Today:

Pick up iclicker NOW

1) Go over Exam 2
2) (at 9:50) Unconformity Review: iclickers out

Finish: Telling Time Geologically

4) (at 10:35) In Class Exercise: Relative Dating
(page 93 class handouts)

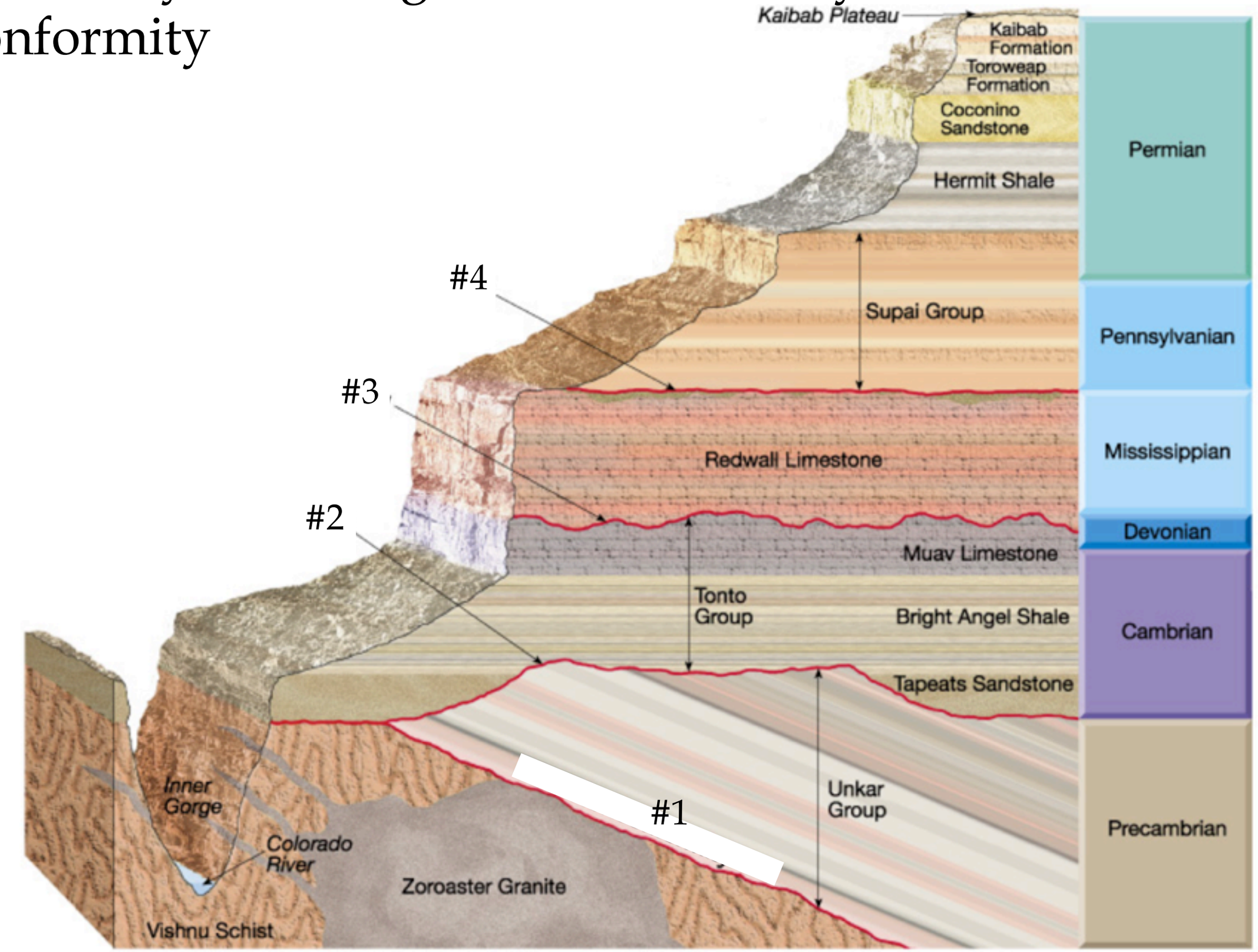
Next Class:

1) Grand Canyon Talk
2) Google Earth Grand Canyon (Time Permitting)

Which unconformity is depicted at #1?

A: Disconformity B: Angular unconformity

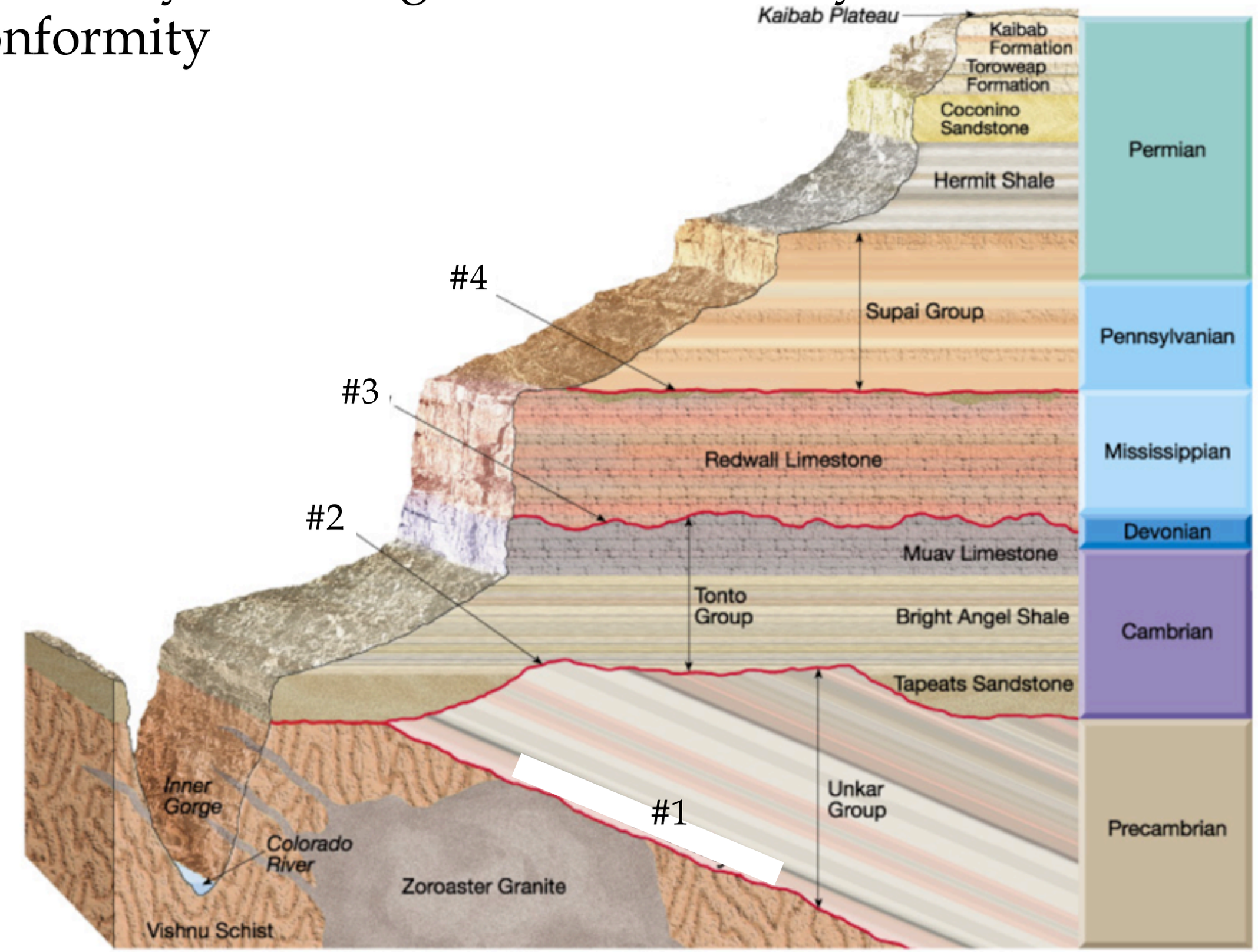
C: Nonconformity



Which unconformity is depicted at #2?

A: Disconformity B: Angular unconformity

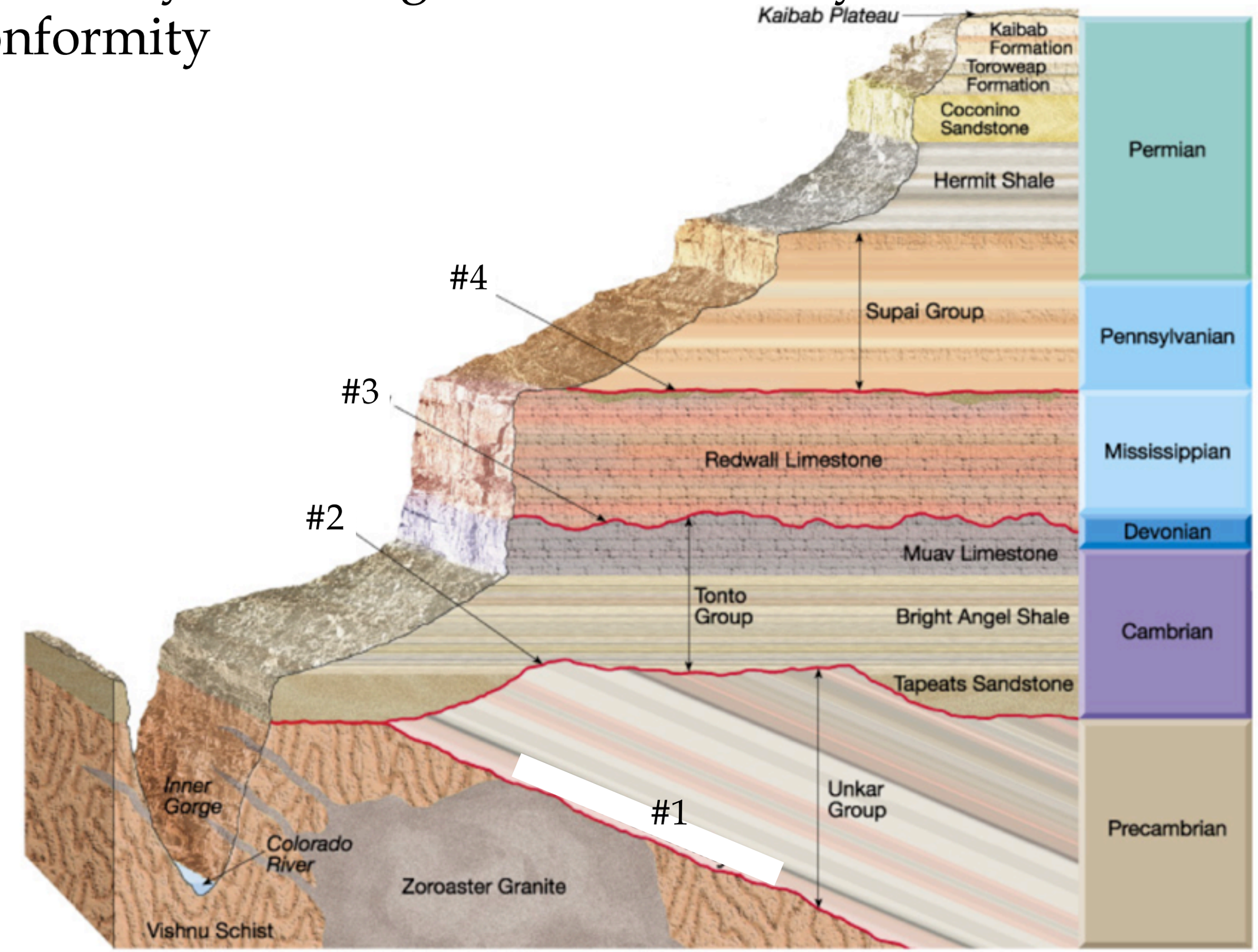
C: Nonconformity



Which unconformity is depicted at #3?

A: Disconformity B: Angular unconformity

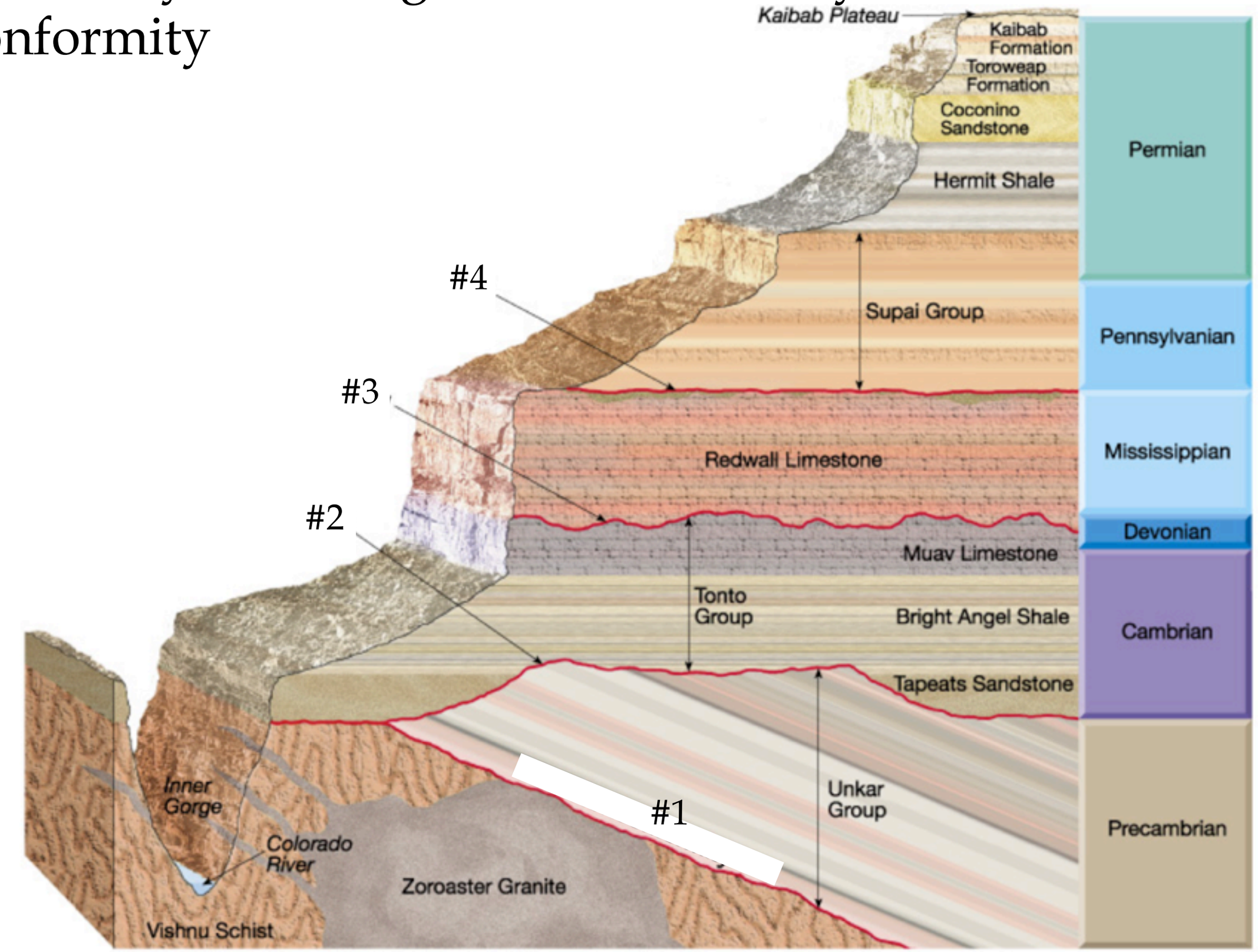
C: Nonconformity



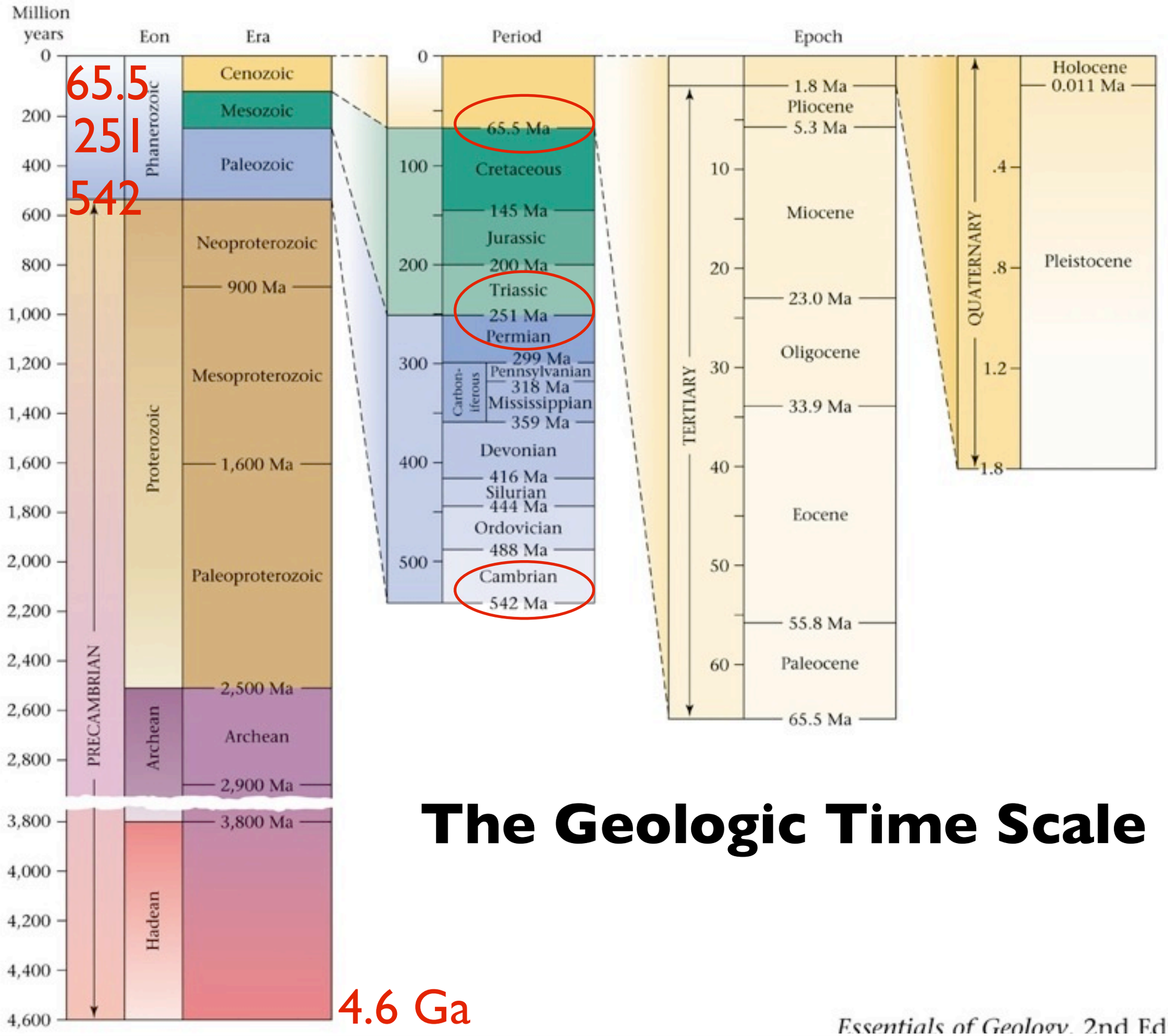
Which unconformity is depicted at #4?

A: Disconformity B: Angular unconformity

C: Nonconformity



Relative Dating
vs.
Absolute Dating
(Geochronology)



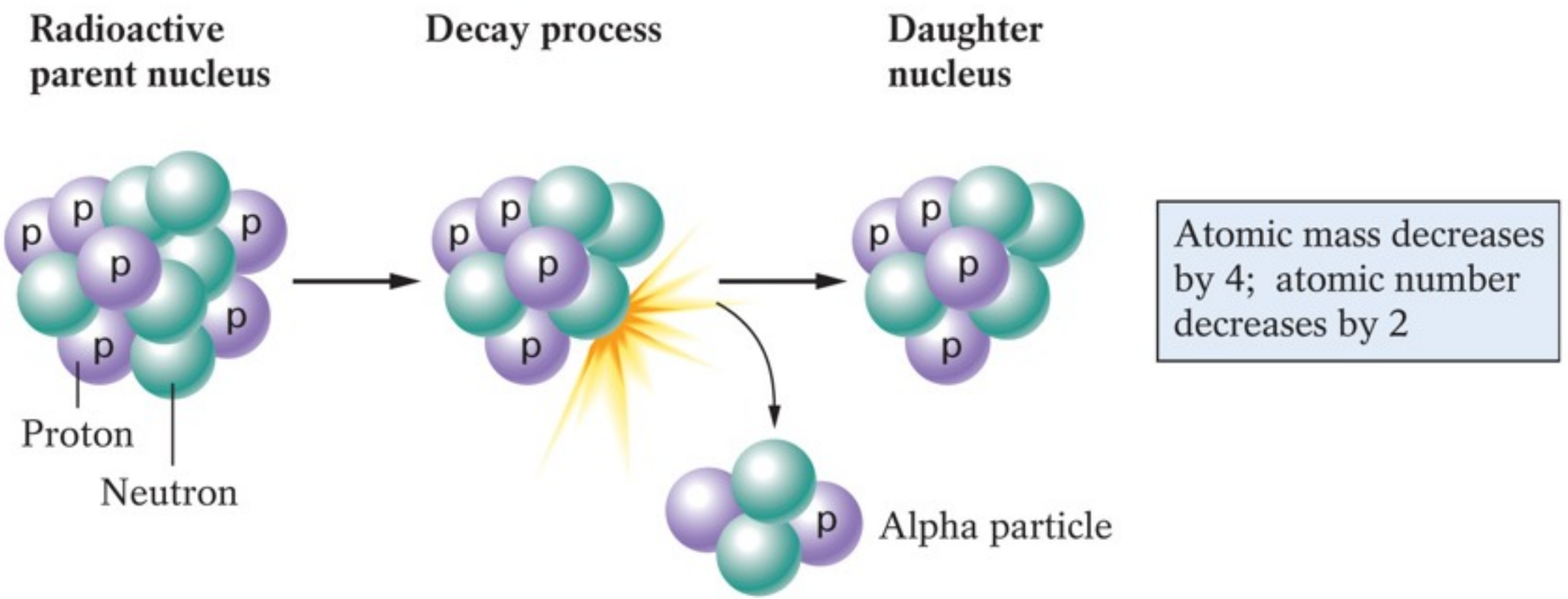
The Geologic Time Scale

Essentials of Geology, 2nd Edit

Radioactive Decay (alpha decay)

Parent

Daughter



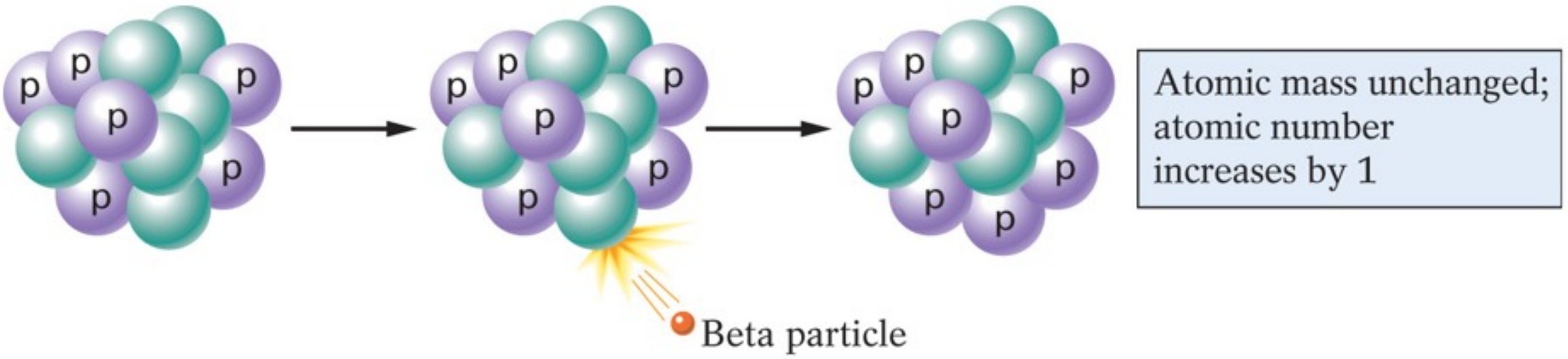
Atomic mass decreases by 4; atomic number decreases by 2

(a) Alpha decay

Radioactive Decay (beta decay)

Parent

Daughter

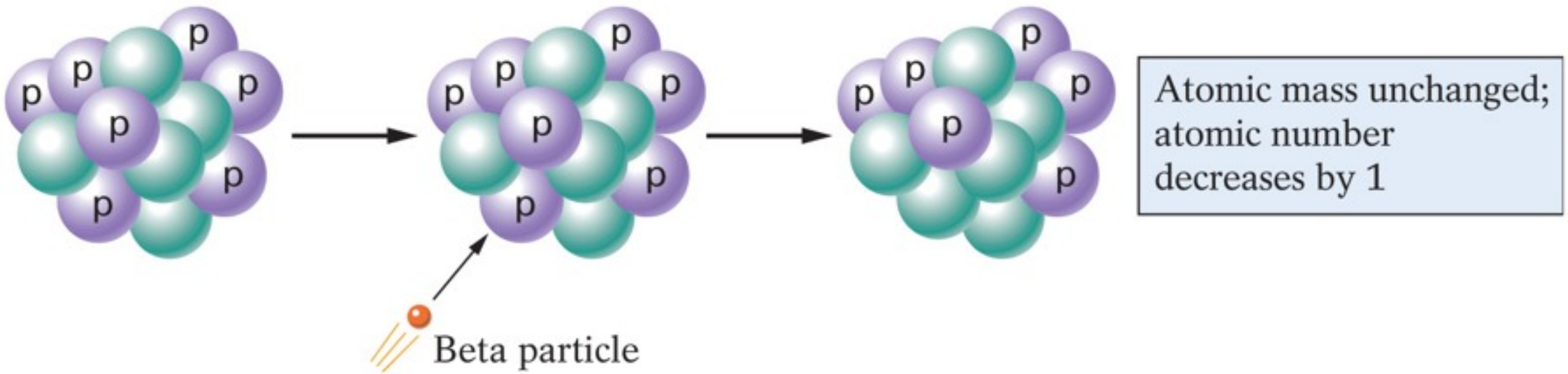


(b) Beta decay

Radioactive Decay (electron capture)

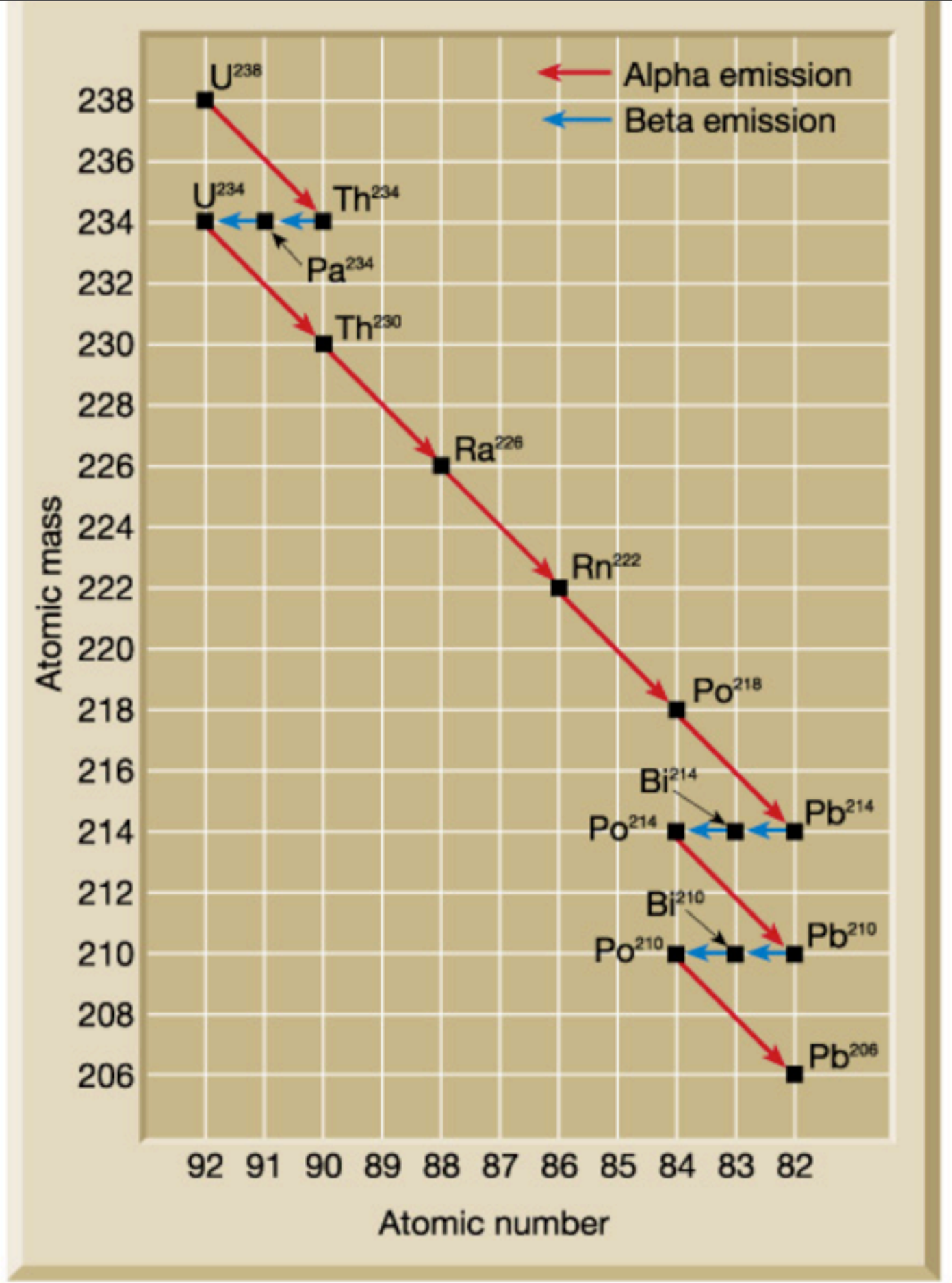
Parent

Daughter



(c) Electron capture

Radioactive Decay Series

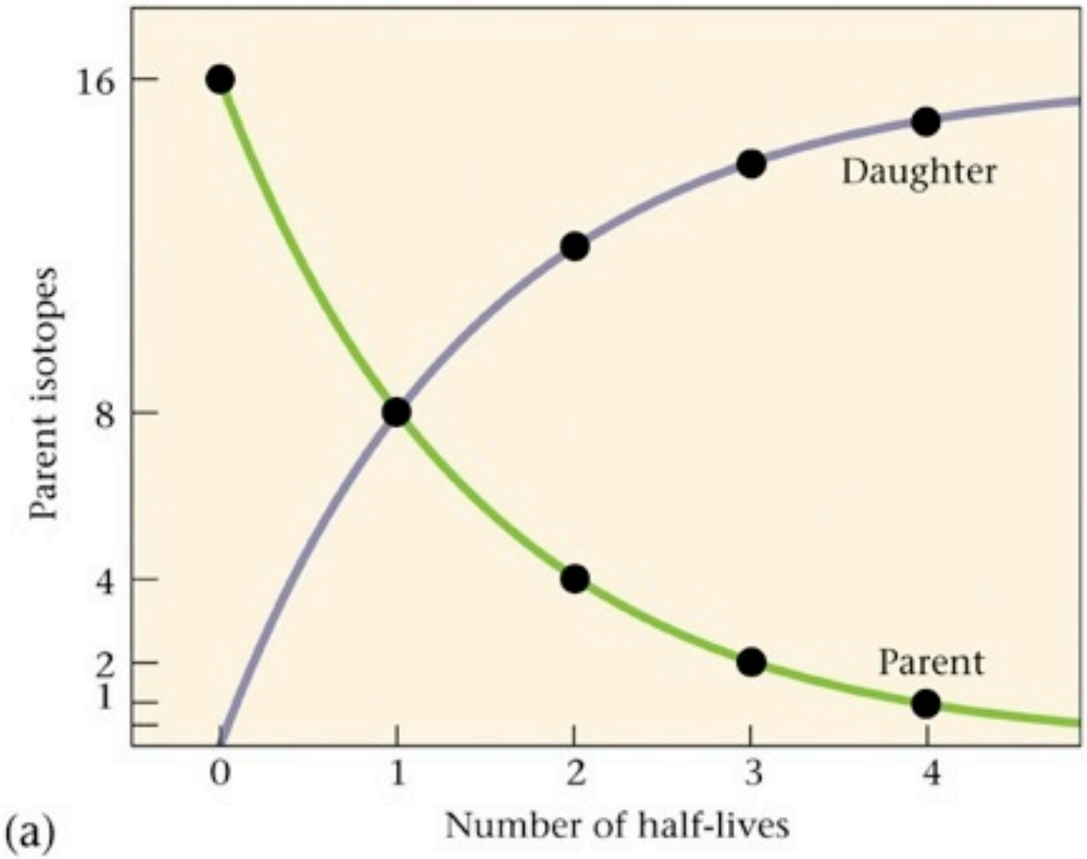


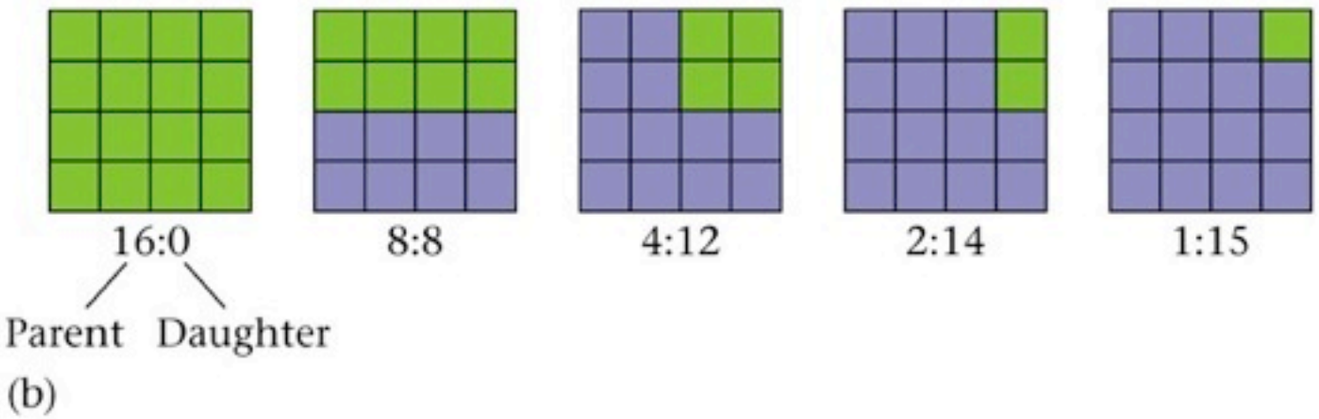
Which type of radioactive decay produces a proton(atomic number goes up)?

A) Alpha decay
B) Beta decay
C) Beta capture
D) A & B
E) B & C

Which type of radioactive decay maintains atomic mass?

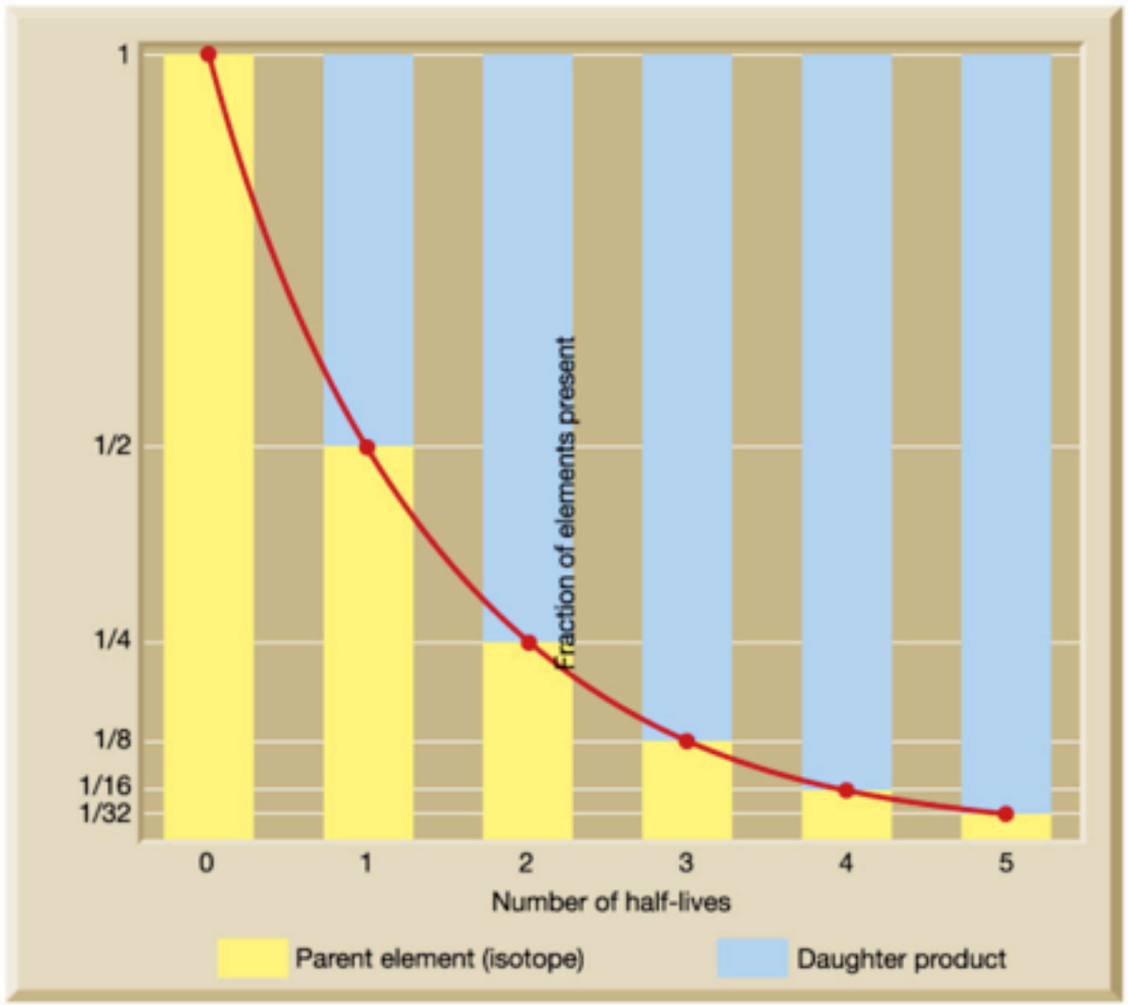
A) Alpha decay
B) Beta decay
C) Beta capture
D) A & B
E) B & C



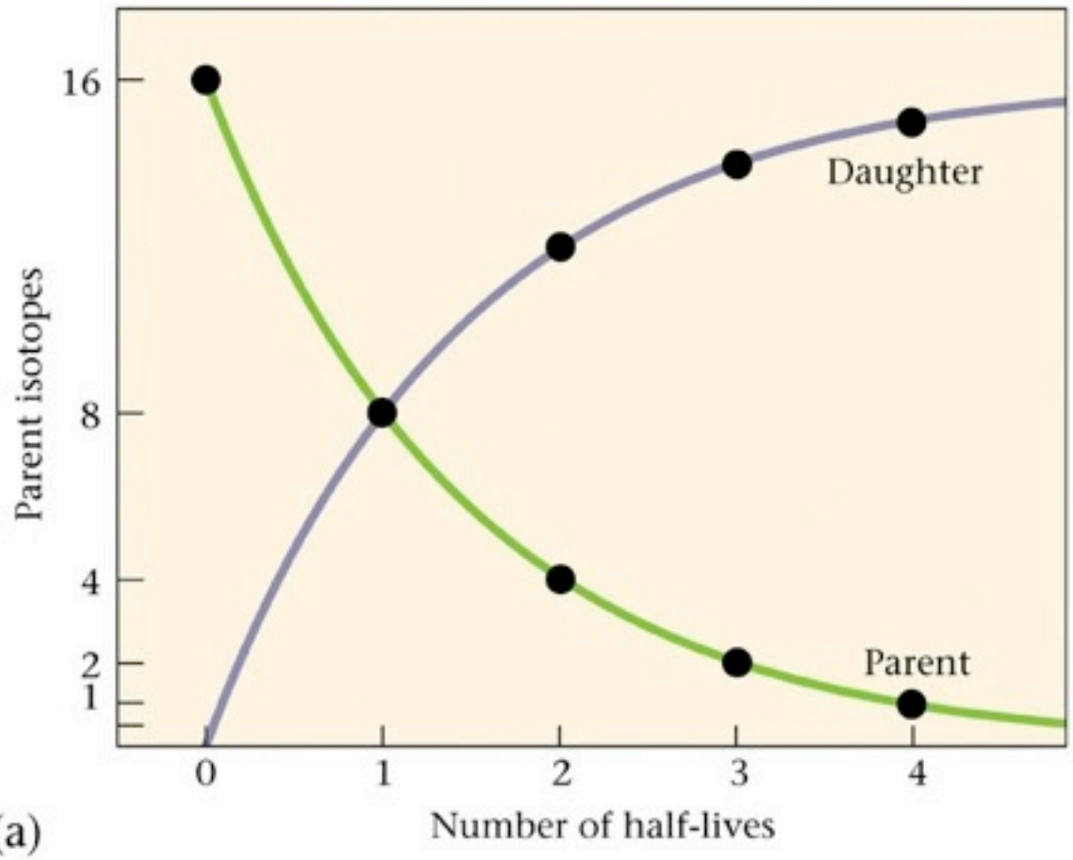


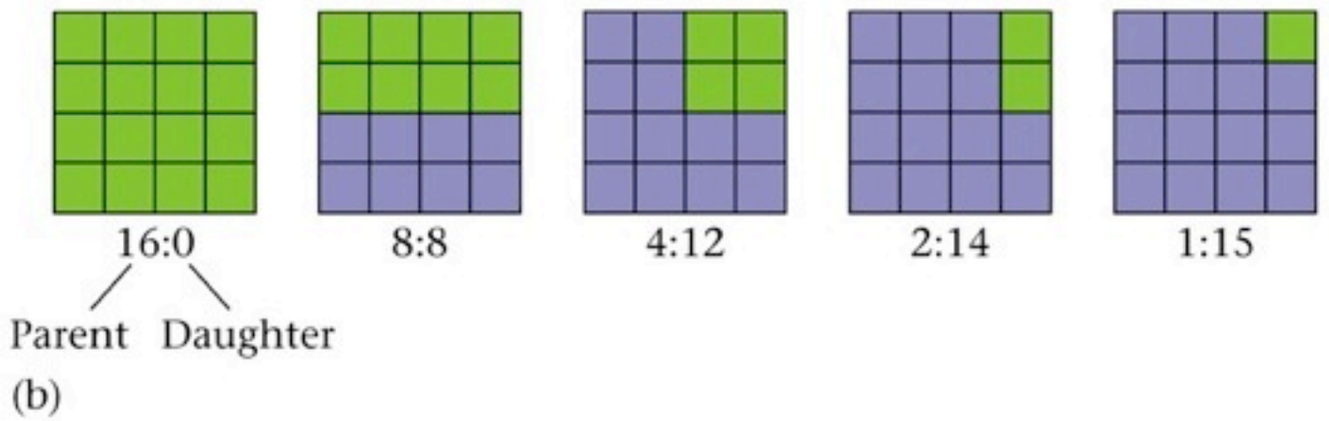
Half Lives

Coin Flip Exercise



Radioactive Decay and the concept of Half lives

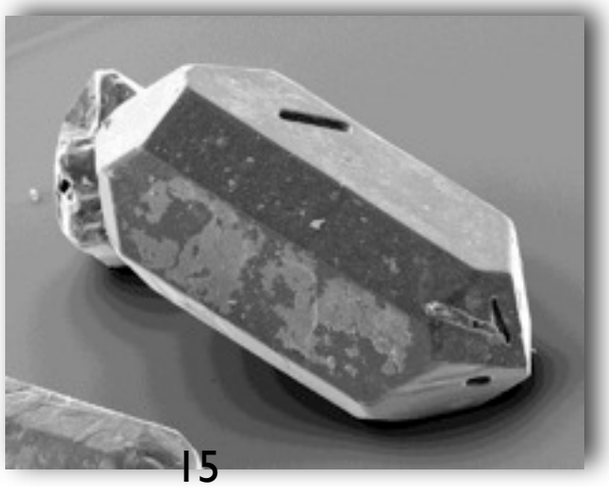




K-spar

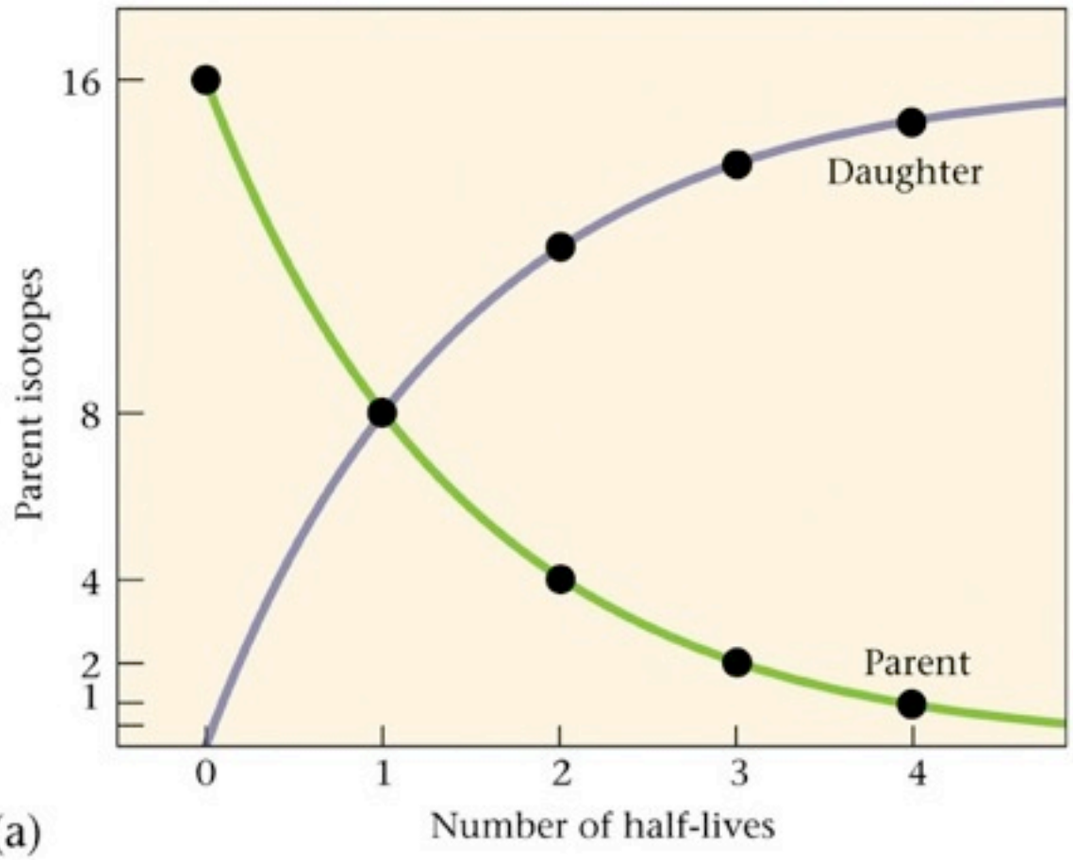
Hornblende

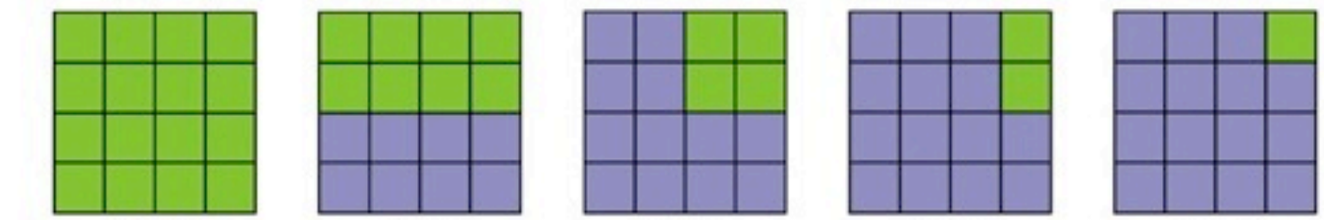
Zircon



Muscovite

Radioactive Decay and the concept of Half lives



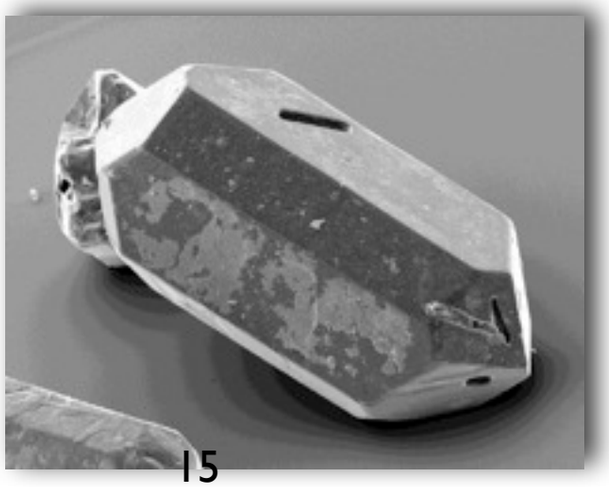


Igneous Minerals

K-spar

Hornblende

Zircon



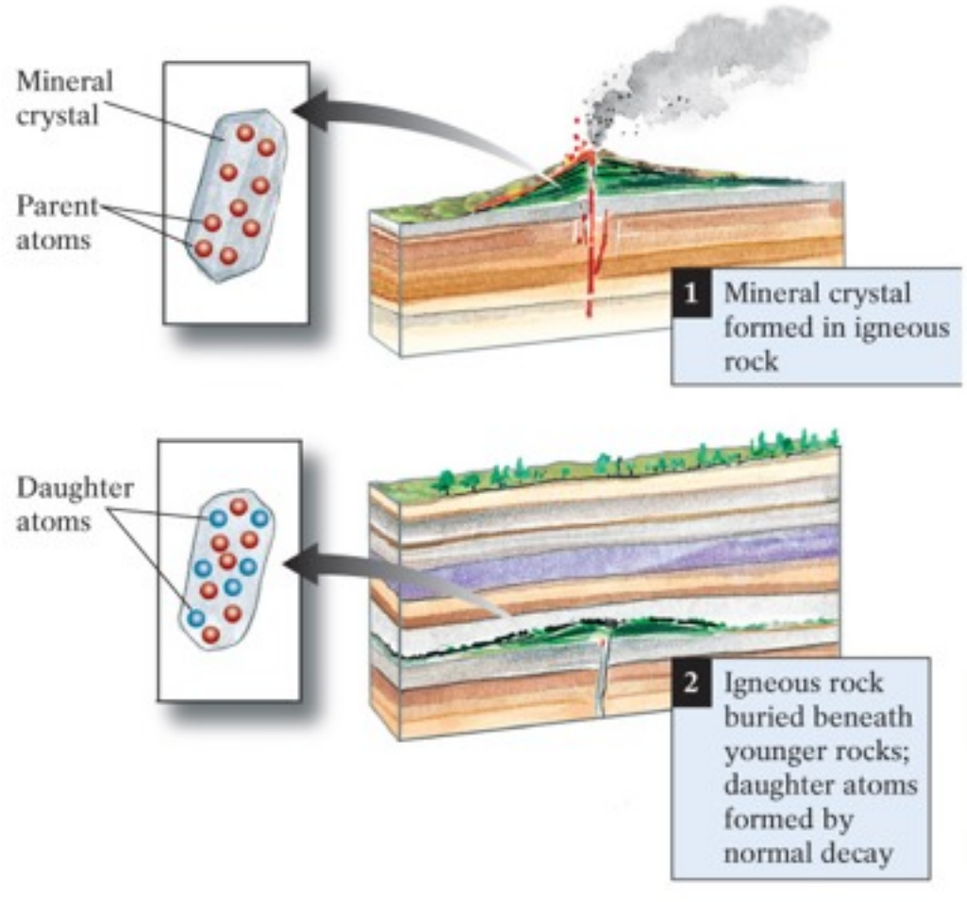
Muscovite

Which Isotope is Best?

Table 8.1 The Major Isotopes Used for Isotope Dating

METHOD	PARENT ISOTOPE	DAUGHTER ISOTOPE	HALF-LIFE OF PARENT (YEARS)	EFFECTIVE DATING RANGE (YEARS)	MATERIALS COMMONLY DATED	COMMENTS
Rubidium–strontium	Rb-87	Sr-87	47 billion	10 million–4.6 billion	Calcium-rich minerals such as plagioclase feldspar and calcium-rich garnets.	Useful for dating the Earth's oldest metamorphic and plutonic rocks.
Uranium–lead	U-238	Pb-206	4.5 billion	10 million–4.6 billion	Zircons, uraninite, and uranium ore such as pitchblende; igneous and metamorphic rock (whole-rock analysis)	Uranium isotopes usually coexist in minerals such as zircon. Multiple dating schemes enable geologists to cross-check dating results.
Uranium–lead	U-235	Pb-207	713 million	10 million–4.6 billion		
Thorium–lead	Th-232	Pb-208	14.1 billion	10 million–4.6 billion	Zircons, uraninite	Thorium coexists with uranium isotopes in minerals such as zircon.
Potassium–argon	K-40	Ar-40	1.3 billion	100,000–4.6 billion	Potassium-rich minerals such as amphibole, biotite, muscovite, and potassium feldspar; volcanic rocks (whole-rock analysis)	High-grade metamorphic and plutonic igneous rocks may have been heated sufficiently to allow Ar-40 gas to escape.
Carbon-14	C-14	N-14	5730	100–70,000	Any carbon-bearing material, such as bones, wood, shells, charcoal, cloth, paper, animal droppings; also water, ice, cave deposits	Commonly used to date archaeological sites, recent glacial events, evidence of recent climate change, and environmental effects of human activity.

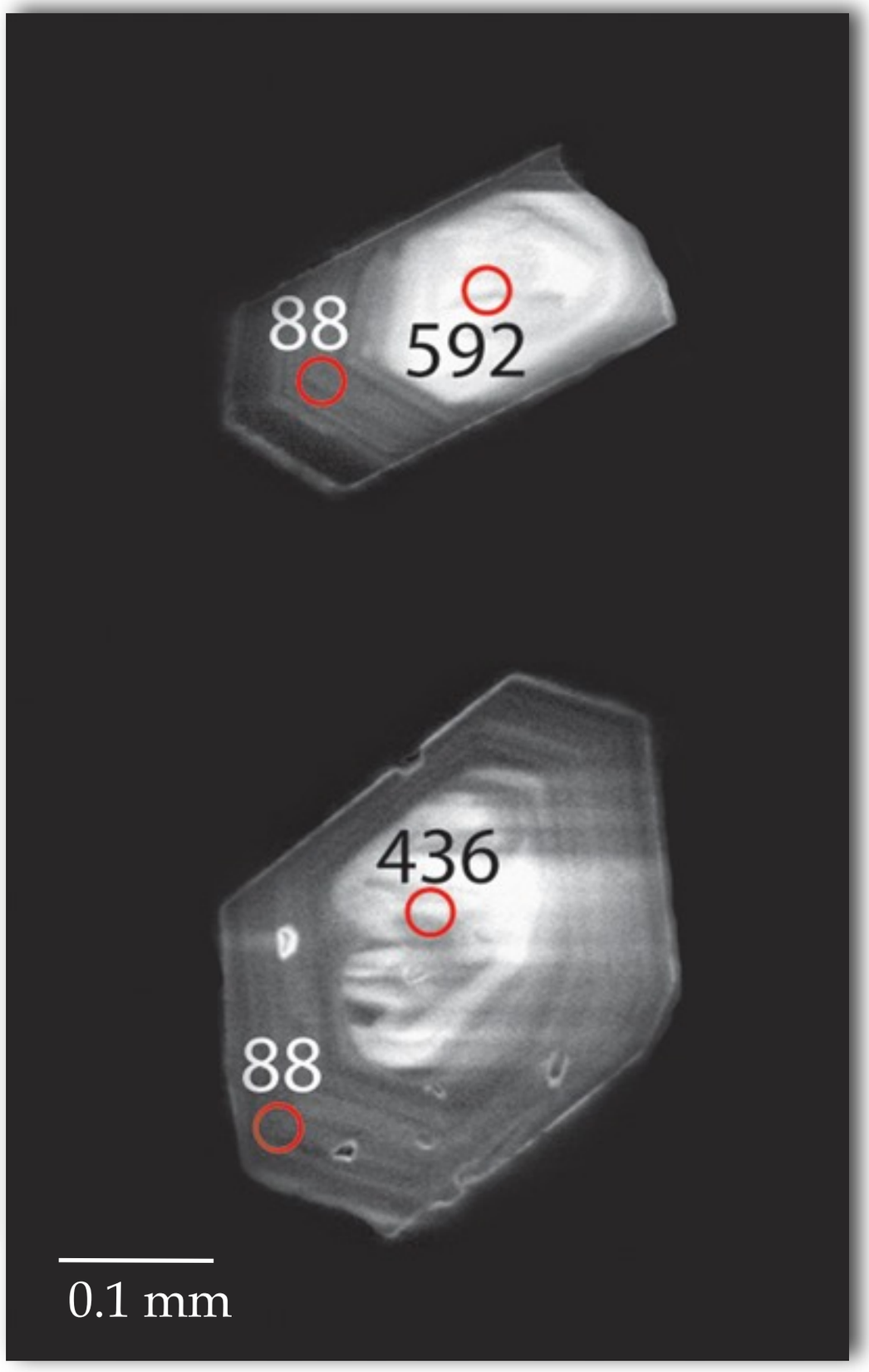
Metamorphisms and Geochronology



Metamorphisms and Geochronology

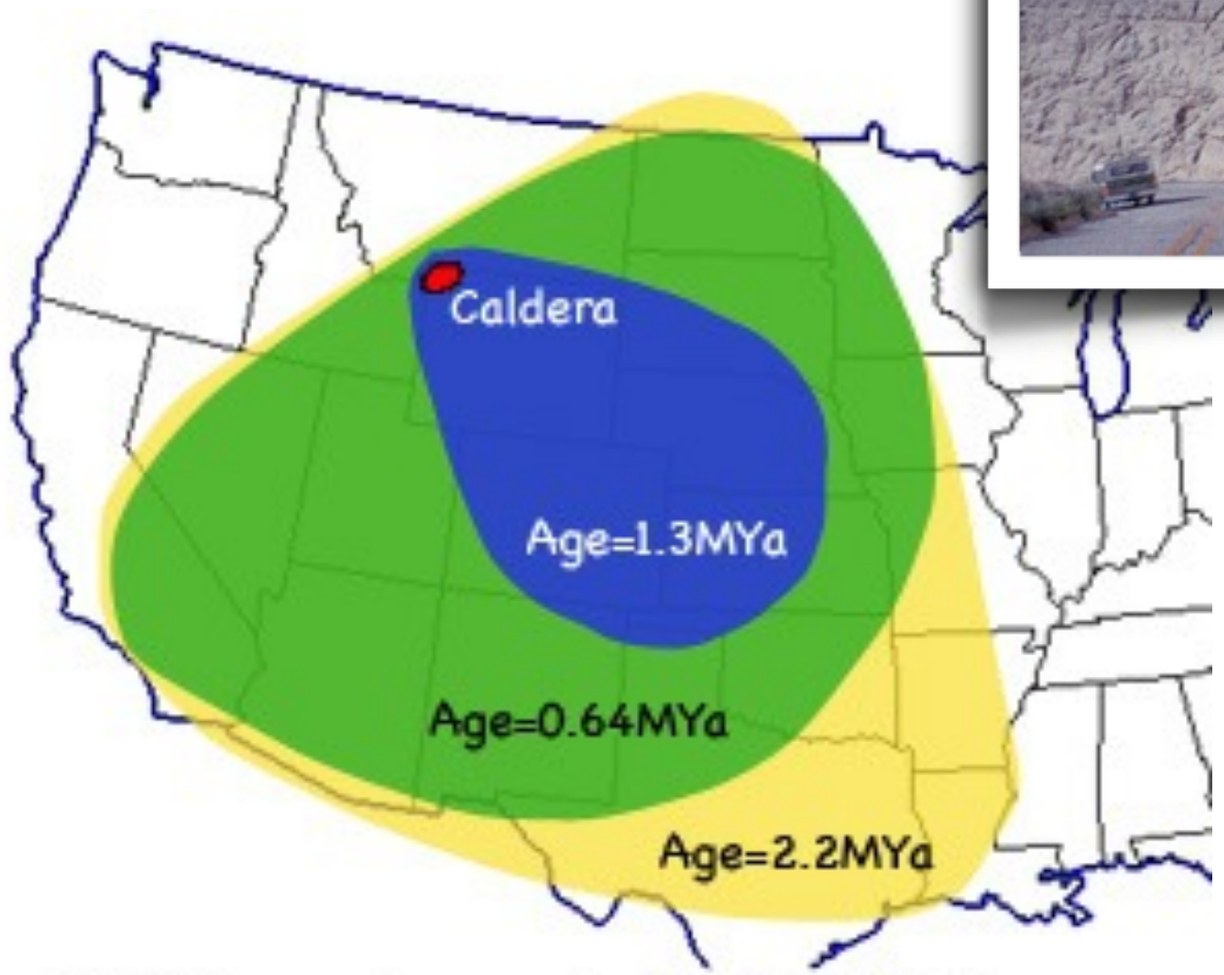
SHRIMP at Stanford Univ.

(Secondary Hi-Resolution ion microprobe Mass Spectrometer)



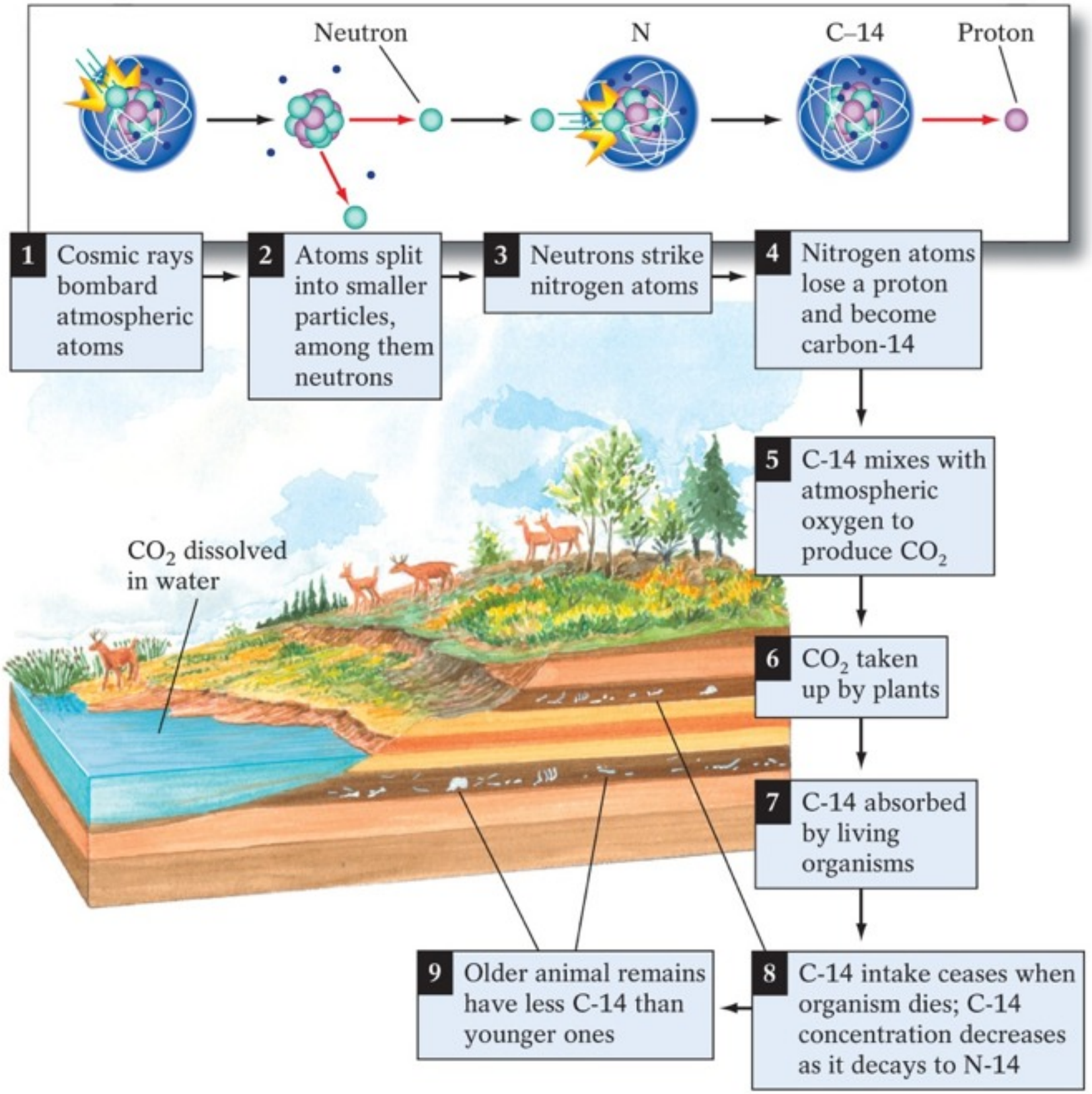
Sedimentary Rocks and Geochronology

Sedimentary Rocks and Geochronology

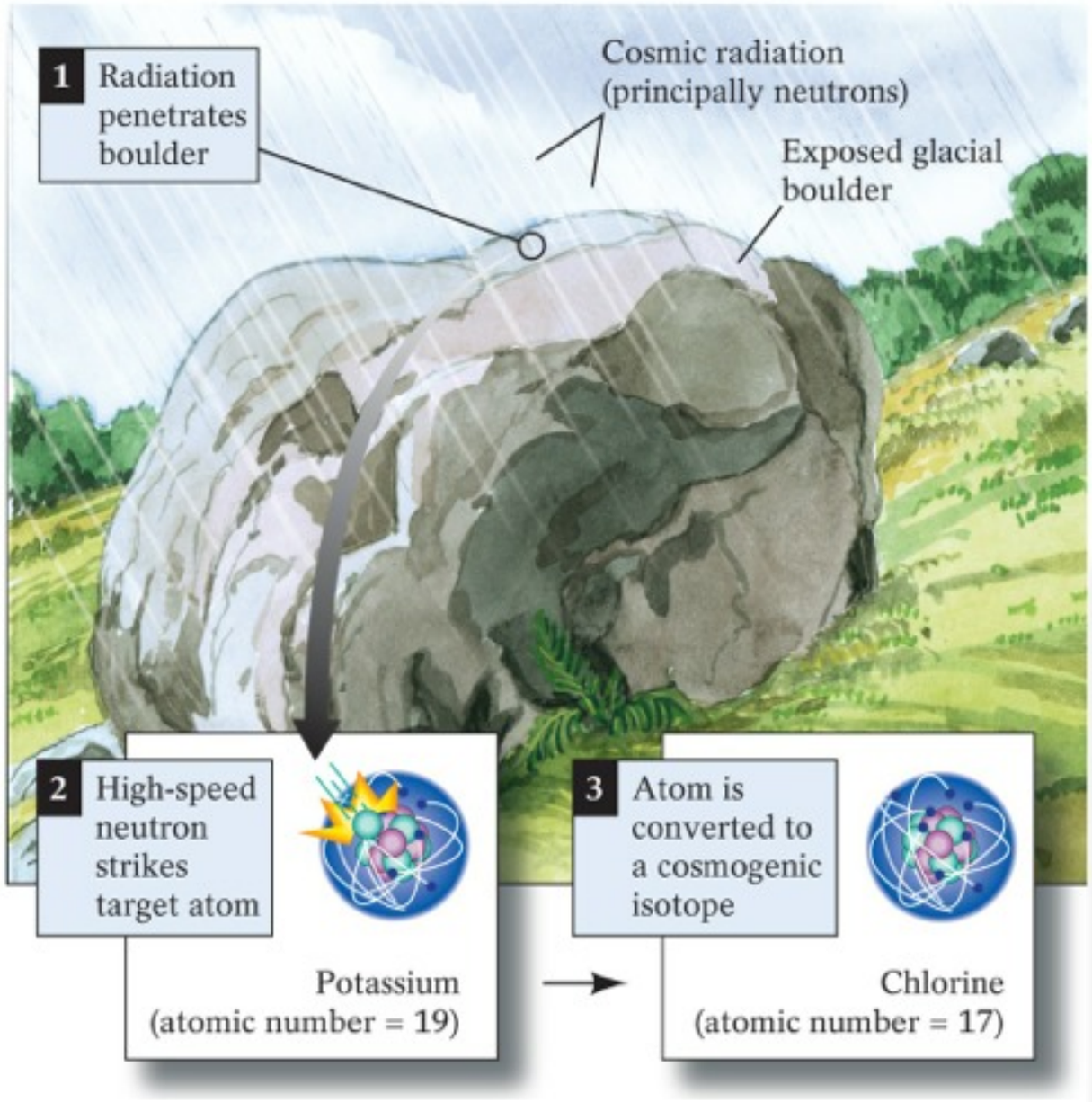


Yellowstone Ash-Fall Zones

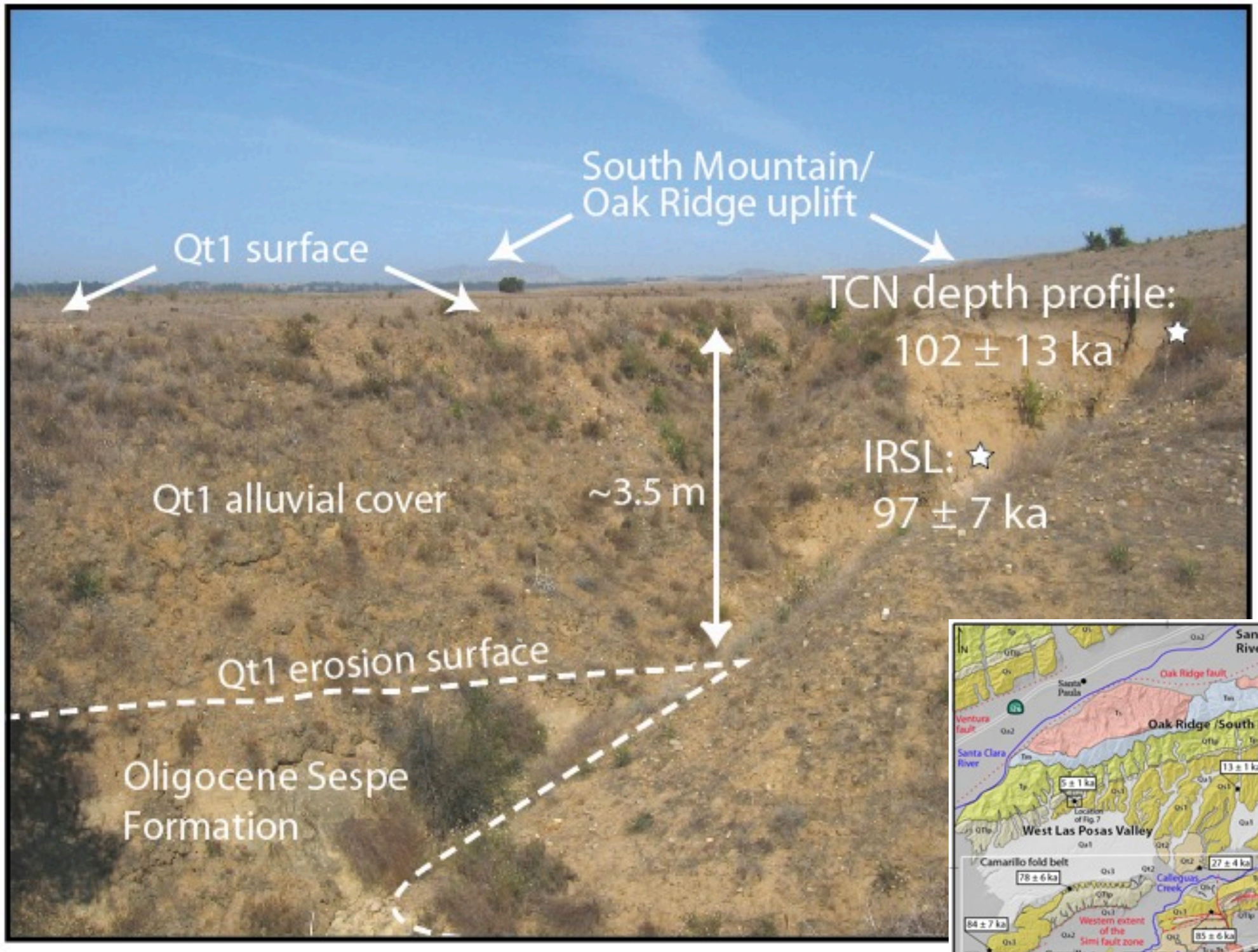
(C14) Radiocarbon Geochronology

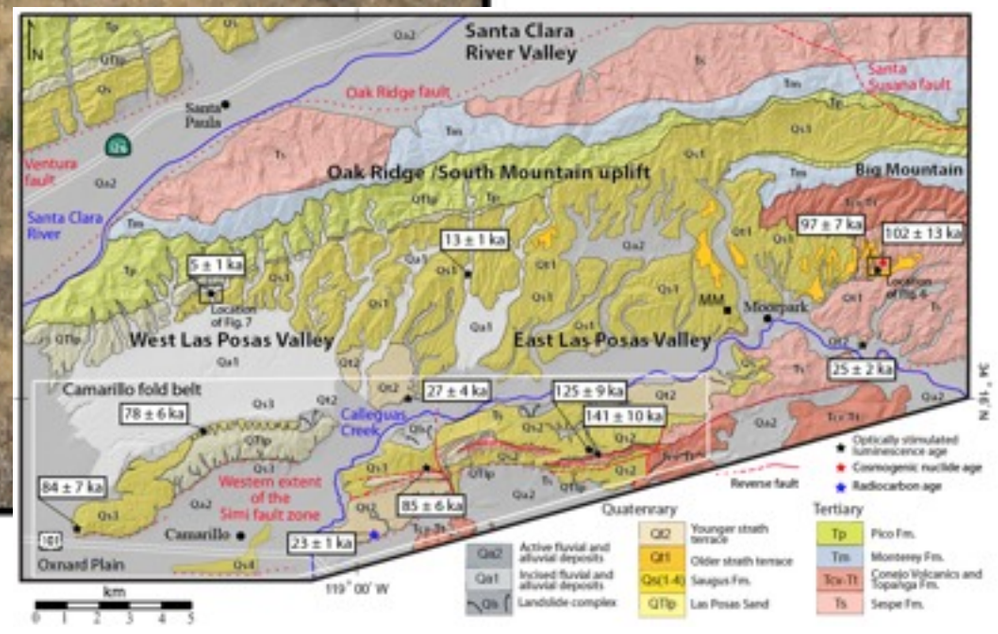


Cosmogenic Radionuclide Geochronology

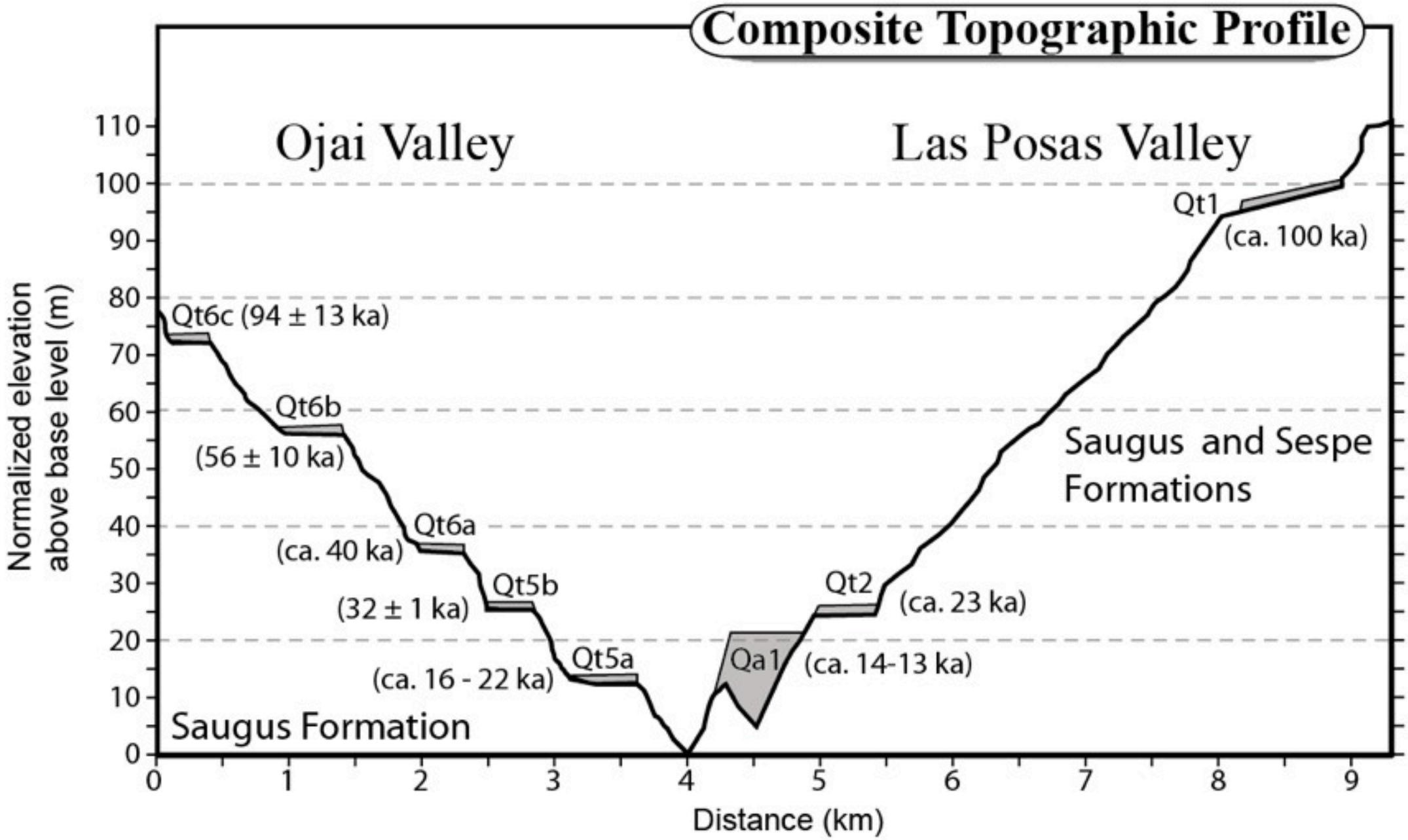


Cosmogenic Radionuclide and Optically Stimulated luminescence (OSL) Geochronology

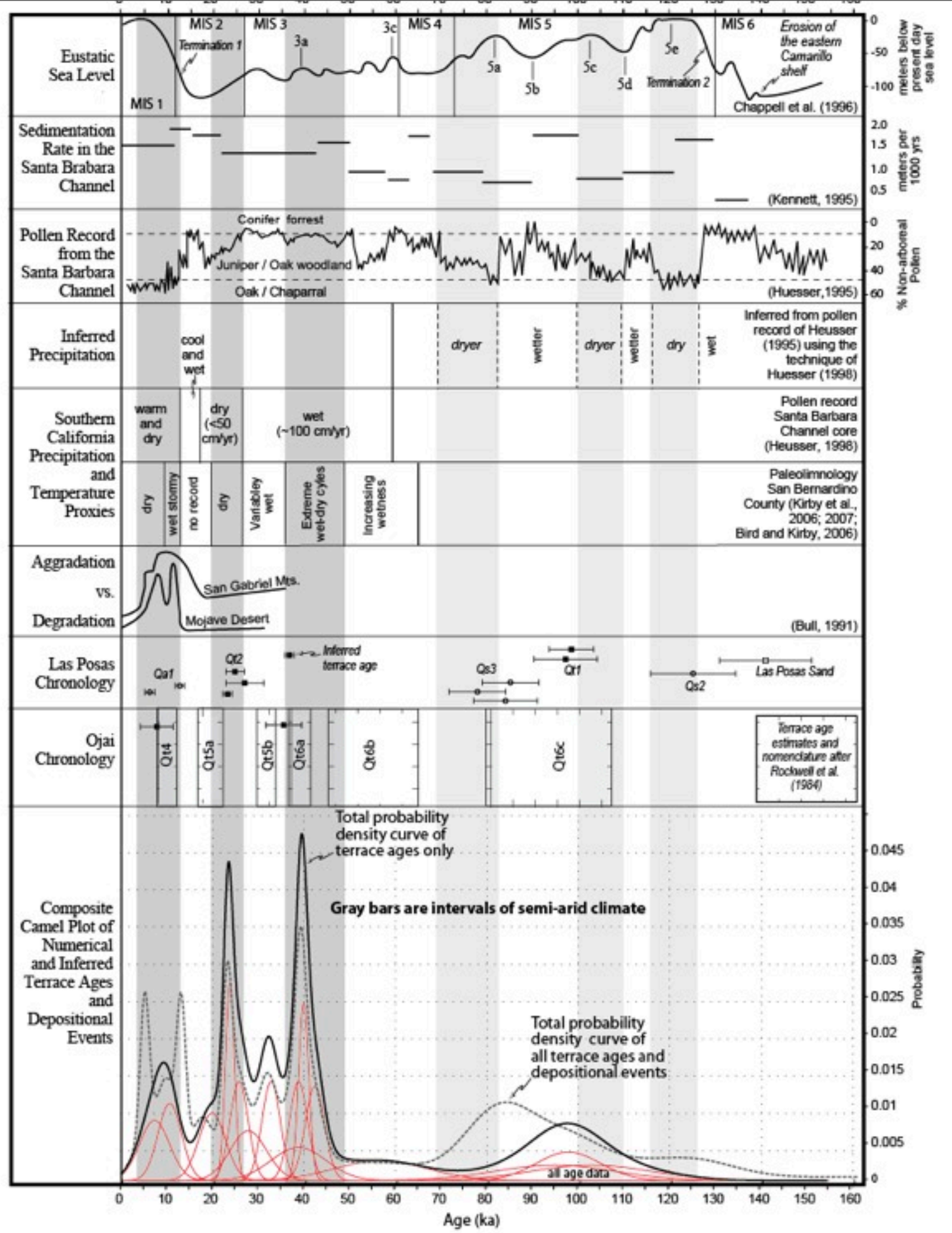


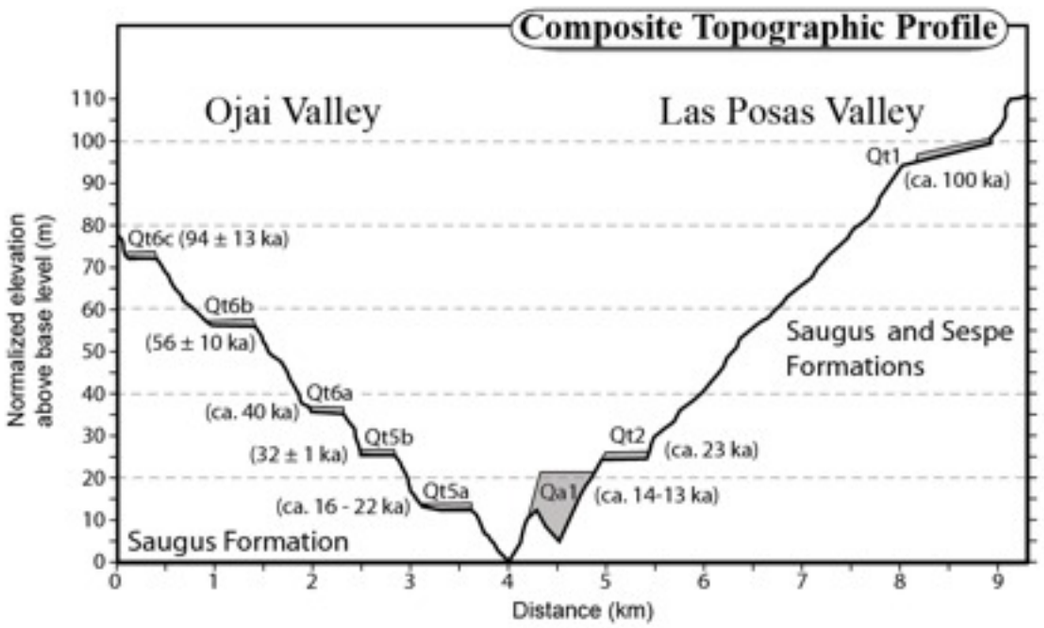


Cosmogenic Radionuclide and Optically Stimulated luminescence (OSL) Geochronology



Climate-controlled Landscape Evolution





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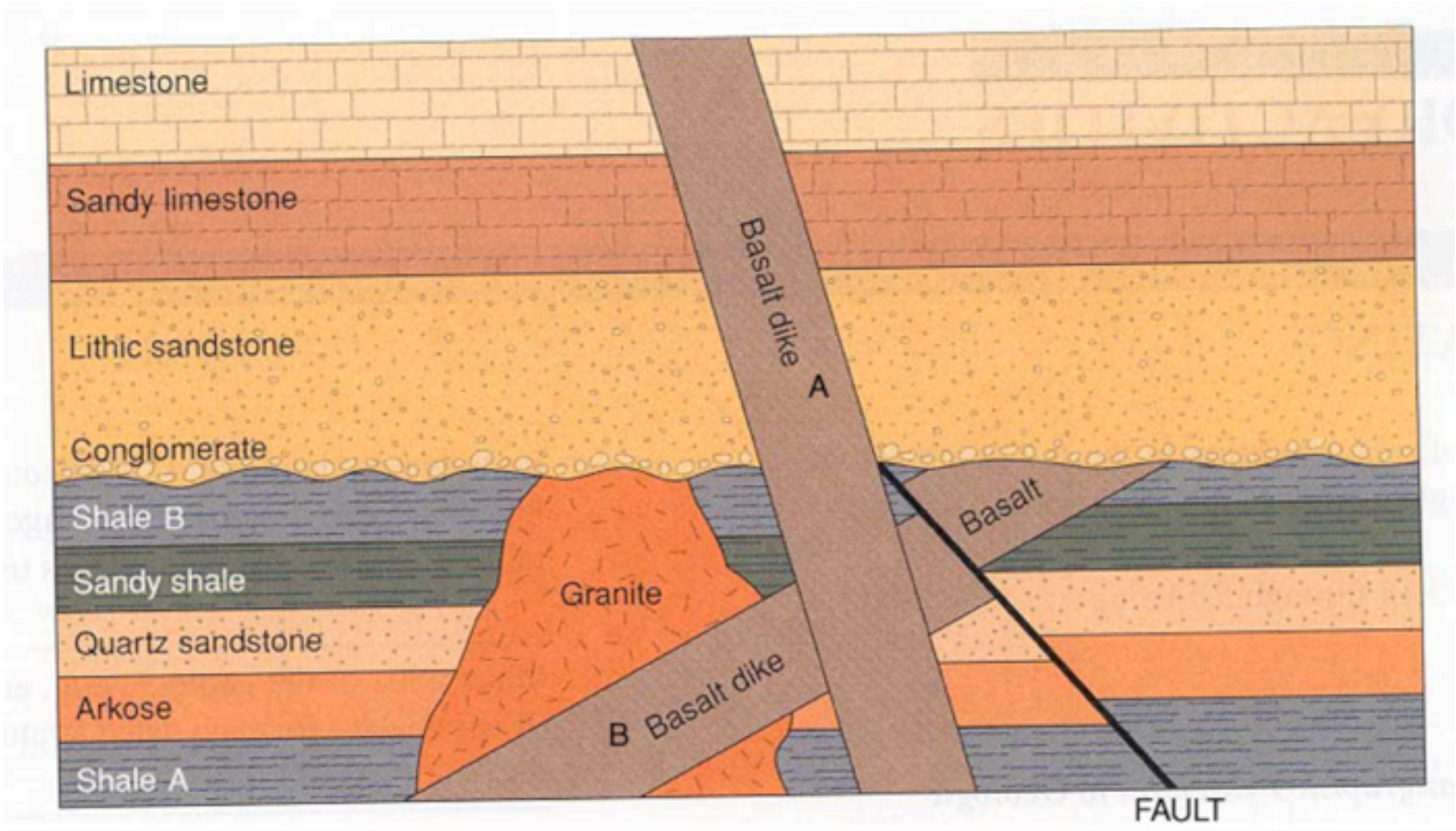


X-Sxn A Stratigraphy

Basalt dike A

Limestone

Sandy limestone

Lithic sandstone

Conglomerate

Dis/nonconformity

Reverse fault

Basalt dike B

Granite

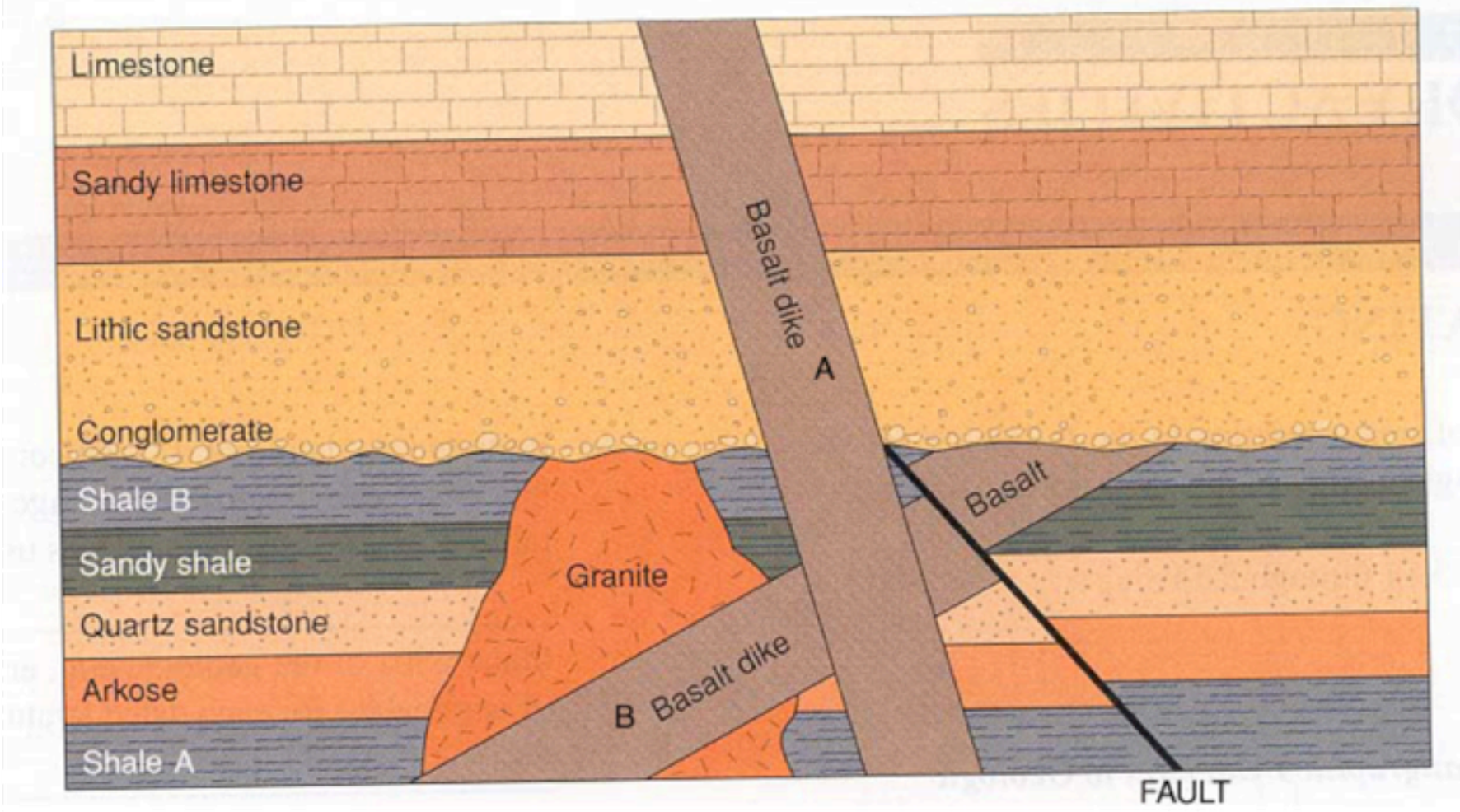
Shale B

Sandy shale

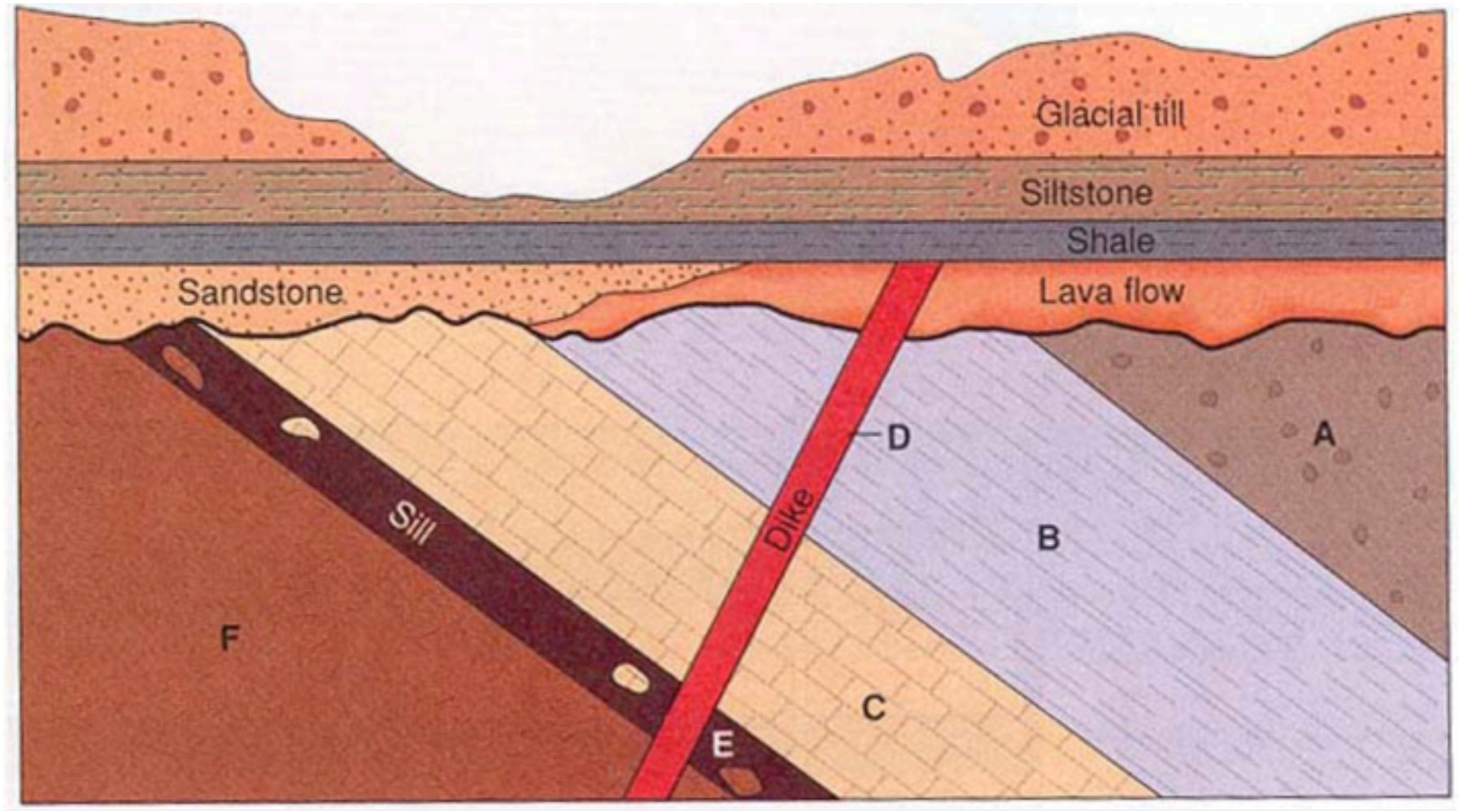
Quartz sandstone

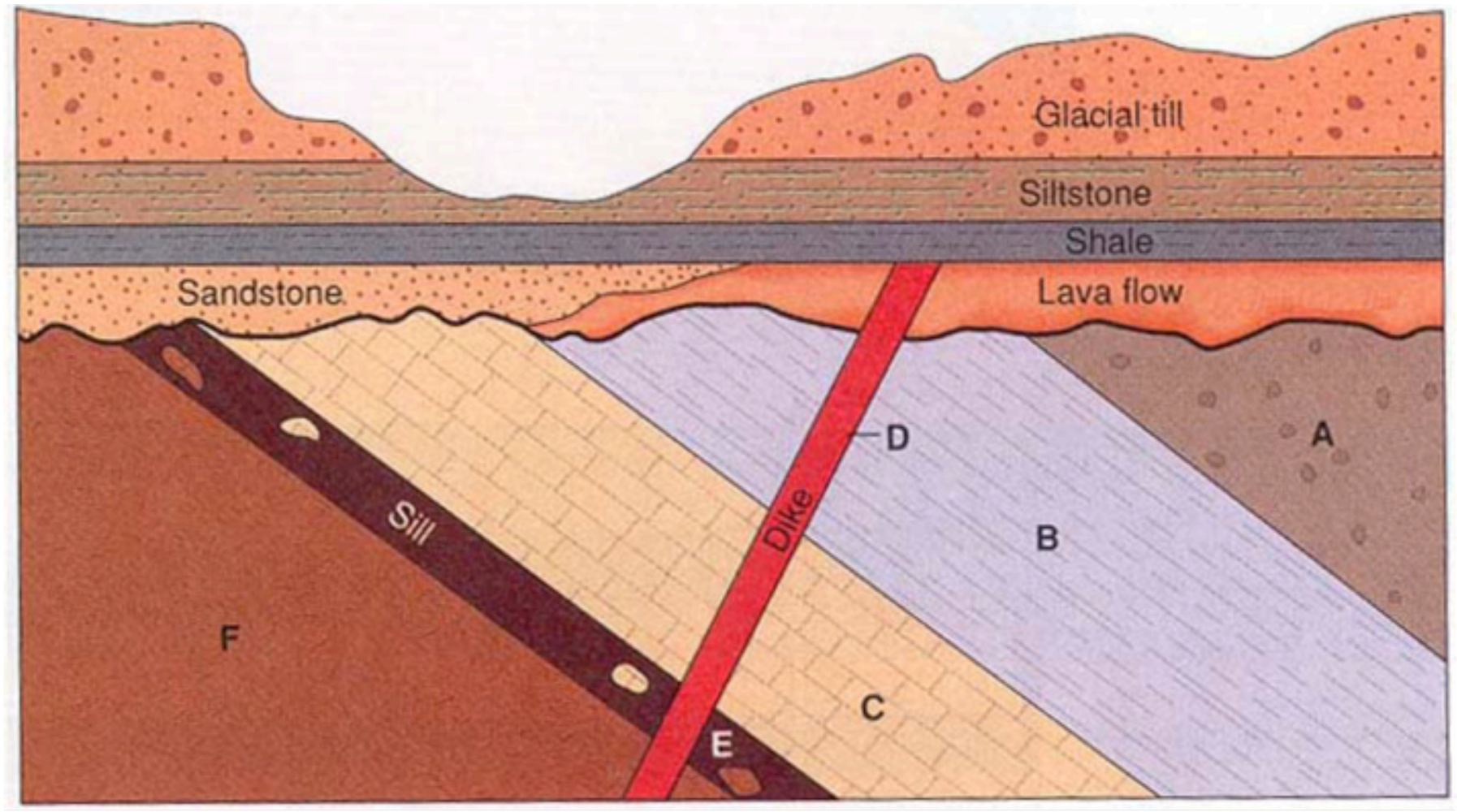
Arkose

Shale A



X-Sxn B Stratigraphy





X-Sxn B Stratigraphy

Erosion in progress

Glacial till

Siltstone

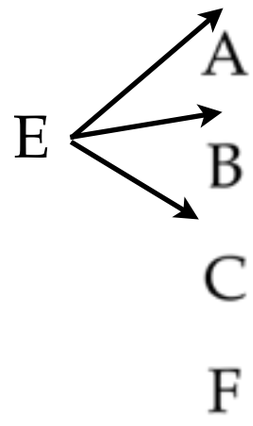
Shale

Sandstone or Dike

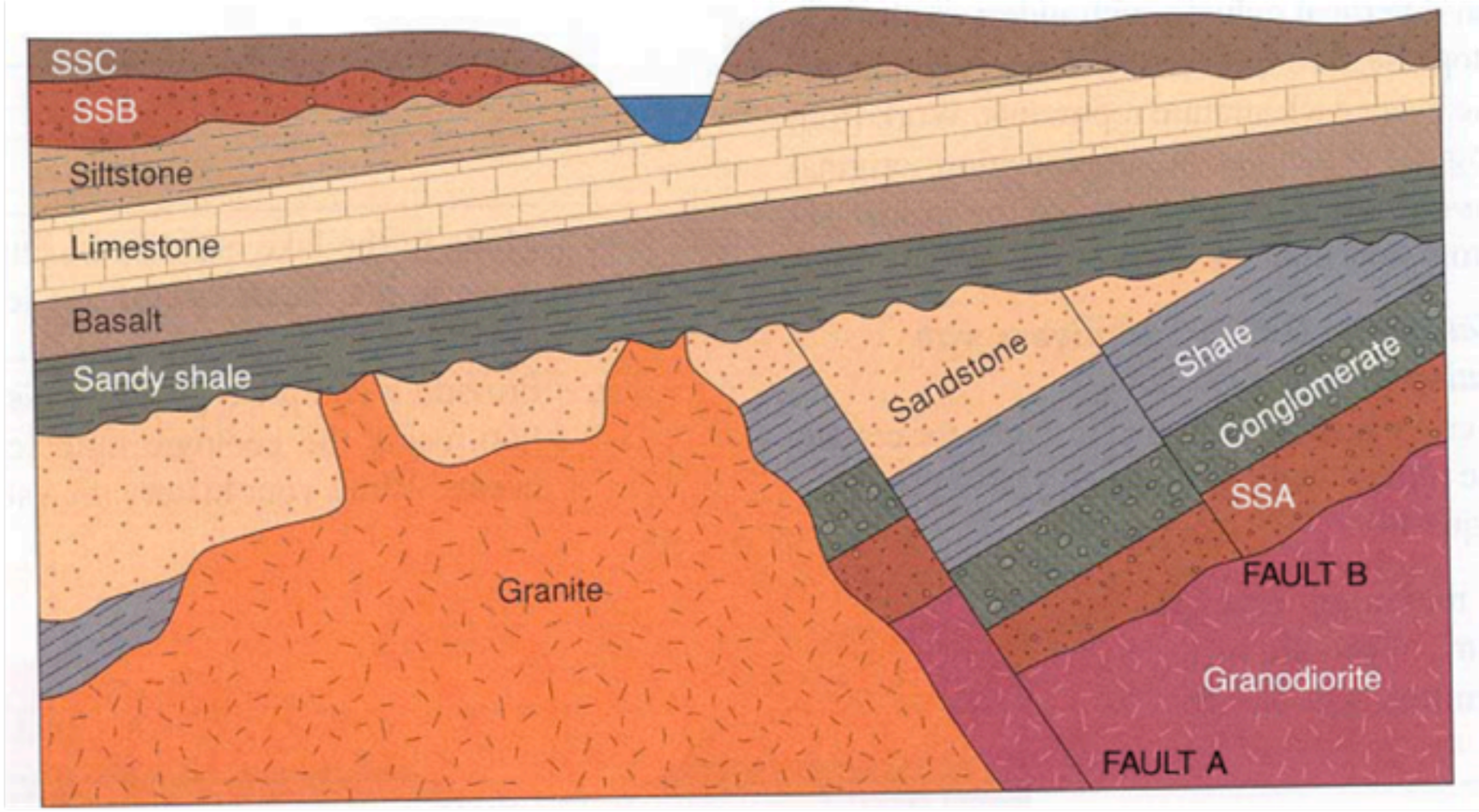
Lava flow

Angular unconformity

Tilt



X-Sxn C Stratigraphy



X-Sxn C Stratigraphy

Erosion in progress, by river that is still present

SSC

Angular unconformity

Tilting

SSB

Disconformity

Siltstone

Limestone

Basalt

Sandy shale

Angular unconformity

Granite or Normal Fault A

Tilt

Granodiorite

Reverse Fault B

Sandstone

Shale

Conglomerate

SSA