

## Fossils and Geologic Time

- **Paleontology** - study of the geologic history of life
- **Fossil** - any evidence of past life
- **Body fossil** - the remains of a part of the organism
- **Trace fossil** - evidence of an organism's behavior or activity
- **Conditions that promote fossilization:**
  1. low-energy environment of deposition
  2. fine-grained sediment
  3. rapid burial
  4. possession of hard parts

## Linnean Classification System

- Plants and animals are grouped in hierarchical order according to their degrees of similarity

Kingdom	-----	Animalia
Phylum	-----	Vertebrata
Class	-----	Mammalia
Order	-----	Primates
Family	-----	Hominidae
Genus	-----	<i>Homo</i>
Species	-----	<i>Sapiens</i>
Individual organism	-----	Dr. Long

## Cladistics

- **Clade:** All the members of a group of related organisms extending back through geologic time to their earliest common ancestor
- **Cladistics:** a procedure based upon comparisons of numerous characteristics of living and fossil organisms to interpret the relationship of their lines of descent (clades) through time.

## Body Plans (symmetry)

- **Spherical, radial:** the organism is symmetrical around a central point. Examples: algal fruiting body, some types of coral
- **Pentagonal:** five-fold symmetry. Example: some echinoids
- **Coiled:**
  - coiling in vertical plane. Example: some gastropods
  - coiling in a horizontal plane. Example: some ammonites
- **Bilateral**
  - bivalves: plane of symmetry passes between the valves, hence each valve is a mirror image of the other valve.
  - brachiopods: plane of symmetry passes through the center of each valve, hence one-half of each valve is the mirror image of the other half.

## Types of Fossilization

- Fossilization *without* alteration – trapped in amber, frozen mammoth, mummification
- Fossilization *with* alteration
  - **Replacement:** atom-by-atom replacement (petrified wood)
  - **Permineralization:** minerals deposited in pores (fossilized bone)
  - **Compression:** carbon residue left behind from soft-part alteration
  - **Mold:** fossil surrounded by hardened sediment is dissolved, leaving a cavity in the shape of the original fossil
  - **Cast:** forms when the mold is filled with sediment (which then hardens)
- Trace fossils - include only *signs* of the organism's activity; examples include footprints, coprolite (fossilized dung; glauconite), and burrows.

## Principles of Stratigraphy

1. **Superposition:** in an undisturbed sequence of strata (layers), younger strata overlie older strata (a law).
2. **Original horizontality:** sediments are initially deposited in horizontal strata (a principle generally observed).
3. **Cross-cutting relationships:** faults and igneous intrusions must be younger than the rocks they cut (a law).
4. **Faunal succession:** there is a regular, definite progression of fossil forms in going from lower (older) to higher (younger) strata. This fossil succession is unique, and cannot be repeated in the same manner during another episode of geologic time (principle).

## Attributes of Index Fossils, and Bias in the Fossil Record

- Index fossils are:
  - abundant
  - geographically wide-ranging
  - readily preserved
  - identifiable with a specific interval of geologic time
  - useful in estimating relative ages of rock bearing fossils
  - helpful in correlating rocks bearing similar fossils
- Bias introduced into the rock record:
  - preservation bias
  - collector's bias

## Geologic Time Scale

- Divided into Archean and Proterozoic (both Precambrian), and Phanerozoic **eons**
- Phanerozoic divided into 3 major **eras**:
  - Cenozoic (most recent)
  - Mesozoic
  - Paleozoic (most ancient)
- Eras divided into geologic **periods**

## Major Geologic Events

(younger to older)

- Pleistocene: Ice Ages
- End of Cretaceous (K): extinction of non-bird dinosaurs
- End of Permian (Pm): largest of all mass extinctions (trilobites go extinct)
- Silurian: plants move to land
- Cambrian: all major animal phyla represented