

FOSSILS, GEOLOGIC TIME & CLADISTICS

See the **GEOLOGIC TIME SCALE** and answer the following questions:

1. During which time period did most of the marine animals go extinct? How long ago was this? Which era was this in?
2. In which period did we see the first fishes? How long ago was this?
3. During which epoch did we see the first placental mammals? Which period was this in?
4. How long ago did the first of "modern man" appear on the time scale?

Now find the **ROCK STRATA** and answer the following:

5. Which type of rock is from the Carboniferous period? (*Refer to your geologic time scale*)
6. If a fossil is found in Hermit Shale, is it older or younger than a fossil found in Limestone?
7. Approximately how old is a fossil found in the Supai group? (*You will have to look back at the geologic time scale to answer this question*)

Look at the **HALF LIFE** example...

8. The half-life of this sample element were 1000 years. Based on what you are given for the remaining amount of the sample element, how old would this fossil be?

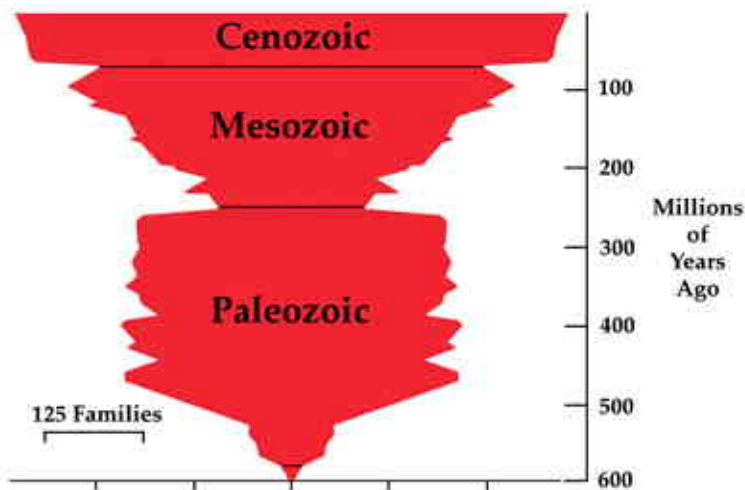
Examine the **EXTINCTIONS OF THE PAST** graph...

9. How many millions of years ago was the **first** major explosion in the number of species?
10. About how many millions of years ago was the **last** major extinction?
11. Which era began immediately following this last extinction?

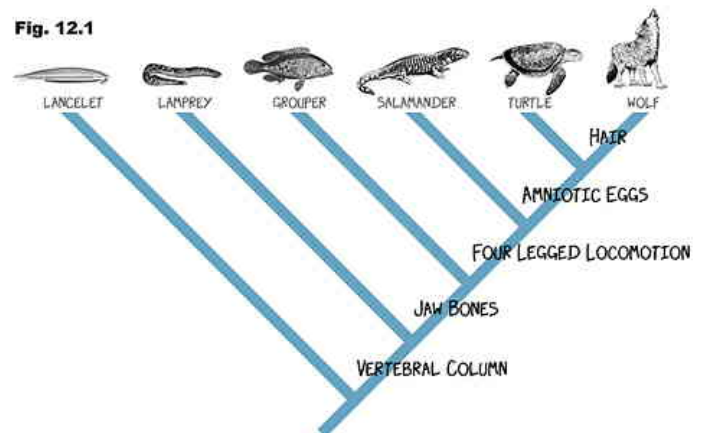
Find the **CLADOGRAM**...

12. What structure is shown here that separates lampreys from groupers?
13. Which type of animal is the 'oldest' on this cladogram?
14. Which animal shown here was the first to have 'four-legged locomotion'?
15. Which animals have an amniotic egg?

EXTINCTIONS OF THE PAST



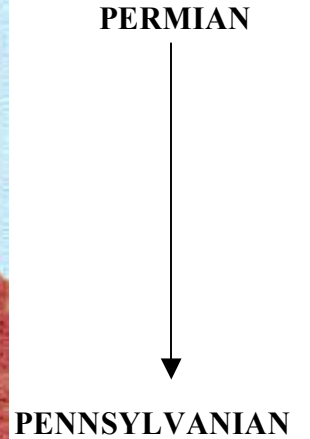
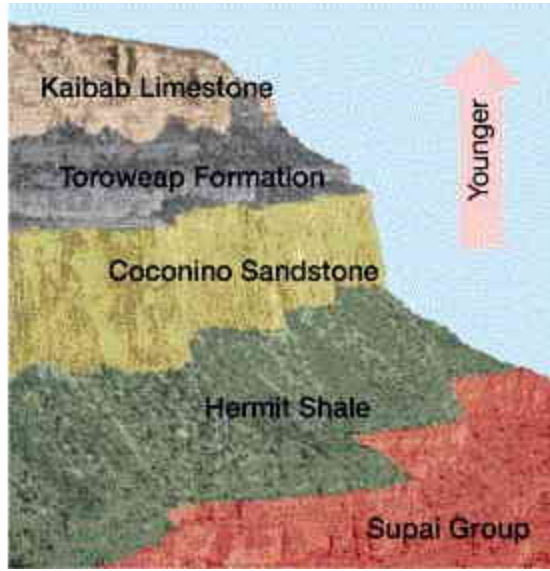
CLADOGRAM



Geologic Time Scale

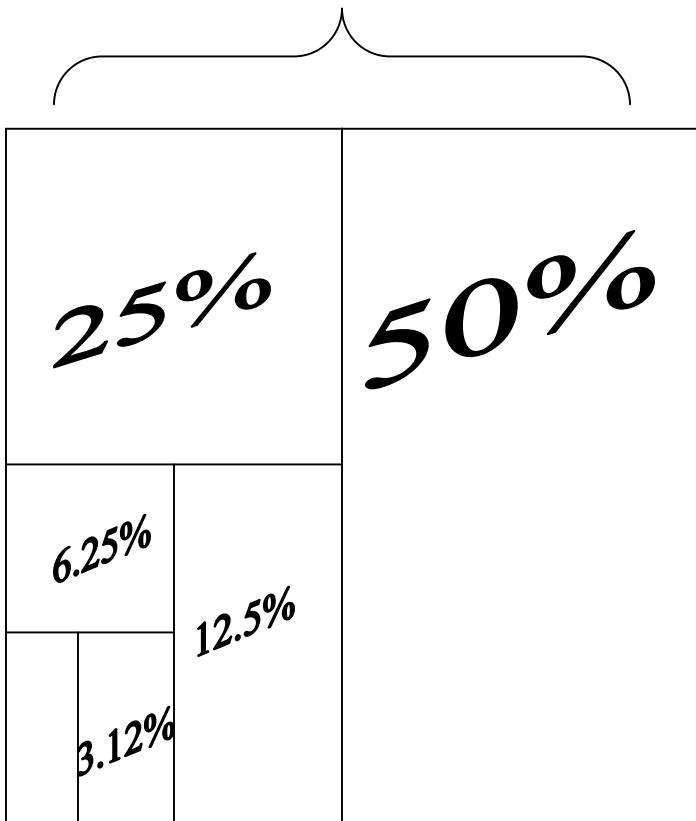
Era	System & Period	Series & Epoch	Some Distinctive Features	Years Before Present
CENOZOIC	Quaternary	Recent	Modern man.	11,000
		Pleistocene	Early man; northern glaciation.	1/2 to 2 million
	Tertiary	Pliocene	Large carnivores.	13 + 1 million
		Miocene	First abundant grazing mammals.	25 + 1 million
		Oligocene	Large running mammals.	36 + 2 million
		Eocene	Many modern types of mammals.	58 + 2 million
		Paleocene	First placental mammals.	63 + 2 million
MESOZOIC	Cretaceous		First flowering plants; climax of dinosaurs and ammonites, followed by Cretaceous-Tertiary extinction.	135 + 5 million
	Jurassic		First birds, first mammals dinosaurs and ammonites abundant.	181 + 5 million
	Triassic		First dinosaurs. Abundant cycads and conifers.	230 + 10 million
PALEOZOIC	Permian		Extinction of most kinds of marine animals, including trilobites. Southern glaciation.	280 + 10 million
	Carboniferous	Pennsylvanian	Great coal forests, conifers. First reptiles.	310 + 10 million
		Mississippian	Sharks and amphibians abundant. Large and numerous scale trees and seed ferns.	345 + 10 million
	Devonian		First amphibians; ammonites; fishes abundant.	405 + 10 million
	Silurian		First terrestrial plants and animals.	425 + 10 million
	Ordovician		First fishes; invertebrates dominant.	500 + 10 million
	Cambrian		First abundant record of marine life; trilobites dominant.	600 + 50 million
	Precambrian		Fossils extremely rare, consisting of primitive aquatic plants. Evidence of glaciation. Oldest dated algae, over 2,600 million years; oldest dated meteorites 4,500 million years.	

ROCK STRATA

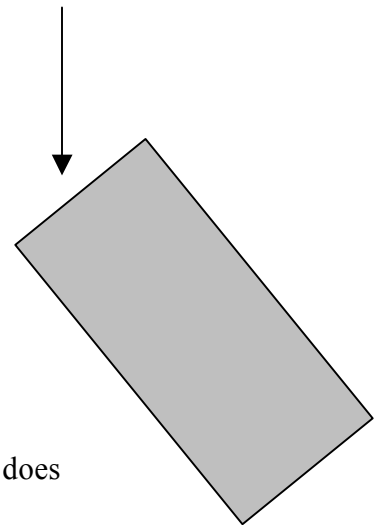


HALF-LIFE EXAMPLE

Total in ORIGINAL sample



FOSSIL sample size



To determine the age...

- What % of the total does the fossil size most closely match?
- How many 'half-lives' have passed to reach this amount?
- How many total years have passed?...

Remember, 1 half-life equals 1000 years in this example.