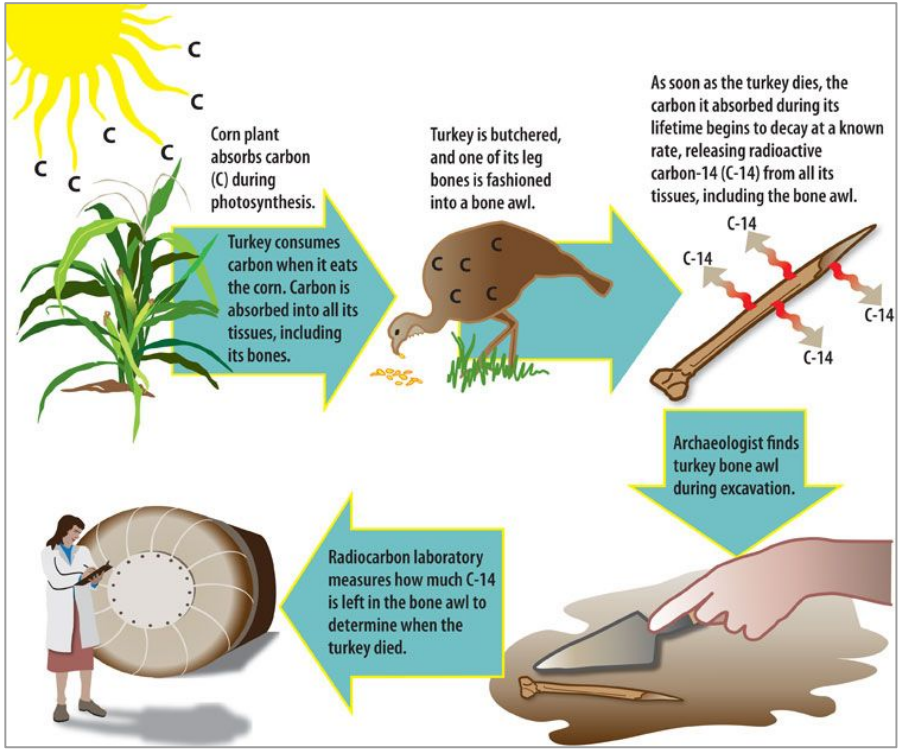
Issues &/or Limitations?

- Region-specific/only rain fed trees
- Need 20 rings for good sample
- Comparison only @ regional level
- Old wood?
- Missing outer ring= no cutting date
- Only to 8000 BCE (12,000 in some)



Absolute Dating: (2) C14

- Precise age of object/culture
- Evidence for time depth & pace
- Global comparisons possible



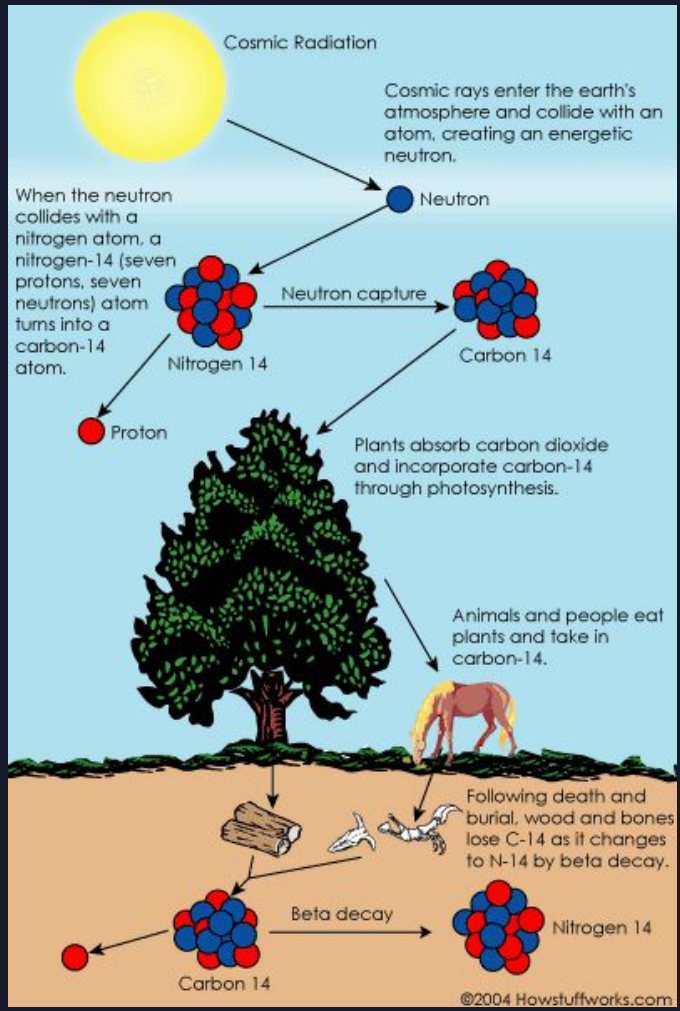
Radiocarbon (C14) Dating

What?

- C14 decays at known rate (5730 years= half-life)
- Plant/animals stop C14 uptake @ death
- Measure the amount of radiocarbon left in an organic sample (bone, wood) to determine age

How old?

- Up to 60,000 years ago



Issues &/or Limitations?

COLUMN / CURIOSITIES

The Scientific Sorcery of Radiocarbon Dating

An archaeologist explains why figuring out an object's age is harder than you think.

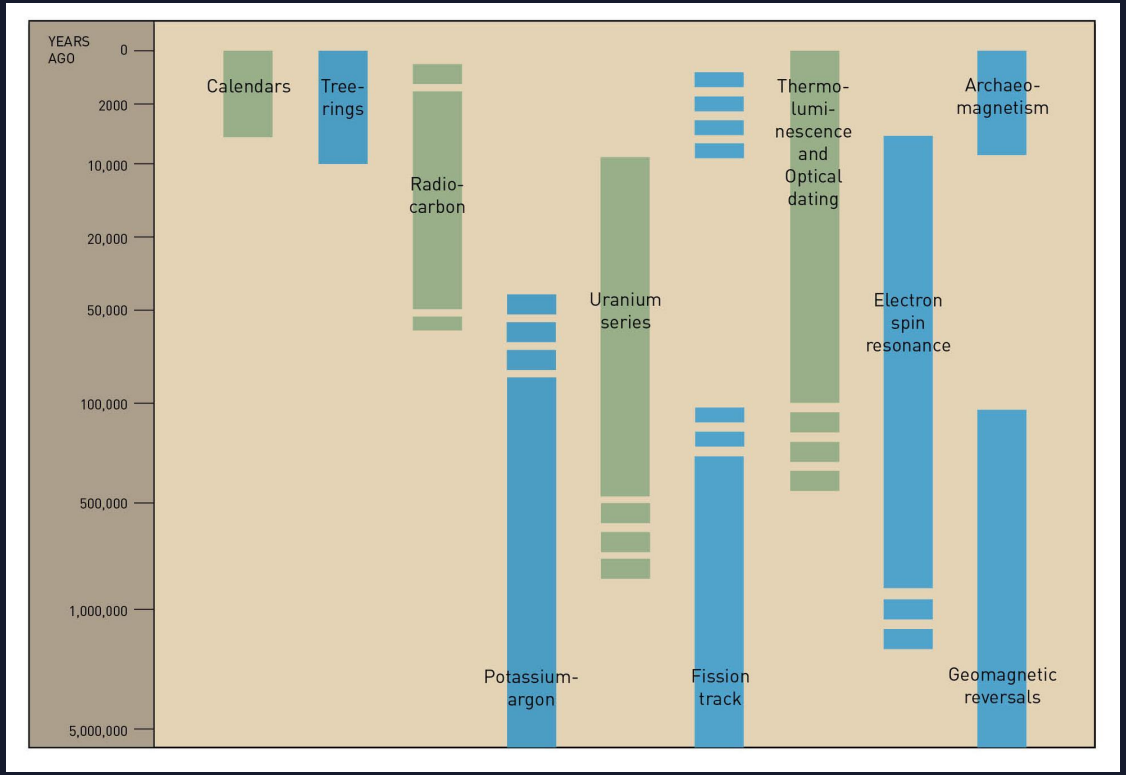
By STEPHEN E. NASH
27 MAR 2020

Stephen E. Nash is a historian of science and an archaeologist at the Denver Museum of Nature & Science. He studies a wide range of subjects, including dendrochronology (tree-ring dating), the history of museums, the archaeology of New Mexico, and Soviet gem-

Website Resources: Radiocarbon Dating & Calibration Information

- Dating: The Radiocarbon Way (GNS Science, 10 minutes)
- Radiocarbon Tree-Ring Calibration (Beta Analytic Testing Lab, text & videos)
- Radiocarbon & Dendrochronology (Kromer 2009)
- Carbon-14 Dating Explained (UChicago News, Explainer Series)
- Archaeological Dating (Crow Canyon)

Other Absolute Methods



More resources on course website!

https://www.archaeologicalresearchservices.com/services/radiocarbon.htm

Thursday: Indigenous Perspectives on Archaeology & Chronology

Week 8

Telling Time

- Absolute & Relative Dating
  - Telling Stories about Time (Ch 3)
  - Scientific Sorcery (Nash 2020)
  - See website Resources too!
- Alternative Approaches to Time
  - Indigenous Perspectives in Chronology Building (Acabado lecture)
  - Indigenous Cultures have Archaeology Too (Urwin 2020)
- Weekly Exercise 6