

Absolute Age Dating

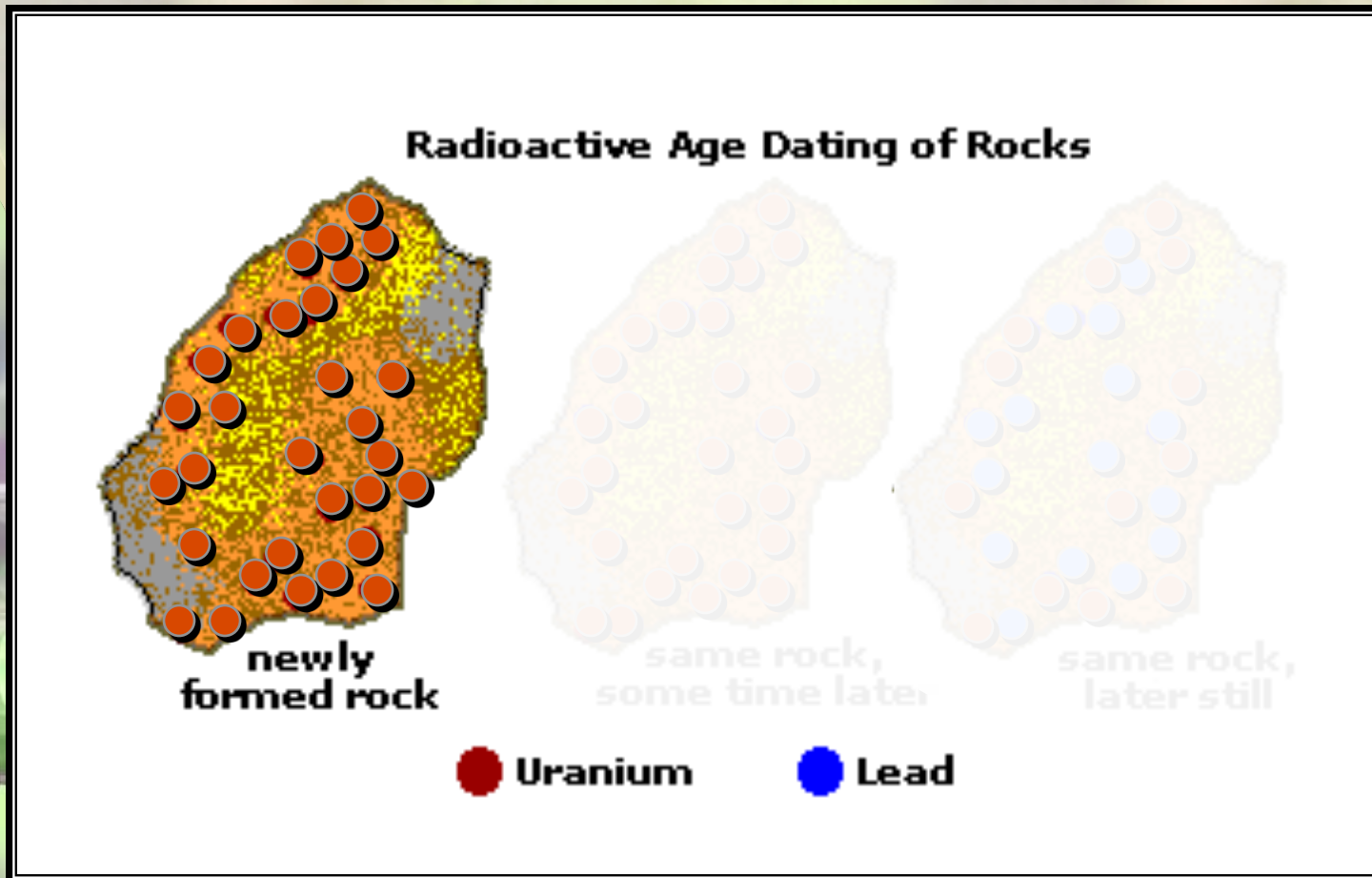
Absolute Ages

Radiometric Dating

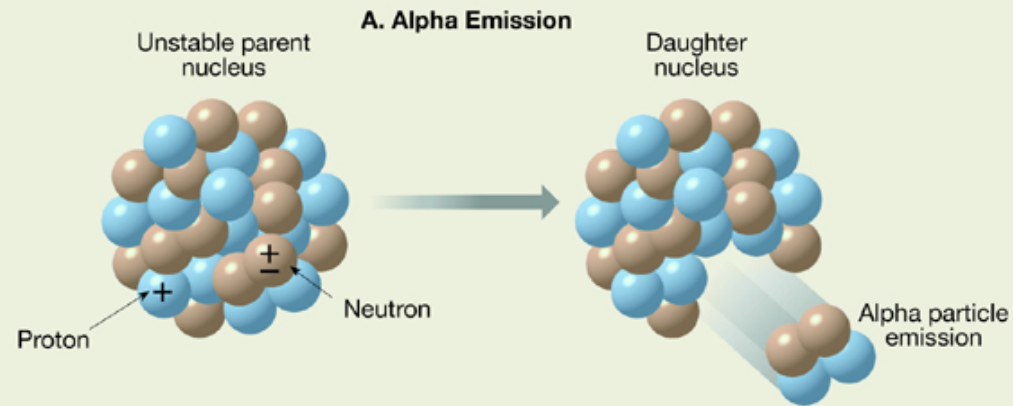
- Radioactive isotopes
- Radioactive decay
- Half-life

Radiometric Dating

Absolute dating using radioactive decay data



Alpha Emission

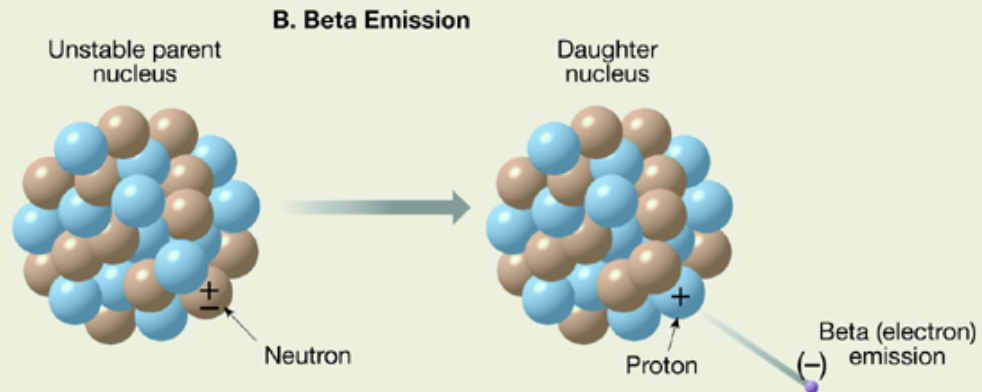


Daughter nucleus-

Atomic number:
2 fewer

Atomic mass:
4 fewer

Beta Emission

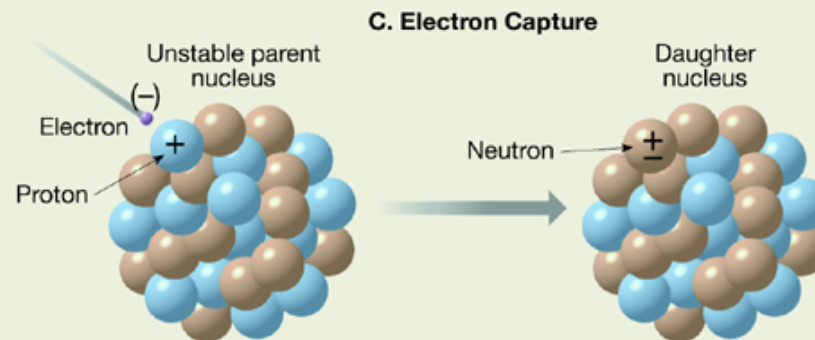


Daughter nucleus-

Atomic number:
1 more

Atomic mass:
no change

Electron Capture



Daughter nucleus-

Atomic number:
1 fewer

Atomic mass:
no change

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Decay of ^{238}U

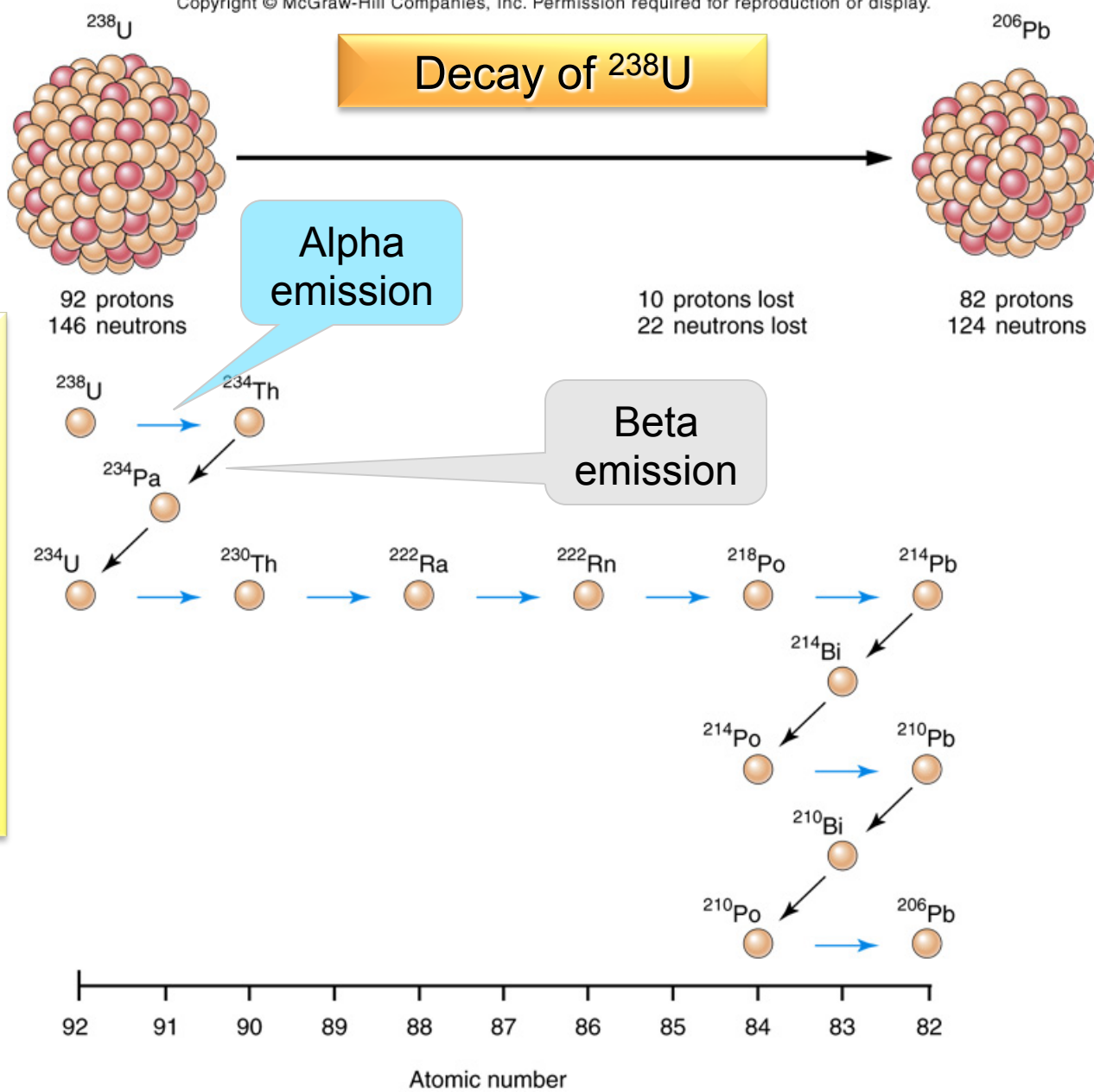


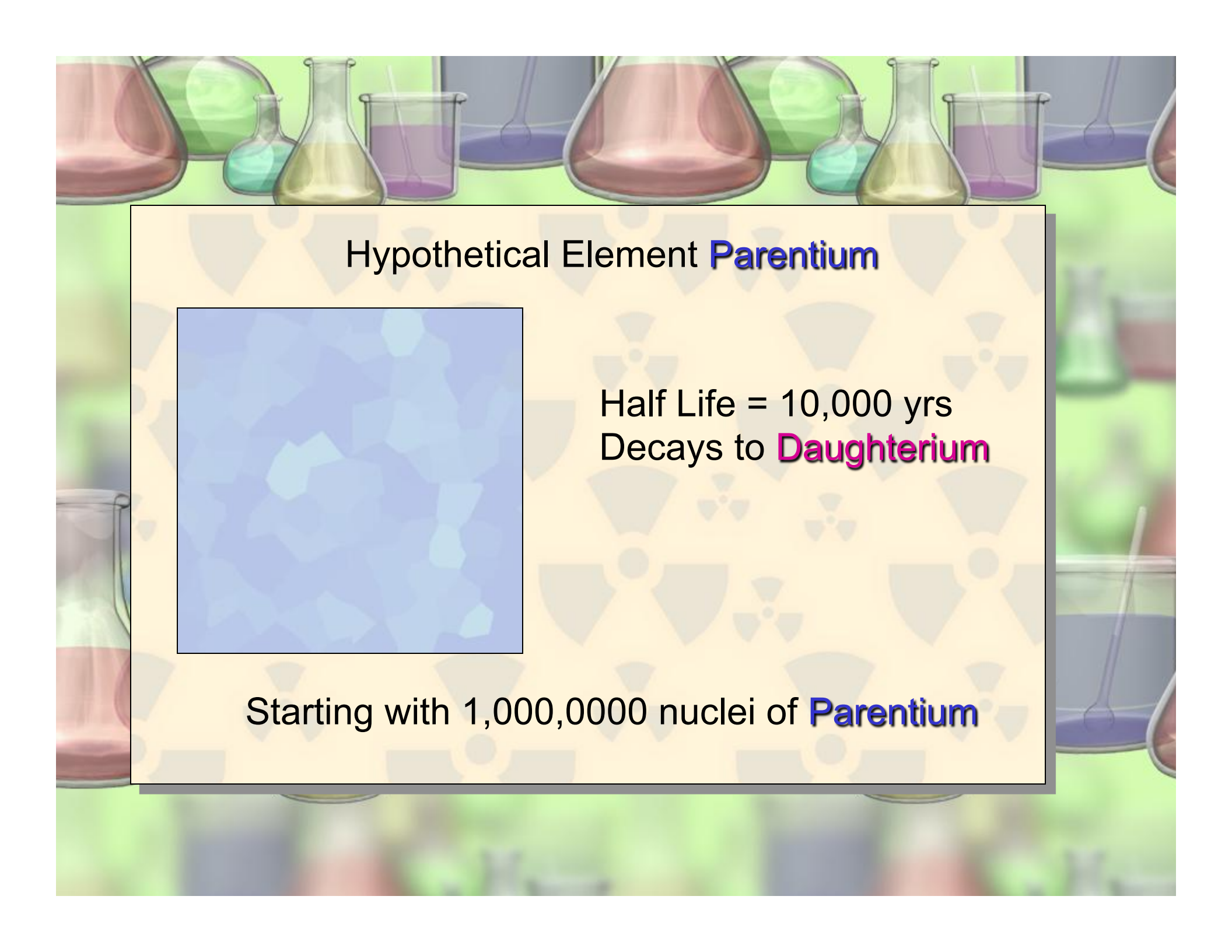
Fig. 08.23

Decay sequence for Uranium-238



<http://www.asa.org/ASA/resources/scienc.html>

Half life – the time it takes for half of the original element to decay to the new element.

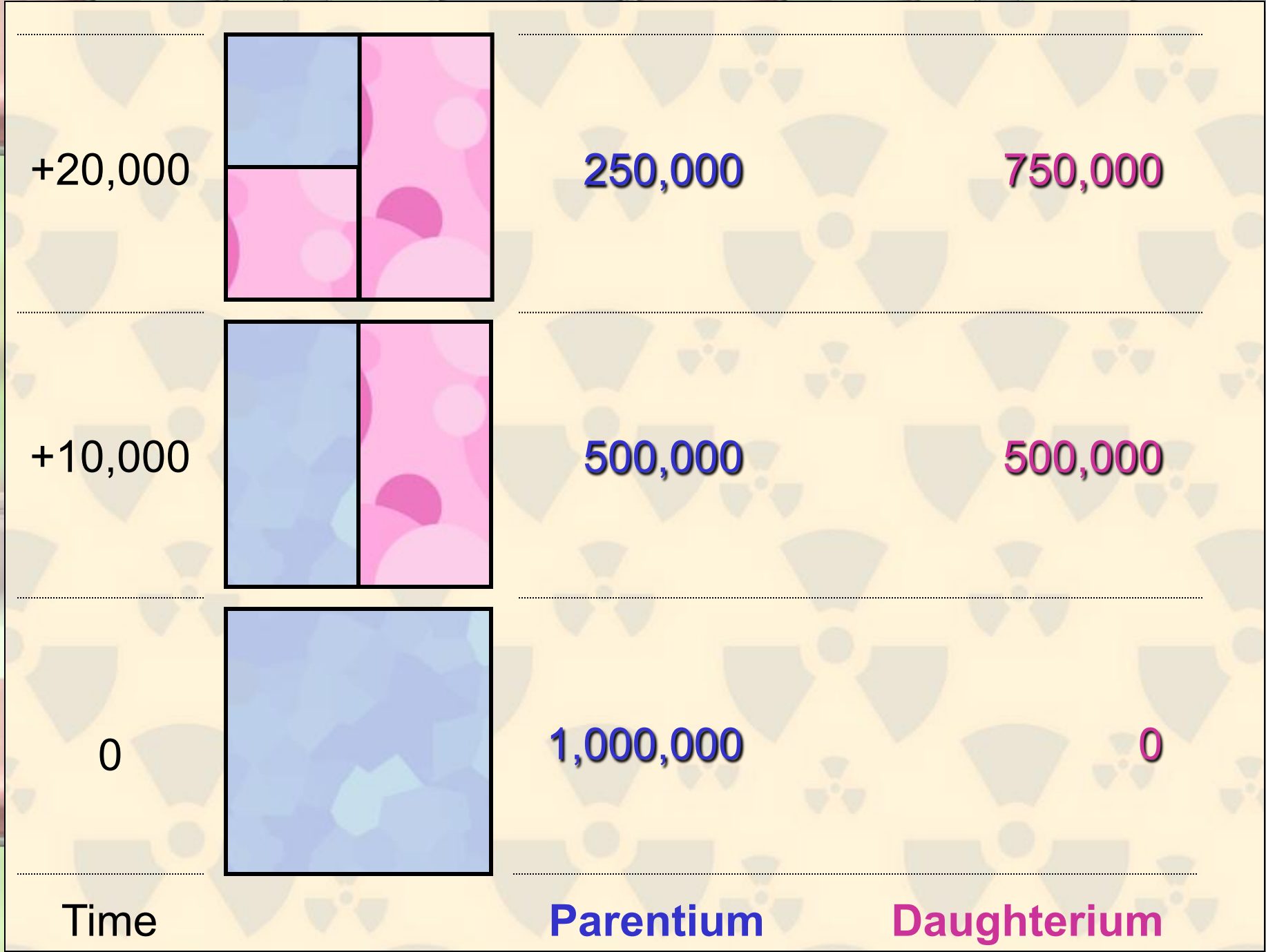
The background of the slide features a row of various laboratory glassware, including Erlenmeyer flasks and beakers, containing liquids of different colors (red, green, blue, purple).

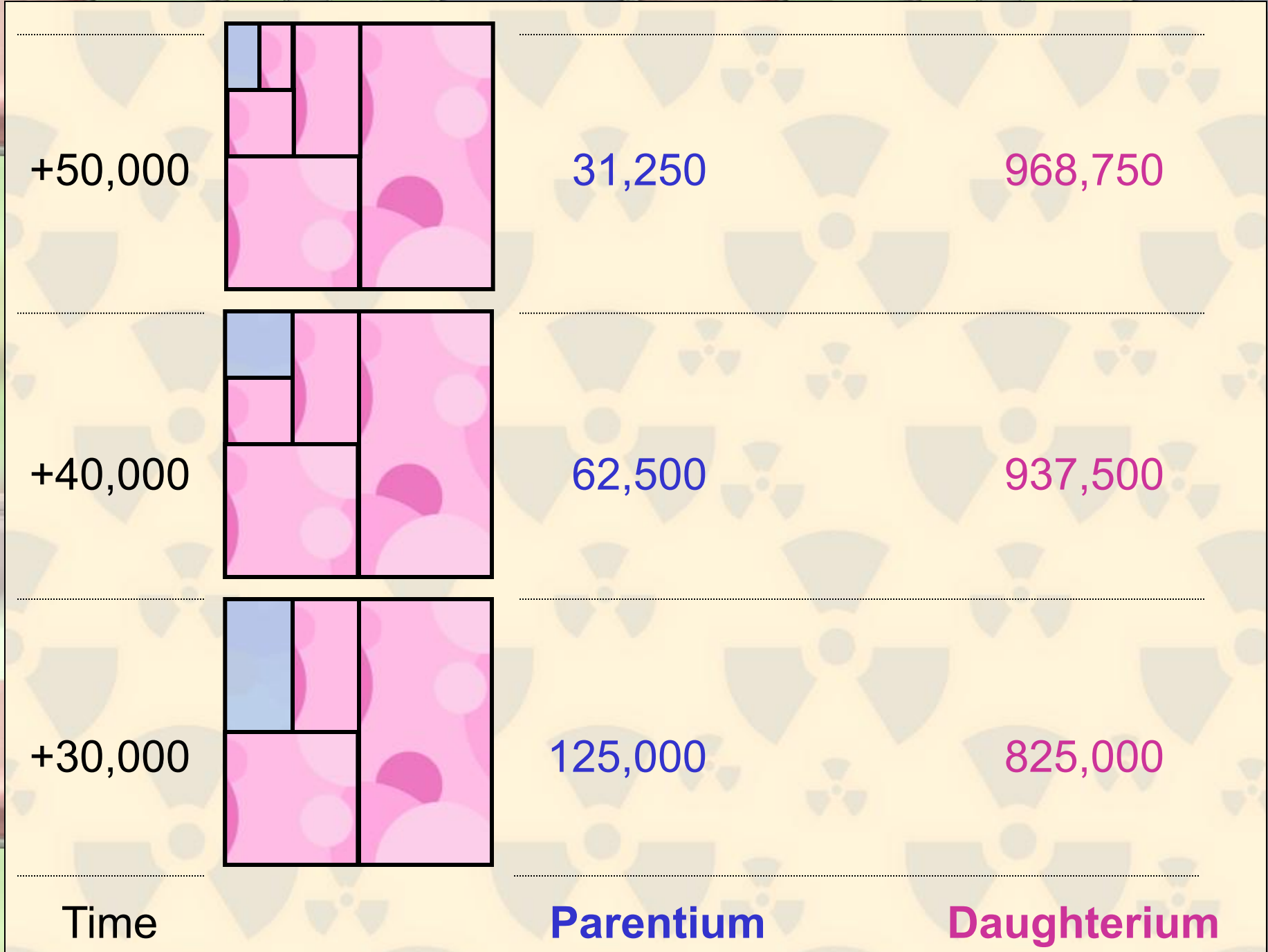
Hypothetical Element **Parentium**



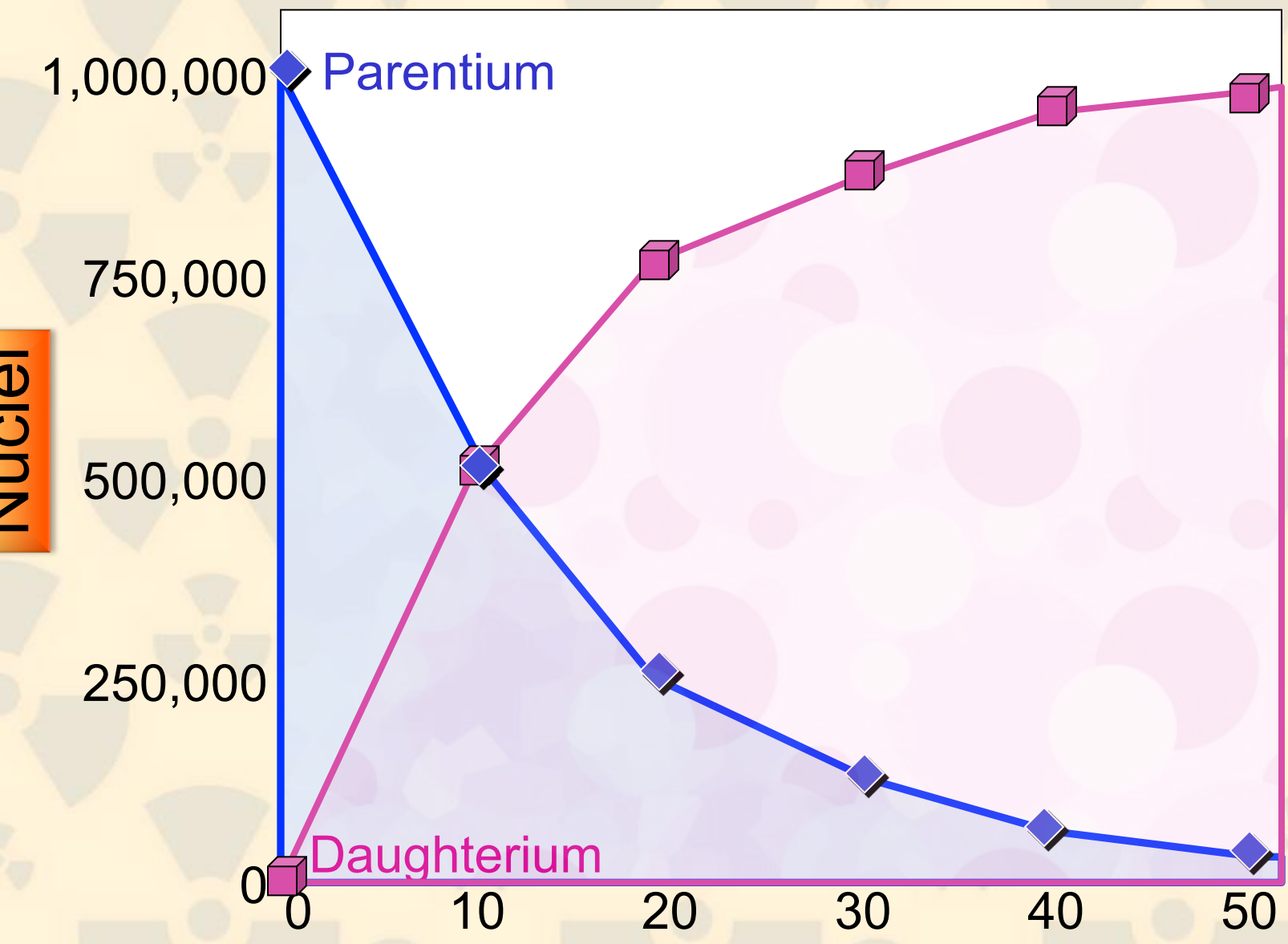
Half Life = 10,000 yrs
Decays to **Daughterium**

Starting with 1,000,000 nuclei of **Parentium**





Nuclei



Time (thousands of years)

Geologically Useful Radioactive Isotopes

Parent	Daughter	Half-life (yrs)	Useful Range (yrs)
^{40}K	^{40}Ar	1,250,000,000	100,000 - formation of Earth
^{238}U	^{206}Pb	4,500,000,000	10,000,000 - formation of Earth
^{235}U	^{207}Pb	713,000,000	10,000,000 - formation of Earth
^{87}Rb	^{87}Sr	49,000,000,000	10,000,000 - formation of Earth



Geologist collects samples of rock



Geochemist finds radiometric age



Geologist interprets the geologic history of area during the time that the rock was being formed

Eon	Era	Period	Epoch	m.y.	
Phanerozoic	Cenozoic	Quaternary	Holocene	-1.5	
			Pleistocene		
		Neogene	Pliocene		
			Miocene		
		Paleogene	Oligocene		-23
			Eocene		
	Paleozoic	Mesozoic	Cretaceous	-65	
			Jurassic		
		Triassic			
		Paleozoic	Permian		-250
Carboniferous					
			Mississippian		
Devonian					
Silurian					
Ordovician					
Cambrian					
Precambrian	Proterozoic		-540		
		Archean			
		Hadean			
				-1600	

Geologically Useful Radioactive Isotopes

Parent	Daughter	Half-life (yrs)	Useful Range (yrs)
^{40}K	\rightarrow ^{40}Ar	1,250,000,000	100,000 - formation of Earth
^{238}U	\rightarrow ^{206}Pb	4,500,000,000	10,000,000 - formation of Earth
^{235}U	\rightarrow ^{207}Pb	713,000,000	10,000,000 - formation of Earth
^{87}Rb	\rightarrow ^{87}Sr	49,000,000,000	10,000,000 - formation of Earth

An analysis of a feldspar crystal in a rock reveals that it contains 75% ^{40}Ar and 25% ^{40}K .

How many half-lives have passed since the formation of the feldspar?

Assuming the feldspar and rock formed at the same time, how old is the rock?

Parent	Daughter	Half-life (yrs)	Useful Range (yrs)
^{238}U	\rightarrow ^{206}Pb	4,500,000,000	10,000,000 - formation of Earth
^{235}U	\rightarrow ^{207}Pb	713,000,000	10,000,000 - formation of Earth

An analysis of a zircon crystal in a rock reveals that it contains:

50.0% ^{238}U and 50.0% ^{206}Pb
 1.6% ^{235}U and 98.4% ^{207}Pb

How many half-lives of ^{238}U have passed since the formation of the zircon?

How many half-lives of ^{235}U have passed since the formation of the zircon?

What is the age of the zircon?