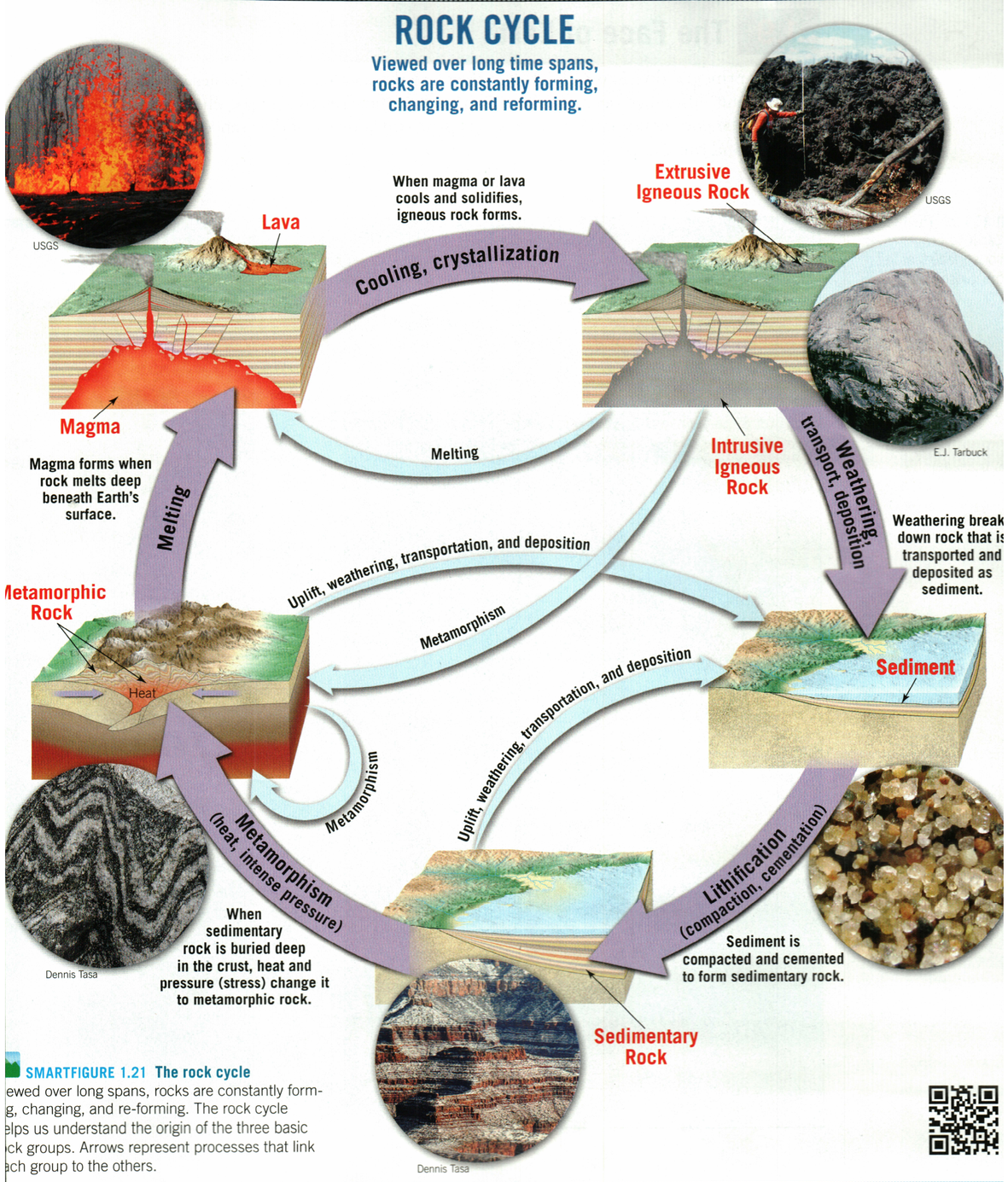
OLLI SG 492
Plate Tectonics

Session 5 - October 17, 2022

Today’s Meeting

- Rock Cycle and rock deformation.
- The formation of the continents; the role of cratons.
- The Supercontinent Cycle.

Rock Cycle

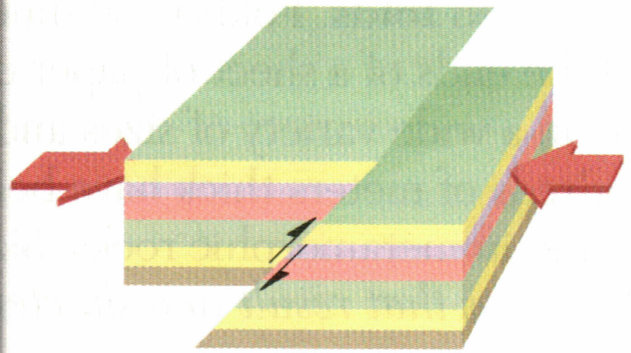
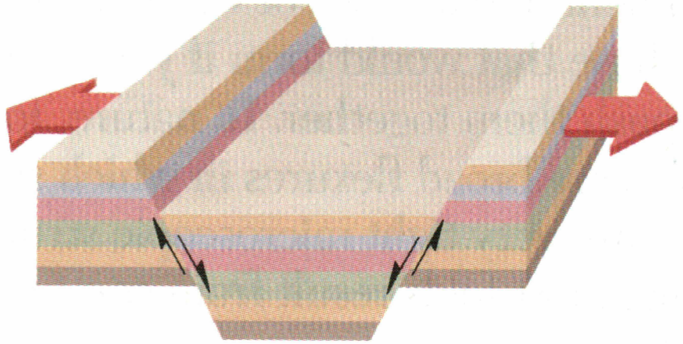
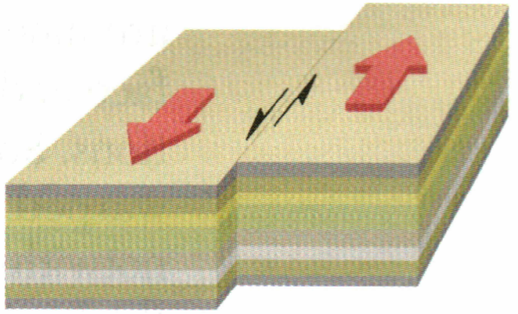
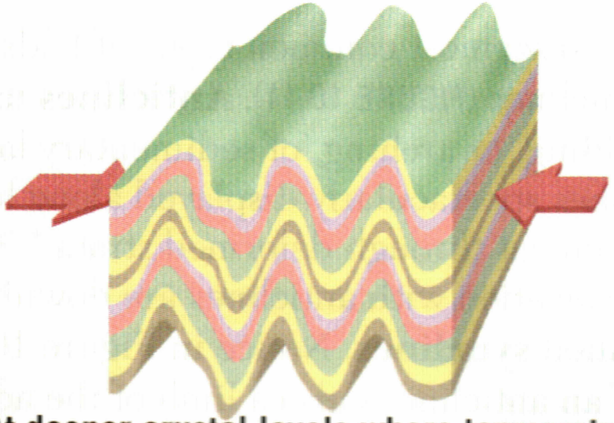
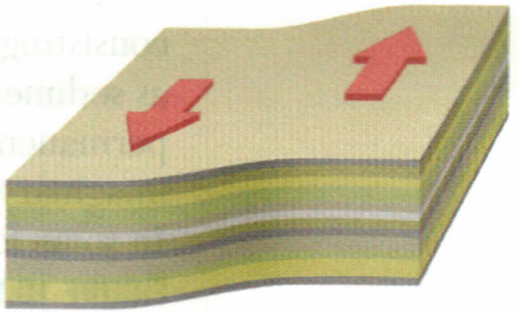


SMARTFIGURE 1.21 The rock cycle
ewed over long spans, rocks are constantly form-
g, changing, and re-forming. The rock cycle
elps us understand the origin of the three basic
ck groups. Arrows represent processes that link
ach group to the others.

Rock Deformation

- Whenever the stresses/forces acting on a rock exceed its strength, the rock will deform by folding, flowing, fracturing, or faulting.
- Factors that affect the strength of a rock include temperature, pressure, rock type, and time.
- When tectonic forces are applied slowly over geologic time spans (eons), rocks tend to deform by bending or flowing, not breaking.

How Rocks Respond to Differential Stress

Type of stress	COMPRESSION (Compression causes shortening)	TENSION (Tension causes stretching)	SHEAR (Shear distorts rock)
At shallow depths rocks exhibit brittle fracture	 At shallow depths shortening occurs by brittle deformation along faults where one rock mass is thrust over another.	 At shallow depths tensional stresses cause rocks to fracture and pull apart.	 At shallow depths shear stress causes offset in crustal blocks along faults.
At deeper crustal depths rocks deform by ductile flow	 At deeper crustal levels where temperatures are high, compressional forces squeeze and fold rock masses.	 At deeper crustal levels where temperatures are high, tensional forces stretch and elongate crustal materials by ductile flow.	 At deeper crustal levels where temperatures are high, shear stress distorts rock masses by ductile flow, usually along shear zones.

Rock Deformation

Folding

Rock Deformation

Sideling Hill Road Cut - I-68: Syncline

Rock Deformation

Sideling Hill Road Cut - I-68: Syncline

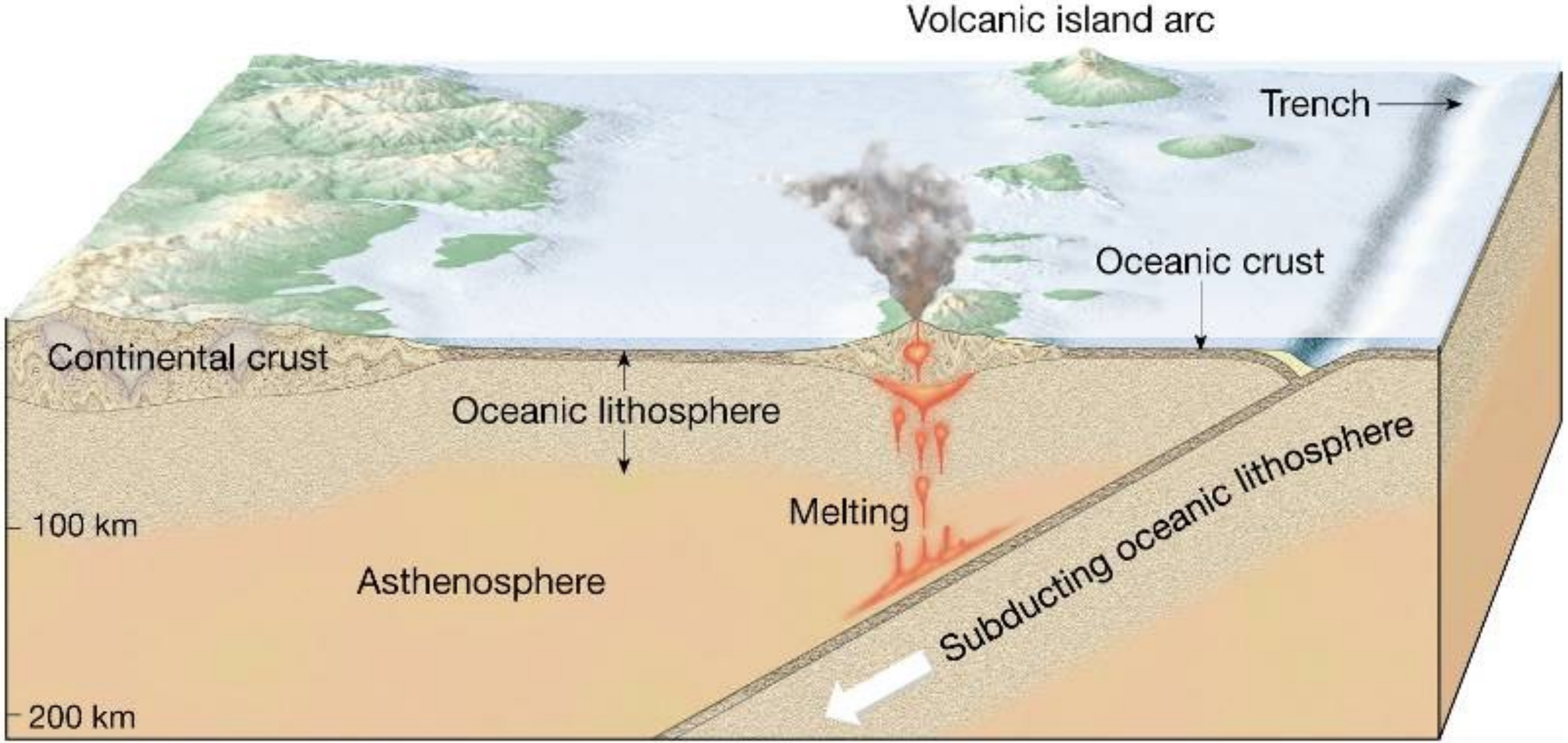
Formation of the Continents

Early Processes

- Early Archaean Earth had cooled sufficiently to have a stable crust, covered by an ocean, and intense vulcanism.
- Volcanos grew to heights that breached the surface of the ocean, bringing both magma/basalt and granite to the surface.
- Erosion of the exposed rock and run-off of sediments enlarged the volcanic island, creating stable continental crust.
- Plate movements caused the collision of these volcanic islands, merging their continental crusts into larger blocks of continental crust.
- Continuation of this process created cratons, the core/kernel of continents.

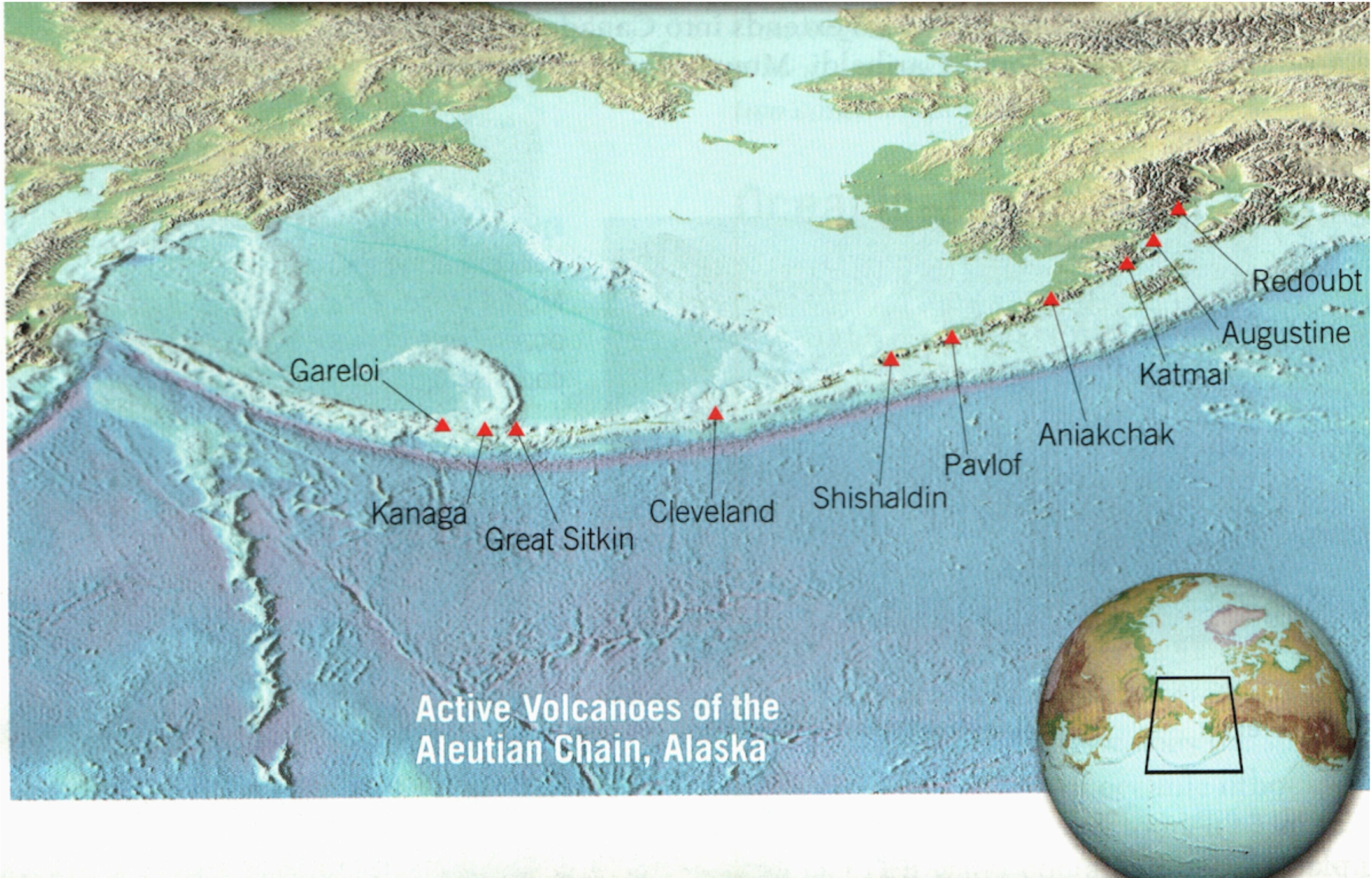
Formation of the Continents

Early Processes - Volcanic Island Arcs



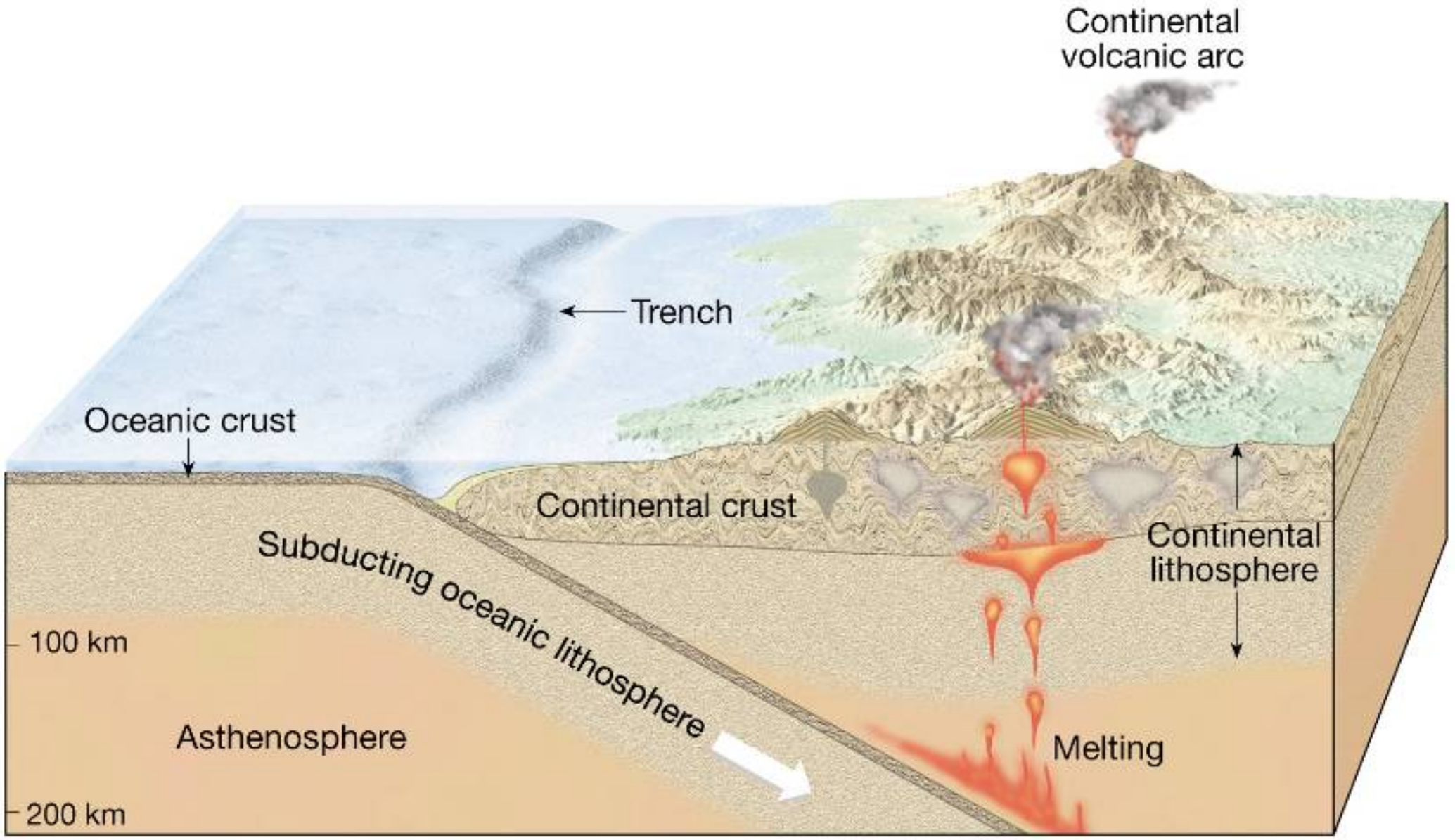
Formation of the Continents

Volcanic Island Arc - Aleutian Islands



Formation of the Continents

Early Processes - Oceanic Crust Subduction



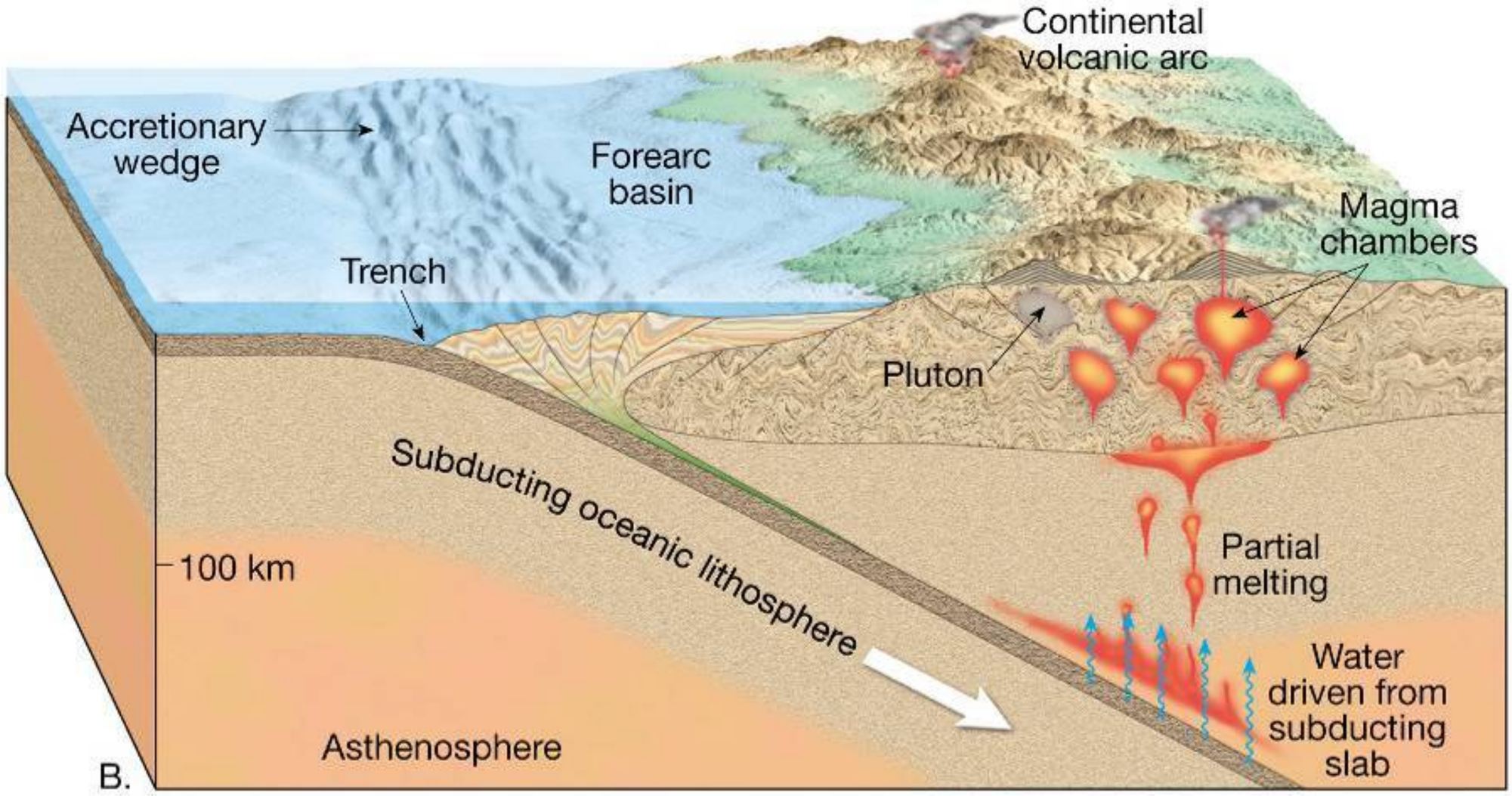
Formation of the Continents

Early Processes

- Hazen video clip 25.1 - from 23;24 TO 26:10

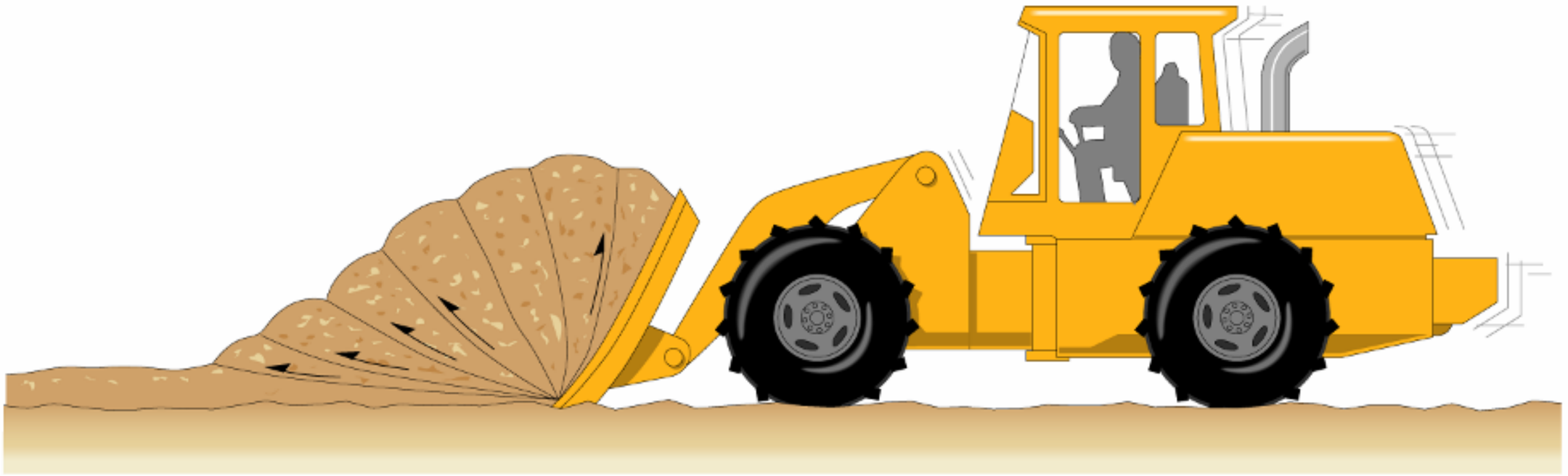
Formation of the Continents

Accretionary Wedge



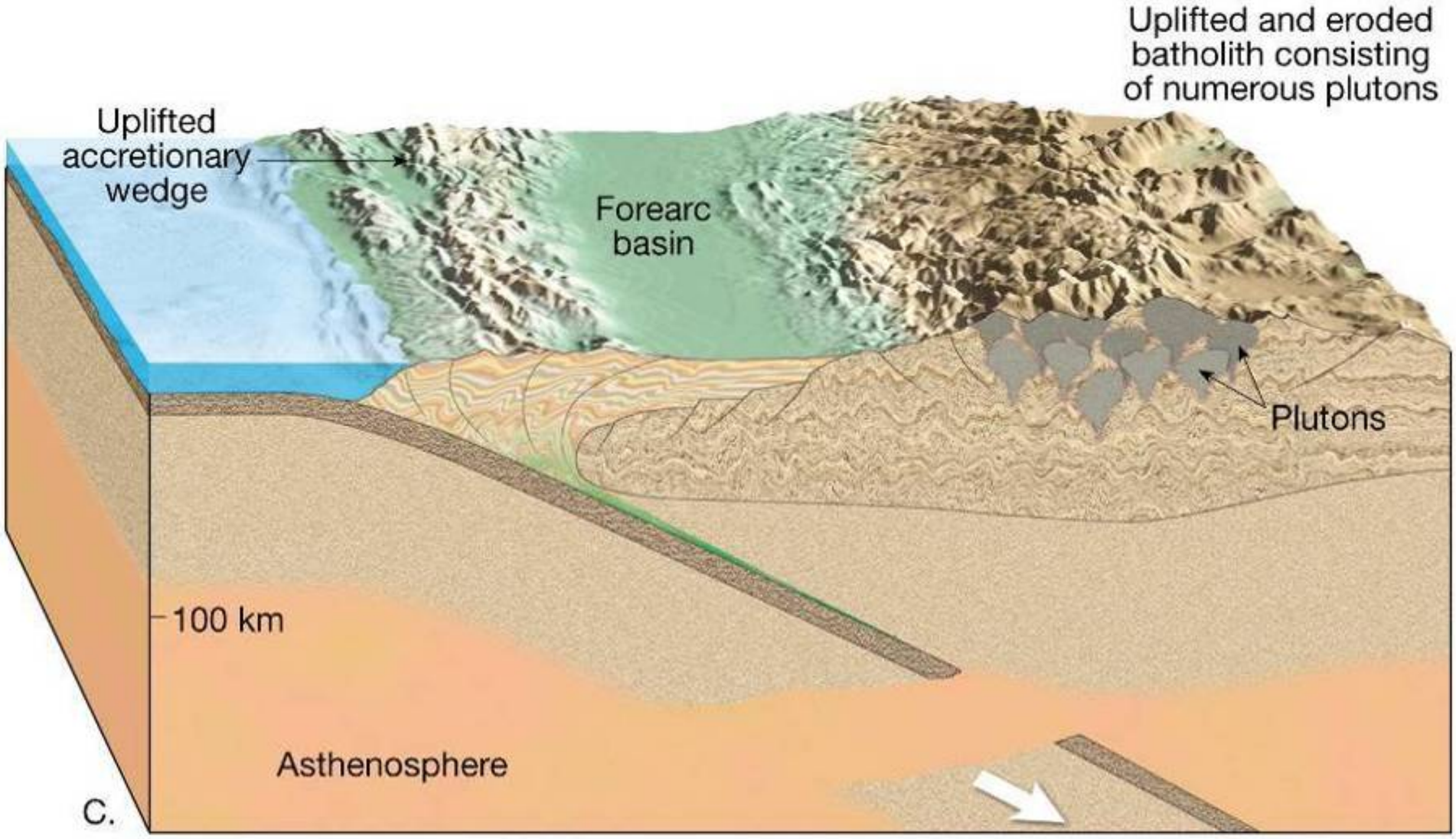
Formation of the Continents

Accretionary Wedge



Formation of the Continents

Accretionary Wedge



Formation of the Continents
EARLY PROCESSES

- Hazen video clips:
  - 34.1 - from 9:23 to 11:40
  - 34.2 - from 16:12 to 18:40
  - 34.3 - From 21:29 to 29:10

Formation of the Continents

Current Distribution of Cratons

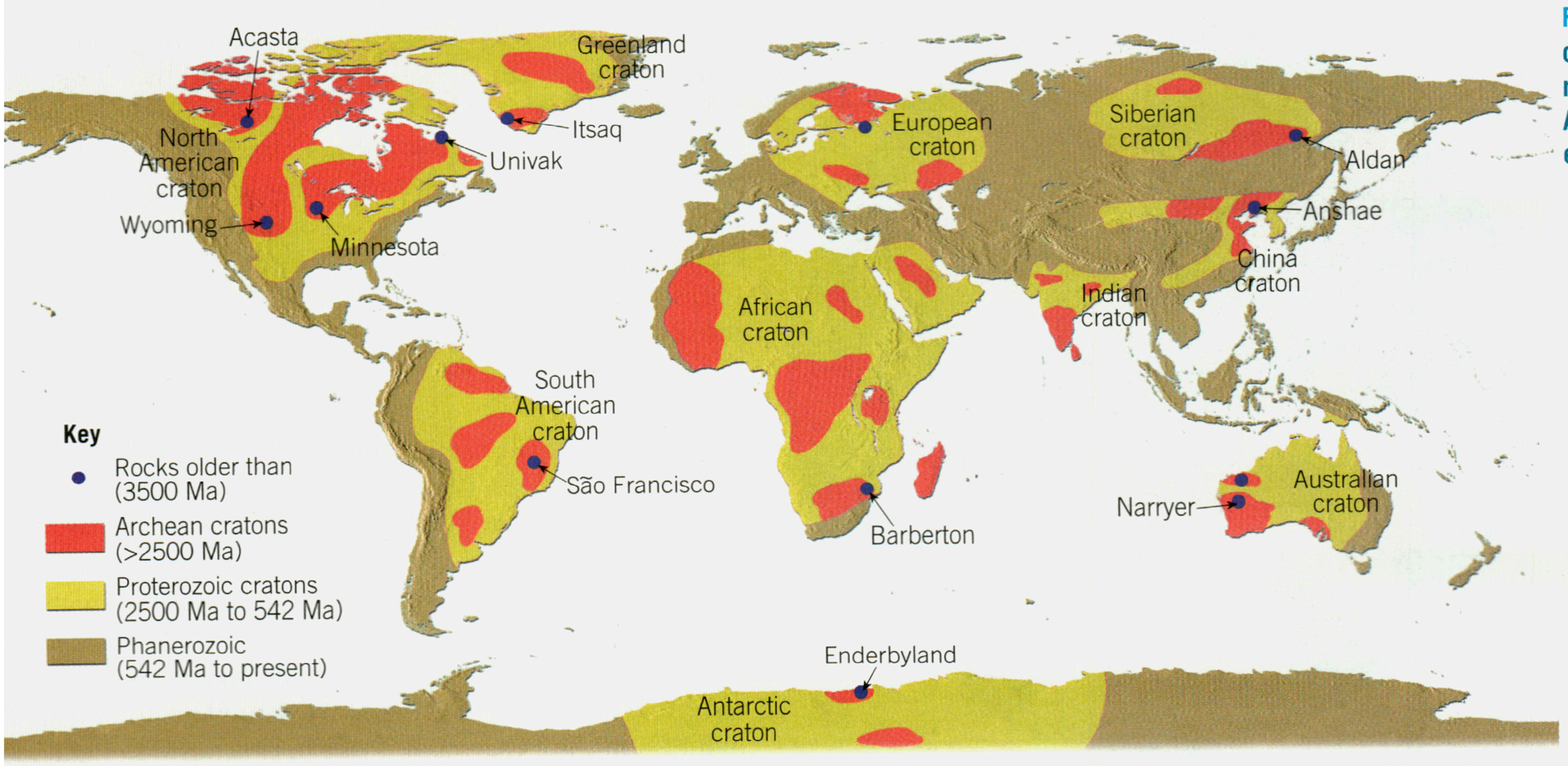


FIGURE 22.12 Distribution of crustal material remaining from the Archean and Proterozoic eons

Supercontinent Cycle

- Hazen video clips:
  - 35.1 - from 0:56 to 10:13
  - 35.2 - from 16:40 to 20:02

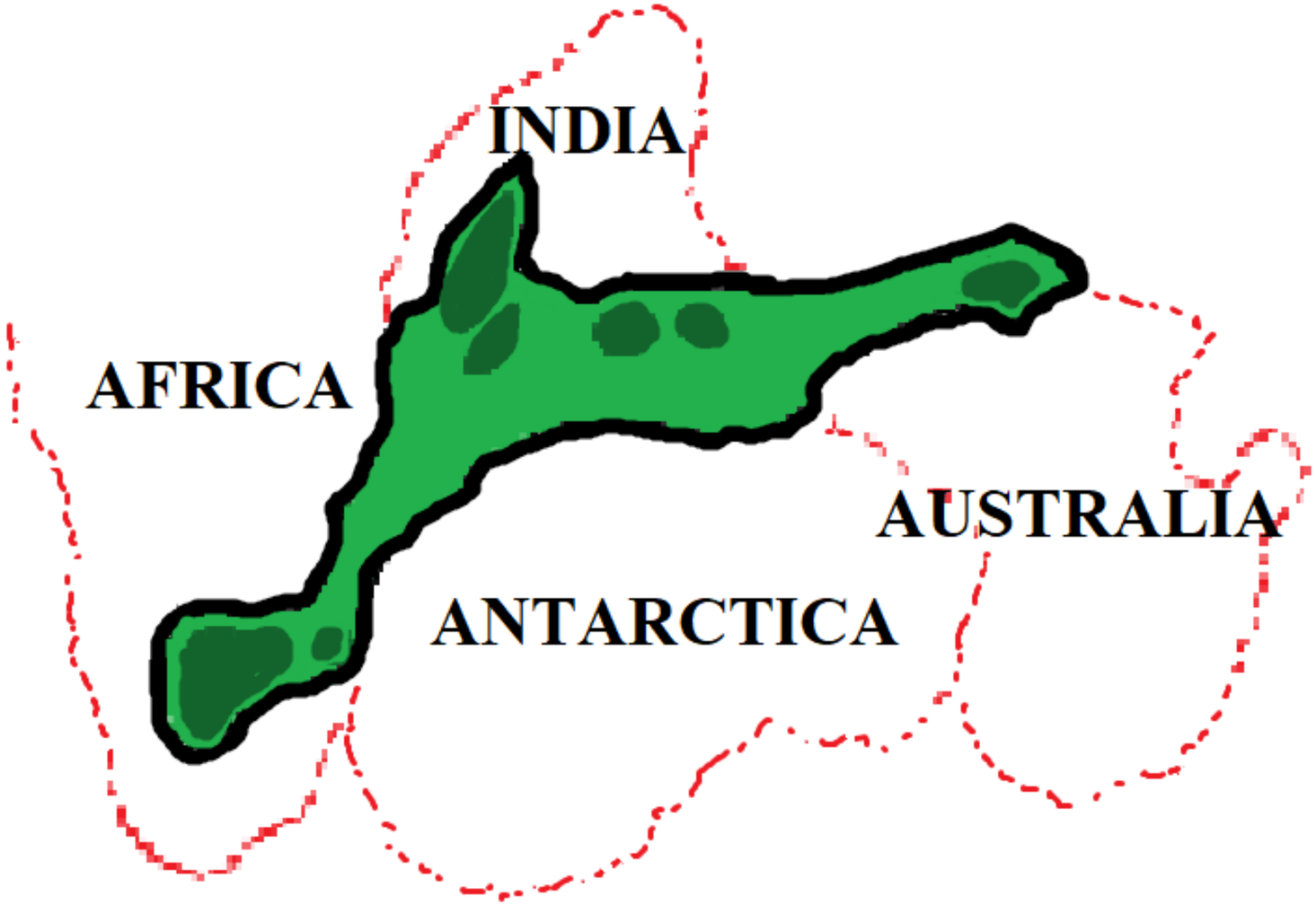
Supercontinent Cycle

Timeline

- Ur - 3.1 BYA
- Kenorland - 2.7 BYA
- Columbia/Nuna - 2.1 BYA
- Rodinia - 1.1 BYA
- Pangaea - 335 MYA

Supercontinent Cycle

Ur

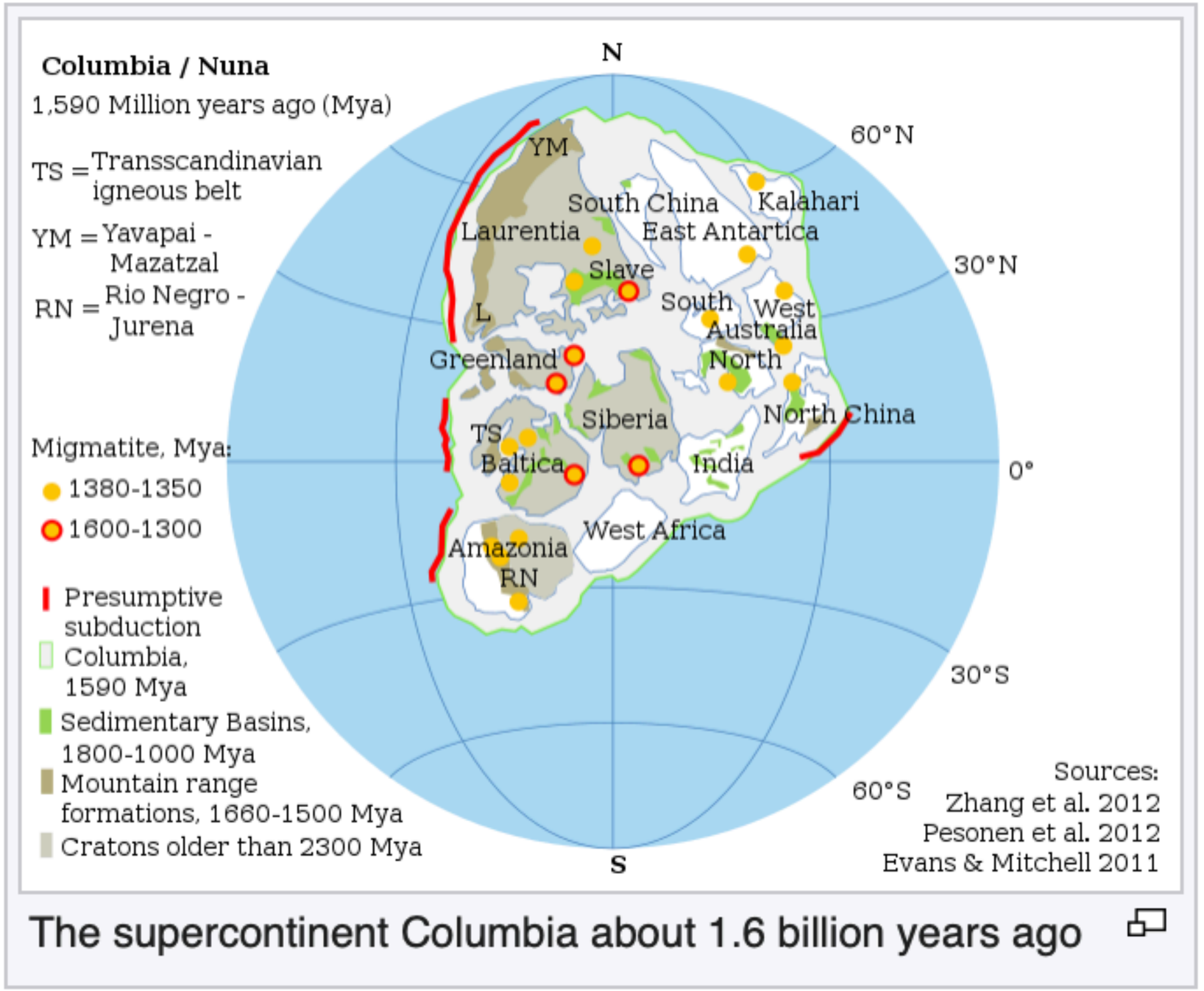


Supercontinent Cycle

Kenorland

Supercontinent Cycle

Columbia/Nuna

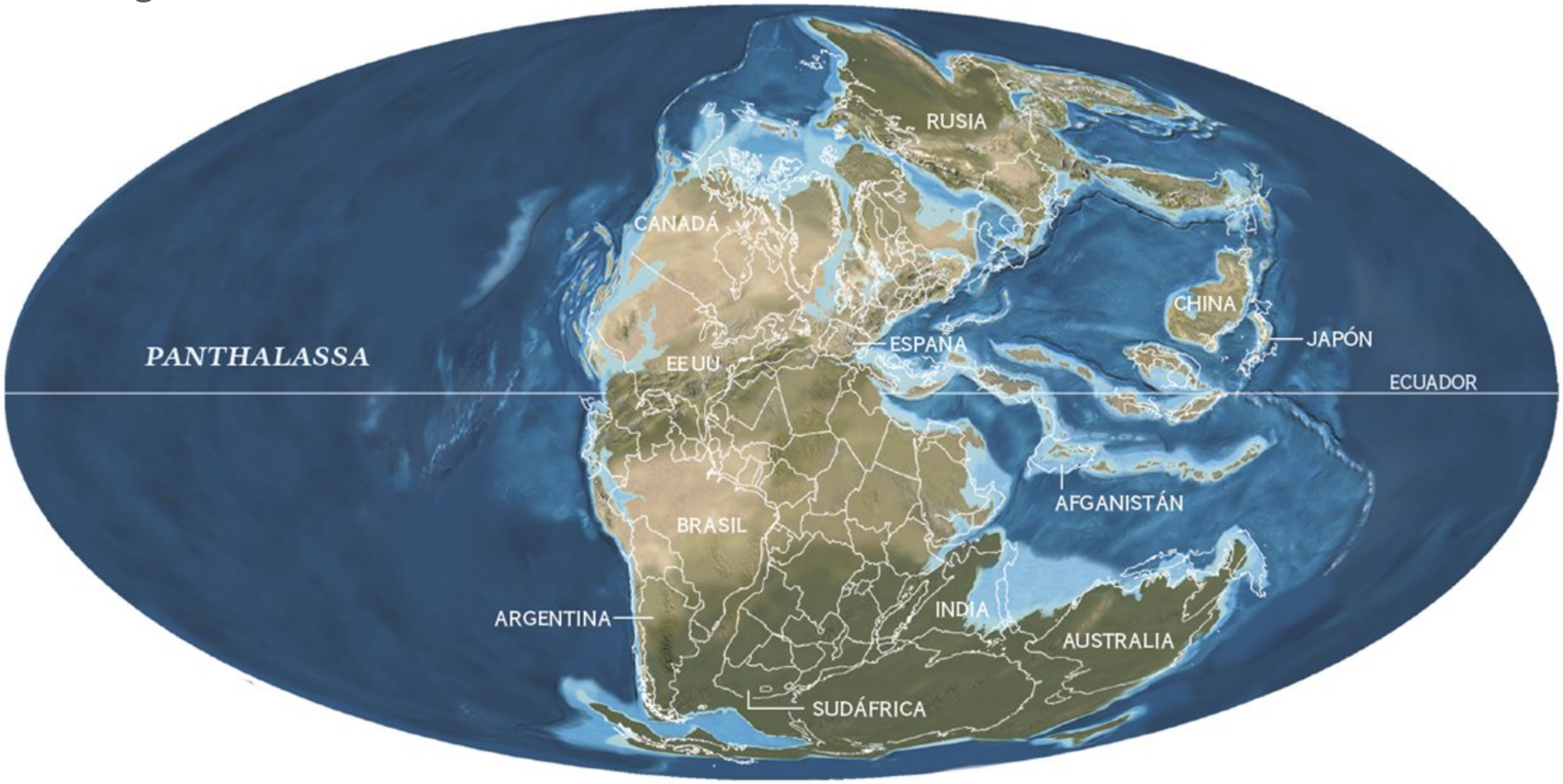


The supercontinent Columbia about 1.6 billion years ago

Supercontinent Cycle

Rodinia

Supercontinent Cycle
Pangaea



Up Next

- Hot Spots
- Basaltic flows and the breakup of Pangaea.
- Hawaii and Yellowstone.