Chapter Outline

- Recovering Cultural and Biological Remains
- Searching for Artifacts and Fossils
- Excavation of Fossils
- Sorting out the Evidence
- Dating the Past
Refresher: Prehistory

- Refers to the period of time before the appearance of written records.
- Does not deny the existence of history, merely of written history.
Archaeology and Paleoanthropology

- Archaeologists study material physical and ecological remains to describe and explain past human cultures.
  - Ecology is study of the relation of plants and living organisms to each other and their surroundings; as well as plant and animal communities.

- Paleoanthropologists study fossil remains to understand the processes at work in human biological evolution.

- Each specialty contributes to the other’s objectives and they share many methods of data recovery.
Artifacts

- Artifacts are objects fashioned or altered by humans, such as a flint chip, a pottery vessel, or a house.
- Material culture is the durable aspects of culture such as tools, structures, and art.
- A fossil is any trace of an organism of past geological time that has been preserved in the earth’s crust.
  - Can be the remains of plants and animals that lived in the past.
Paleo-anthropologists study fossils to help construct the complex path of human evolution.

- The oldest fossils are remains of marine organisms that populated the planet's oceans. When they died, the plants and animals were buried by mud, sand, or silt on the sea floor. Land animals and plants usually decomposed or were eaten, and mainly the hard parts -- teeth, bones, shells, or wood -- were preserved.

- Fossils can be formed in several ways. Buried bone and shell contain tiny air spaces into which water can seep, depositing minerals. Reinforced by these mineral deposits, bone and shell can survive for millions of years. Even if the bone or shell dissolves, the mineral deposits in the shape of the body structure remain.
Fossil study: It’s a biocultural approach (focusing on the interaction of biology and culture)

- Besides rock, fossils may be found as the result of an organism being entombed in ice, tar or amber (a pale yellow, sometimes reddish or brownish, fossil resin - any of a class of nonvolatile, solid or semisolid organic substances, as copal or mastic, that consist of amorphous mixtures of carboxylic acids and are obtained directly from certain plants as exudations or prepared by polymerization of simple molecules), in which ancient insects have been found, wonderfully preserved.

- Rare but highly informative are fossils created by a sudden event, like a volcanic eruption, that traps living things or, footprints of human ancestors millions of years old.

- Fossil remains come to the attention of scientists when they are exposed at Earth's surface. Erosion, land movements, or excavations often have revealed important fossil finds.
Fossilization

- Involves the hard parts of an organism and may involve preservation in bogs or tar pits, immersion in water, or inclusion in rock deposits.
- Is apt to occur among animals and other organisms that live in or near water because of the likelihood that their corpses will be buried and preserved on sea, lake, and river bottoms.
The cultural practice of burial of the dead, dating about 10,000 years ago, greatly improved the fossil record.

Entirely preserved fossil skeletons before this time are rare.

Sometimes both fossils and archaeological remains are discovered accidentally, during plowing, quarrying, or building construction.
Sites

- Places containing archaeological remains of previous human activity are known as sites.
- Examples of sites are hunting campsites, kill sites, in which game was killed and butchered; village sites and cemeteries.
- Soil marks are stains that show up on the surface of recently plowed fields that reveal an archaeological site.
- Middens are a refuse or garbage disposal area in an archaeological site.
Once a site or locality has been selected for excavation, the area is divided and carefully marked with a grid system. The starting point of the dig is called the datum point – used to describe the location of unknown points on the earth. Each square within the grid is carefully excavated, and any archaeological or fossil remains are recovered. Once excavated, artifacts and fossils undergo cleaning and preservation in the laboratory.
Flotation

- An archaeological technique employed to recover very tiny objects by immersion of soil samples in water to separate heavy from light particles.
Stratified sites: marked/identified/labeled during the excavation of a large site

Layering; said of archaeological sites where the remains lie in layers, one upon another.
Soil Layers

- **O Horizon** - The top, organic layer of soil, made up mostly of leaf litter and humus (decomposed organic matter).

- **A Horizon** - The layer called *topsoil*; it is found below the O horizon and above the E horizon. Seeds germinate and plant roots grow in this dark-colored layer. It is made up of humus (decomposed organic matter) mixed with mineral particles.

- **E Horizon** - This eluviation (*leaching*) layer is light in color; this layer is beneath the A Horizon and above the B Horizon. It is made up mostly of sand and silt, having lost most of its minerals and clay as water drips through the soil (in the process of eluviation - the movement through the soil of materials brought into suspension or dissolved by the action of water).

- **B Horizon** - Also called the *subsoil* - this layer is beneath the E Horizon and above the C Horizon. It contains clay and mineral deposits (like iron, aluminum oxides, and calcium carbonate) that it receives from layers above it when mineralized water drips from the soil above.

- **C Horizon** - Also called *regolith*: the layer beneath the B Horizon and above the R Horizon. It consists of slightly broken-up bedrock. Plant roots do not penetrate into this layer; very little organic material is found in this layer.

- **R Horizon** - The unweathered rock (*bedrock*) layer that is beneath all the other layers.
Excavation of Fossils

- A fossil is of little value unless its place in the sequence of rocks that contain it can be determined.
- Skill and caution are required to remove a fossil from its burial place without damage.
Although the wooden posts of a house may decay, their positions may be marked by soil discoloration.

The plan (left) of an ancient posthole pattern and depression at Snaketown, Arizona, permits the hypothetical house reconstruction (right).
Sorting Out the Evidence

- Excavation records include:
  - Scale map of all the features
  - Stratification of each excavated square
  - Description of the exact location and depth of every artifact or bone unearthed
  - Photographs and scale drawings of the objects
Bioarchaeology: Understanding Past Cultures through analysis of skeletal remains

- What are coprolites?
  - Coprolite is the scientific term for fossilized human or animal feces.
  - They provide information on prehistoric diet and health.
  - Elements such as seeds, insect skeletons, and tiny bones from fish and amphibians have been found/preserved in coprolites.

- Weather & climate changes can destroy evidence of organic remains.
  - Rain and humidity can destroy traces of woodwork, textiles or basketry.
Laboratory Methods & Genetic Revolution:
Extracting Genetic Material from Skeletal Remains

- **Endocast** - A cast of the inside of a skull; helps determine the size and shape of the brain.

- **Polymerase chain reaction (PCR)** - A technique for amplifying or creating multiple copies of fragments of DNA so that it can be studied in the laboratory.
  - DNA will decay over time if it is not preserved in a stable material like amber.

- **Bioarchaeology** - The archaeological study of human remains emphasizing the preservation of cultural and social processes in the skeleton.

3 hours of lab work for each hour of fieldwork
Dating the Past

- **Relative dating** - In archaeology and paleoanthropology, refers to the process of designating an event, object, or fossil as being older or younger than another.

- **Absolute or chronometric dating** - In archaeology and paleoanthropology, dates for archaeological materials based on solar years, centuries, or other units of absolute time.
Dating the Past…

Some archaeologists prefer the terms *chronometric* or *calendar dating*; when we think of the word "absolute", it implies a certainty and precision that is rarely possible in archaeology.

Remember, archaeologists examine every recoverable detail from past societies including all kinds of structures (not just palaces and temples), hearths (base of fireplaces), garbage dumps, bones and plant remains.
### Absolute And Relative Dating Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Time Period</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratigraphy</td>
<td>Relative only</td>
<td>Based on the <strong>law of superposition</strong>.</td>
</tr>
<tr>
<td>Fluorine analysis</td>
<td>Relative only</td>
<td>Compares the amount of fluorine from surrounding soil absorbed after deposition</td>
</tr>
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</table>

This law states that strata that are younger will be deposited on top of strata that are older, given normal conditions of deposition. This law is the guiding principle of **stratigraphy**, or the study of geological or soil layers. **Stratigraphy** is still the single best method that archaeologists have for determining the relative ages of archaeological materials.
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<tr>
<td>Faunal and floral series</td>
<td>Relative</td>
<td>Sequencing remains into chronological order based on an evolutionary sequence established in another region with reliable absolute dates</td>
</tr>
<tr>
<td>Seriation</td>
<td>Relative</td>
<td>Sequencing cultural remains into relative chronological order based on stylistic features</td>
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<td>Dendrochronology</td>
<td>3,000 years (BP) max.</td>
<td>Compares tree growth rings in a site with a tree of known age.</td>
</tr>
<tr>
<td>Radiocarbon</td>
<td>Accurate &lt; 50,000 BP</td>
<td>Compares the ratio of radioactive reliable absolute dates $^{14}\text{C}$ (with a half-life of 5,730 years) to stable $^{12}\text{C}$ in organic material</td>
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<tr>
<td>Potassium</td>
<td>&gt;200,000 BP</td>
<td>Compares the amount of radioactive potassium (40K with a half-life of 1.25 billion years) to stable argon.</td>
</tr>
<tr>
<td>Amino acid</td>
<td>40,000–180,000 BP</td>
<td>Compares the change in the number of proteins in a right vs. left-sided three-dimensional structure</td>
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<td>Thermoluminescence</td>
<td>Possibly up to 200,000 BP</td>
<td>Measures the light given off due to radioactivity when sample heated to high temperatures</td>
</tr>
<tr>
<td>Electron spin resonance</td>
<td>Possibly up to about 200,000 BP</td>
<td>Measures the resonance of trapped electrons in a magnetic field</td>
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<td>Fission track</td>
<td>Wide range of times</td>
<td>Measures tracks left in crystals by uranium as it decays</td>
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<tr>
<td>Paleomagnetic reversals</td>
<td>Wide range of times</td>
<td>Measures orientation of magnetic particles in stones and links them to whether magnetic field of earth pulled toward the north or south during their formation</td>
</tr>
<tr>
<td>Uranium series</td>
<td>40,000–180,000</td>
<td>Measures the amount of uranium decaying in cave sites</td>
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