**17.2 Determining Absolute Age**

1. Counting **varves** – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bands that can be found in glacial lakes
   * A coarse summer layer and the overlying fine winter layer make up one \_\_\_\_\_\_\_\_.
2. Radioactive decay
   * A radioactive isotope “decays” or breaks down at a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rate from its “parent” element to its “daughter” element. At any one time, a scientist can measure the amount of parent to daughter material and identify the absolute age of the rock.
   * For instance, 10 grams of U-238 (parent) will decay into 5 grams of Pb-206 (daughter) in \_\_\_\_\_\_\_ billion years. This is considered its **half-life**, the time it takes for half the mass of a radioactive element to \_\_\_\_\_\_\_\_\_\_\_ into its daughter elements.
   * By counting half-lives, the oldest rocks on Earth have been dated at \_\_\_\_\_\_ billion years old.
3. Carbon dating
   * Carbon-14 (parent) decays into Nitrogen-14 (daughter) in 5,730 years and is great for dating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material like wood, bones, shells, and the remains of early humans.

**17.3 The Fossil Record**

* **paleontology** is the study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Almost all fossils are found in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rock. Sediments generally cover but do not damage a dead organism. Only dead organisms that are buried quickly or protected from decay can be fossils.
  + Why aren’t fossils found in metamorphic or igneous rock?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Kinds of Fossils:
  + **mummification** – remains are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and do not decay
  + **amber** – organism preserved in hardened tree \_\_\_\_\_\_\_\_\_\_
  + **tar seeps** – remains preserved in natural \_\_\_\_\_\_\_ seeps (formed by thick petroleum oozing to the earth’s surface).
    - La Brea Tar Pits, Southern \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + **freezing –**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ remains; no decay
    - Mastodons, woolly mammoths, woolly rhinoceroses – all which lived 40,000 to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years ago
  + **petrification** – atom by atom, remains are replaced by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Silica, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and pyrite are common petrifying minerals
    - Petrified Forest National Park, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + **trace fossils** – tracks, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, droppings, and burrows that provide information about an organism’s prehistoric life
  + **imprints -** displays the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ features of the organism
    - Carbonized imprints of leaves, stems, flowers, and fish made in soft mud or clay
  + **molds** – empty cavities that once contained \_\_\_\_\_\_\_\_\_\_\_\_ of snails, parts of trees, etc.
    - It retains the shape and surface markings of the original organism
  + **cast -**  when sand or mud fills a mold and hardens
    - This creates a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the original organism
  + **coprolites** – fossilized \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material from ancient animals
  + **gastroliths** – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from a dinosaur’s digestive system
* **index fossils** – fossils that are typical of a particular \_\_\_\_\_\_\_\_\_\_ segment of Earth’s history
  + What are characteristics of an index fossil?
    - Must be easily recognizable
    - Must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Must be limited in time (not found in every time period)