

Chapter 9

Geologic Time

Relative Time-Principles

- Superposition
- Originally Horizontal
- X-Cutting
- Unconformities
- Continuity of Layers

Which Event(s) Came First--"Sequencing"

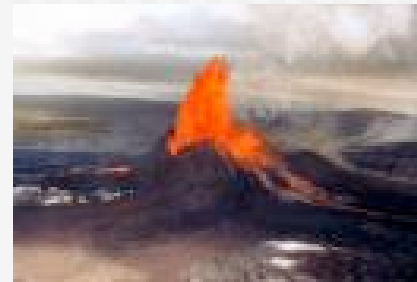
Absolute Time??



- Bishop Ussher (1581)--6000 yrs
Biblical Genealogy



- Lord Kelvin (1890)--20-40 million yrs
Magma Cooling

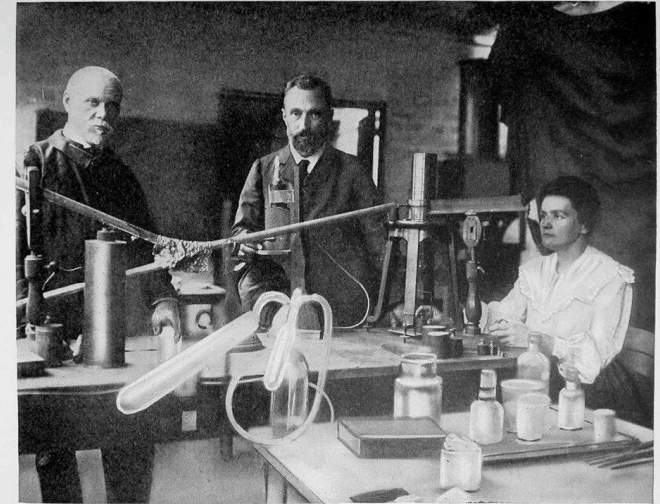


Radioactivity

- Becquerel 1896
- Curie 1867-1934

Rocks...Minerals....Elements

“some elements decay at known rates and can act like a clock”



Henri Manuel, Paris

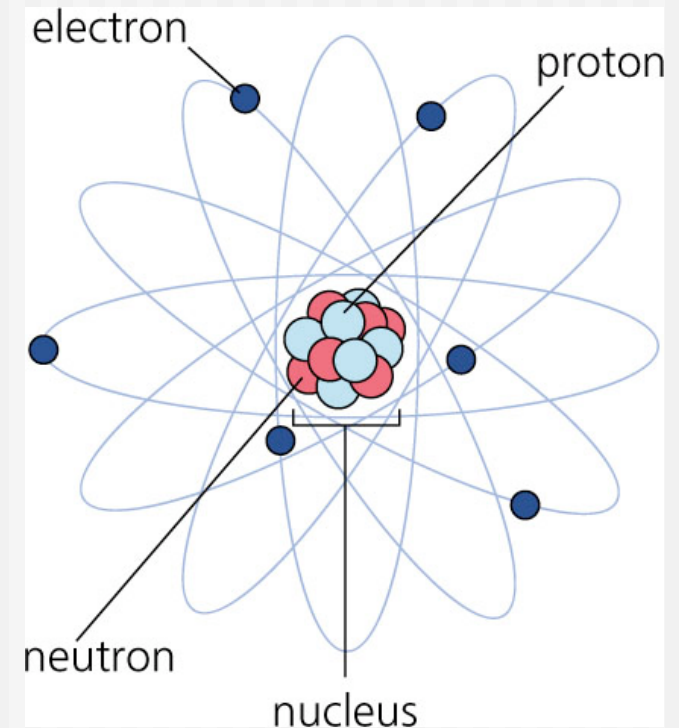
Pierre and Marie Curie in their laboratory, where radium was discovered



Dating with radioactivity

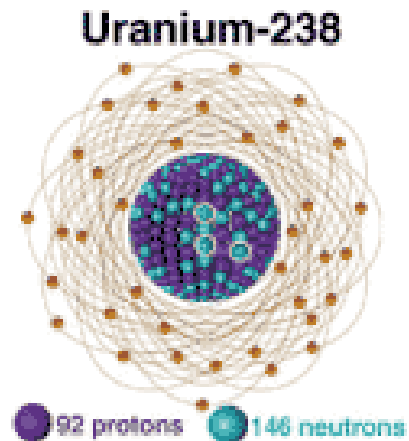
■ Reviewing basic atomic structure

- **Atomic number**
 - Equal to the number of protons
- **Mass number**
 - Sum of protons and neutrons

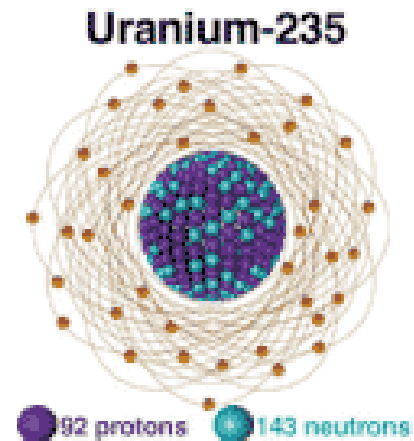


Dating with radioactivity

- **Reviewing basic atomic structure**
 - **Isotope-element with varying number of neutrons (protons are the same)**



extra neutrins - heavier



lighter and more active

Dating with radioactivity

■ **Radioactivity**

- **Spontaneous decay in the atom**

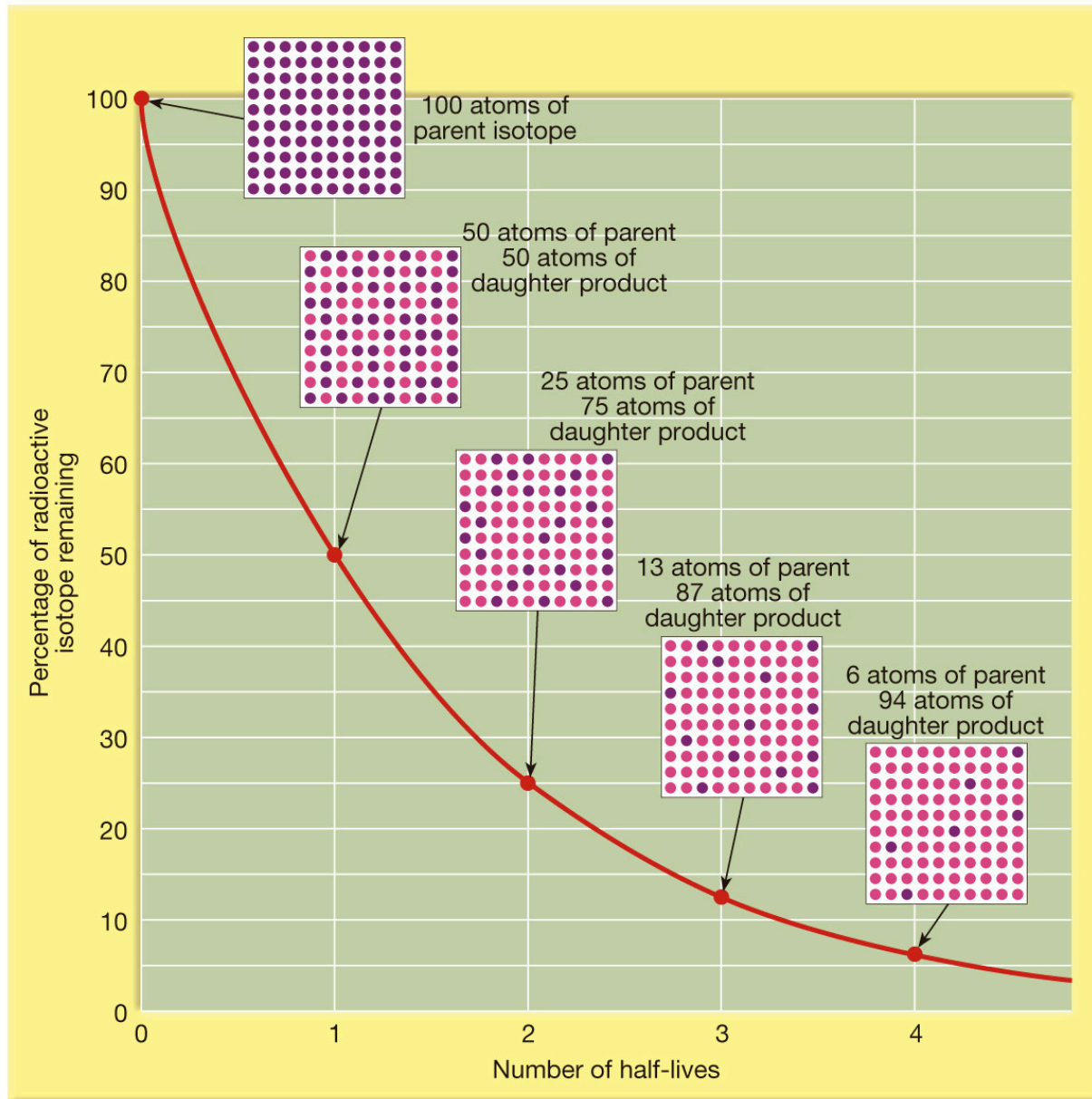
■ **Types of radioactive decay**

- **Alpha emission**
- **Beta emission**
- **Gamma Rays**

Dating with radioactivity

- **Parent** – an unstable radioactive isotope
- **Daughter product** – the isotopes resulting from the decay of a parent
- **Half-life** – the time required for one-half of the radioactive nuclei in a sample to decay

Radioactive decay curve



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TABLE 9.1**Isotopes Frequently Used
in Radiometric Dating**

Radioactive Parent	Stable Daughter Product	Currently Accepted Half-life Values
Uranium-238	Lead-206	4.5 billion years
Uranium-235	Lead-207	713 million years
Thorium-232	Lead-208	14.1 billion years
Rubidium-87	Strontium-87	47.0 billion years
Potassium-40	Argon-40	1.3 billion years

Time Scale

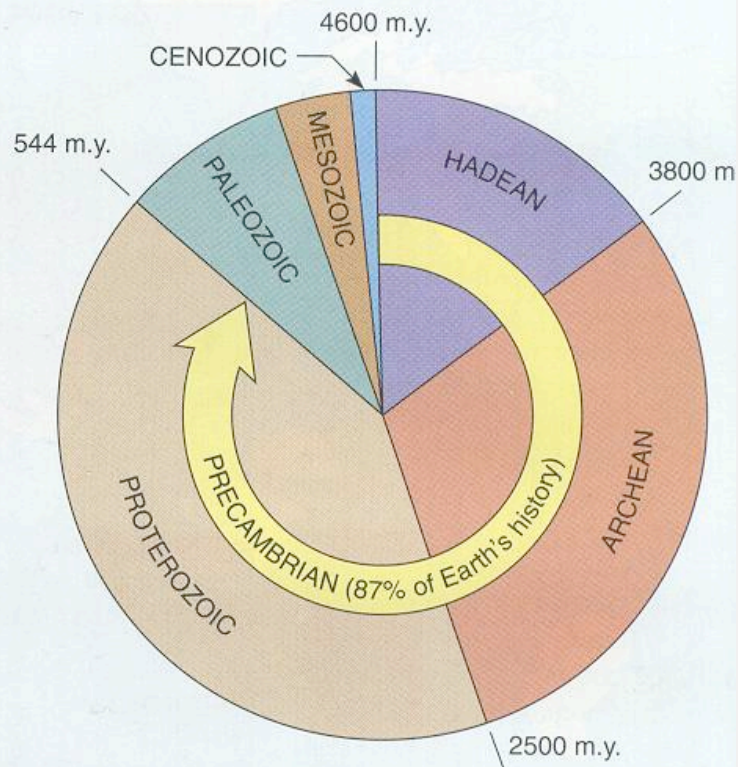
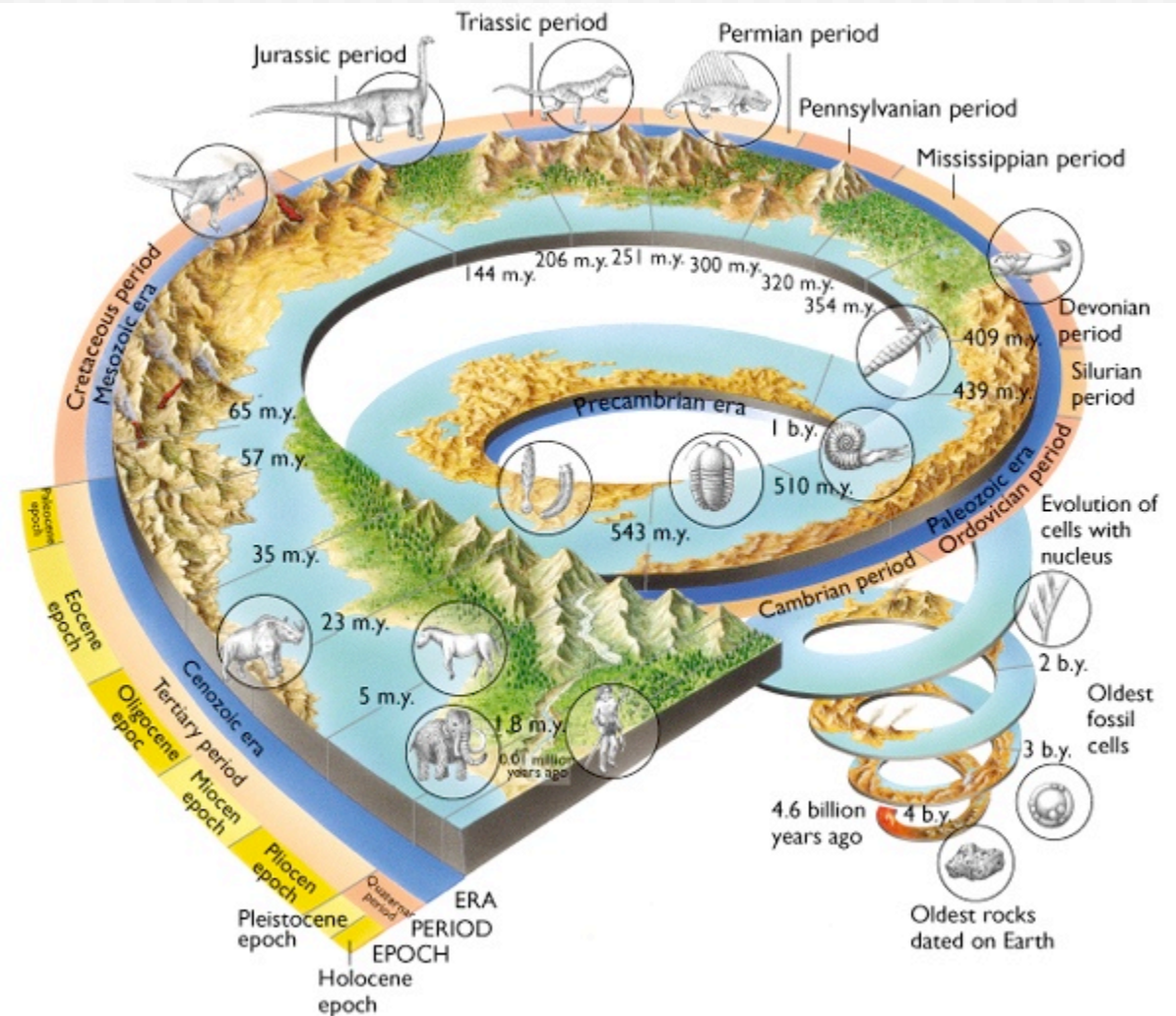


FIGURE 6-14 Proportions of geologic time encompassed by the Precambrian and its divisions, the Hadean, Archean, and Proterozoic eons.

Eon	Era	Period	Epoch	m.y.	
Phanerozoic	Cenozoic	Quaternary	Holocene	1.5	
			Pleistocene		
		Neogene	Pliocene		
			Miocene		
		Paleogene	Oligocene		23
			Eocene		
	Paleocene				
	Mesozoic	Cretaceous	65		
		Jurassic			
		Triassic			
	Paleozoic	Carboniferous	Permian	250	
			Pennsylvanian		
			Mississippian		
		Devonian			
		Silurian			
Ordovician					
Cambrian					
Precambrian		Proterozoic			540
	Archean		2500		
	Hadean		3800		
				4600	

Geologic Time Perspectives

- Yard Stick
- Calendar



Bracketing sedimentary ages using igneous rocks

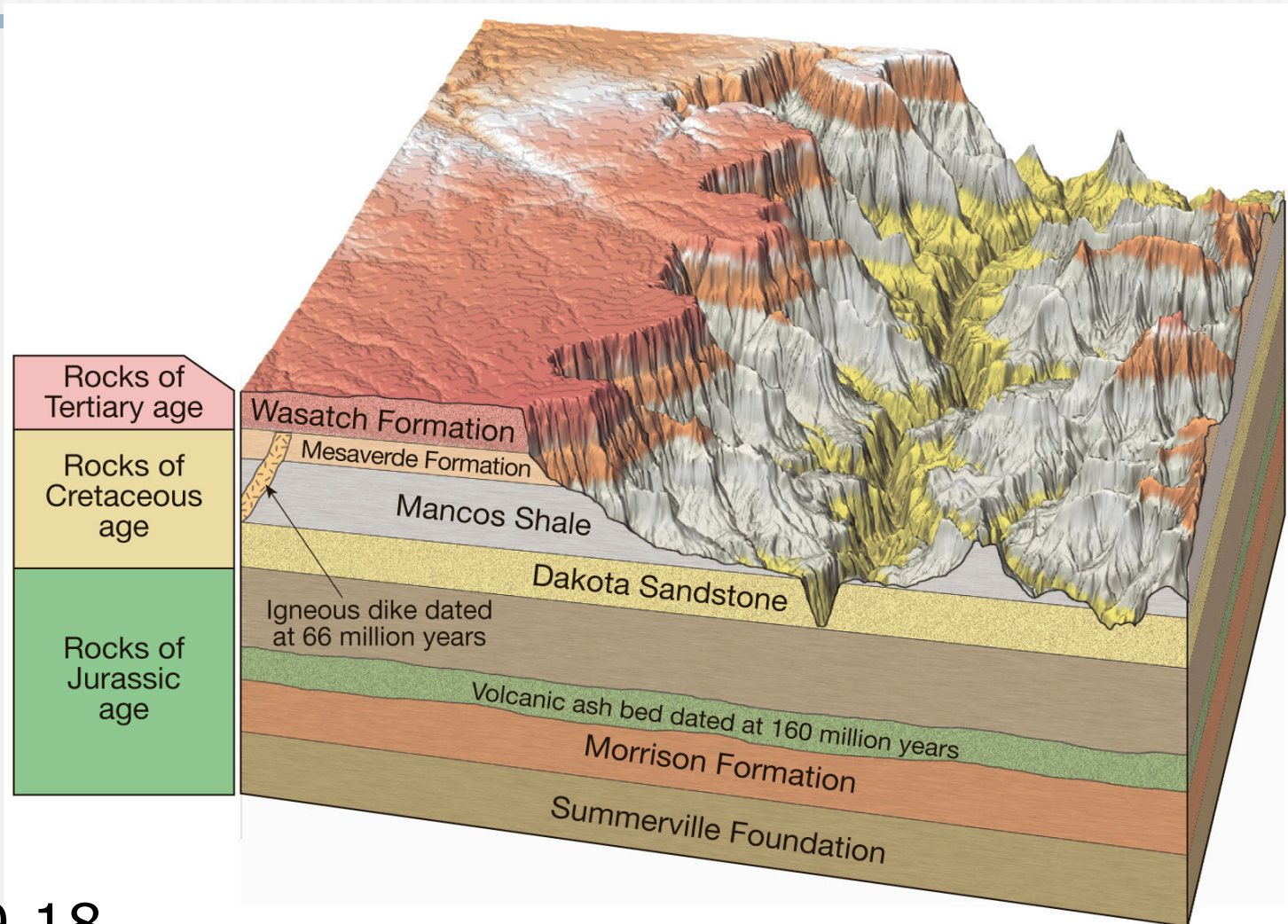


Figure 9.18

End of Chapter 9
