

Fossils are preserved remains or traces of living organisms.

- *Fossils are found in sedimentary rocks:* Fossilization is not random. Hard parts — teeth, bones, shells — are most likely to be fossilized. Only under very rare conditions are soft body parts fossilized. Taphonomy is discussed in the laboratory on macroevolution.
- *Trace fossils preserve some behaviors:* Footprints, tracks, burrows, and underground nests occasionally provide information about behavior, e. g. stride length, gait, etc.
- *Some recent fossils can yield DNA for analysis:* DNA, primarily mitochondrial DNA, has been extracted from many fossils. The current upper limit is roughly 100,000 years. Whether DNA can be extracted from a fossil depends on the conditions of preservation and storage. Heat and humidity degrade DNA rapidly. Claims of sequencing DNA extracted from older specimens, including ancient bacteria, leaves, dinosaurs, and insects in amber, are not valid.

Relative and absolute dates can be estimated

- *Relative dates:* Relative ages are indicated by relative position. The principle of superposition, that older strata lie under younger strata, was recognized in the 18th century by mining engineers.
- A stratum was and is recognized by finding index fossils, which are fossil species or groups of fossil species that together uniquely identify it. For example, trilobites are fossils that indicate the beginning of the Paleozoic era.
- You are responsible for the periods and eras of the phanerozoic (the past 540 million years, or so).
- *Absolute dates:* Radioactive elements, such as carbon-14 and uranium-238 decay at rates that are measurable today. Using the uniformitarian assumption, you can convert the ratio of “parent” to “daughter” isotopes into an estimate of time.
- Different elements are used to estimate ages of fossils of very different age. C¹⁴ has a half-life of 5730 years, which makes it suitable for dating organic remains found at archaeological sites. N¹⁴ is the daughter isotope, which is otherwise very rare. U²³⁸ has a half-life of 4.5 billion years. The daughter isotope is Pb²⁰⁶.

Example question

Which is the correct assignment of approximate dates to the **ends** of the eras listed?

- a. Precambrian (542 mya), Paleozoic (251 mya), Mesozoic (65.5 mya).
- b. Precambrian (542 mya), Paleozoic (251 mya), Mesozoic (50 mya).
- c. Precambrian (2200 mya), Paleozoic (542 mya), Mesozoic (50 mya).
- d. Precambrian (1200 mya), Paleozoic (251 mya), Mesozoic (65.5 mya).
- e. Precambrian (542 mya), Paleozoic (65.5 mya), Mesozoic (6 mya).

Answer: A