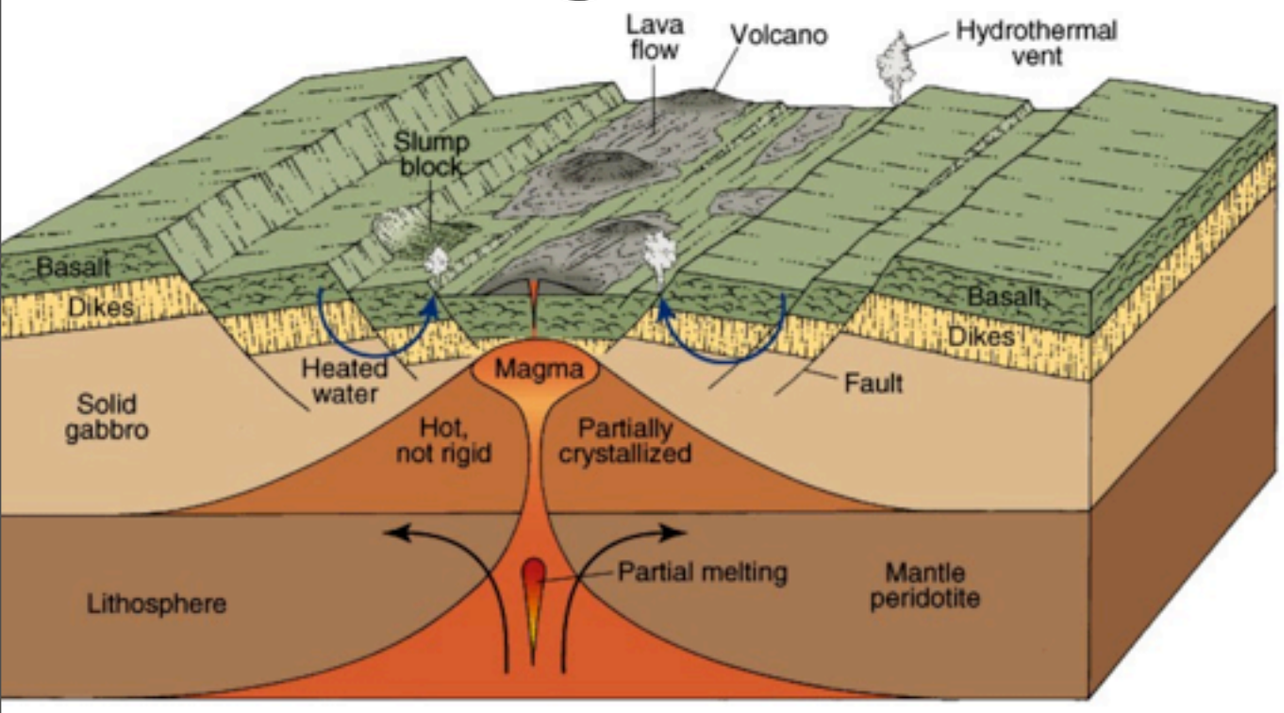
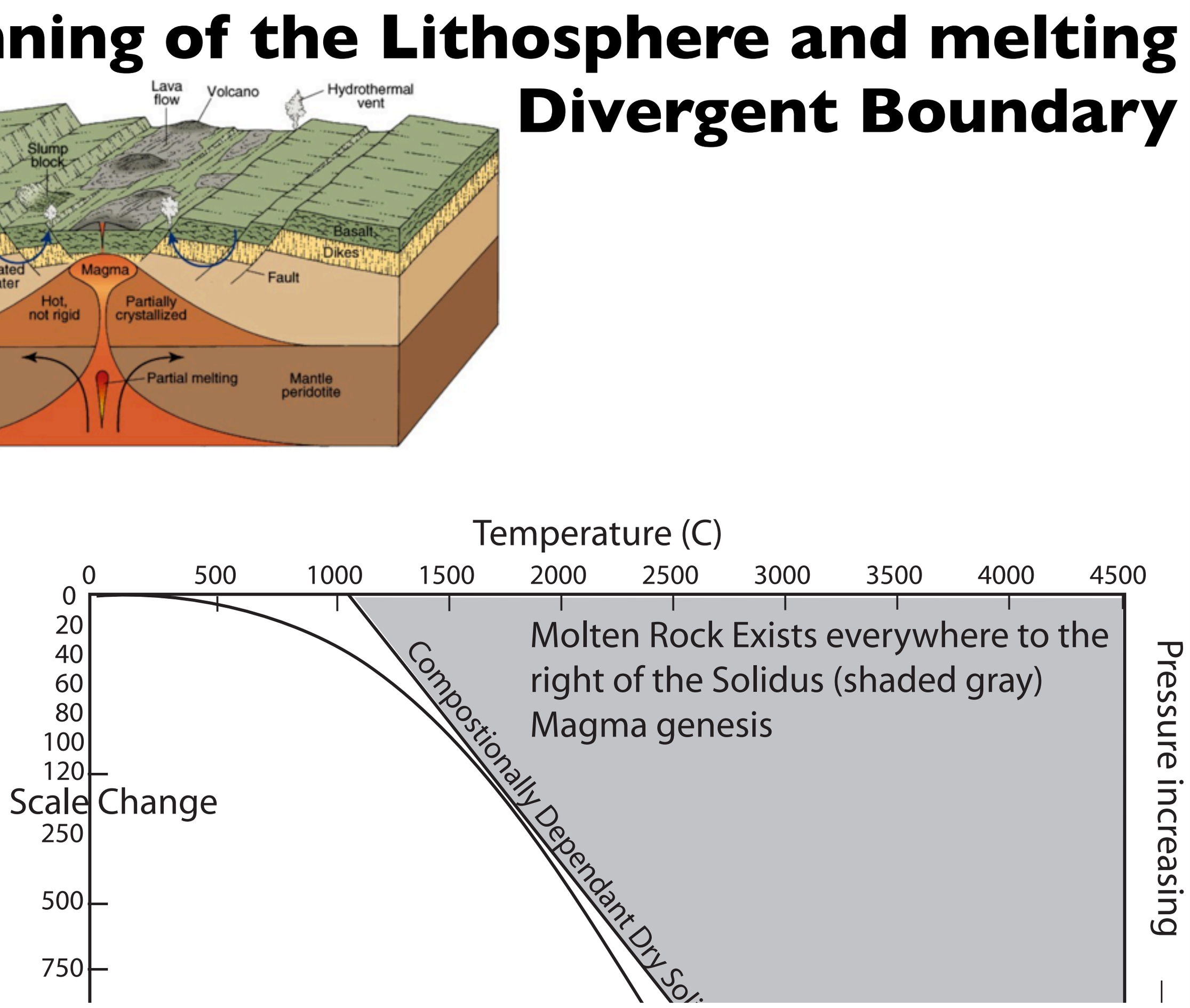
No Quiz Today

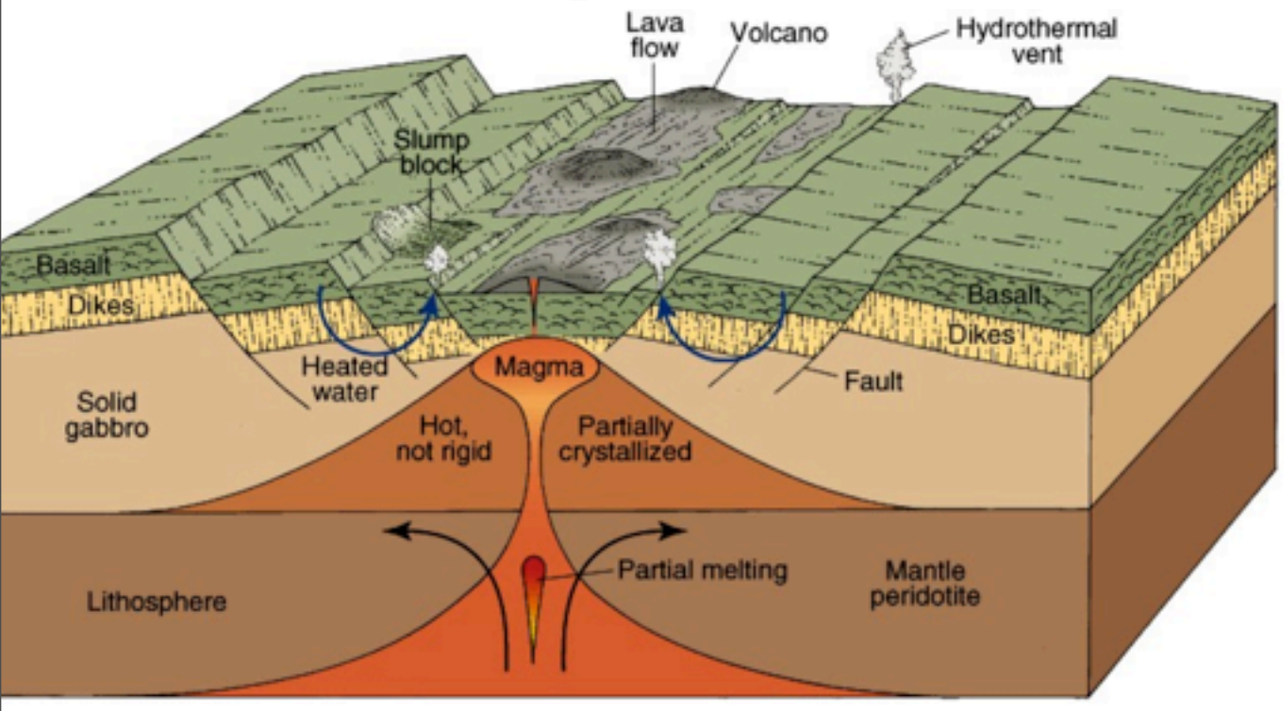
Plate Tectonic Lecture part 3

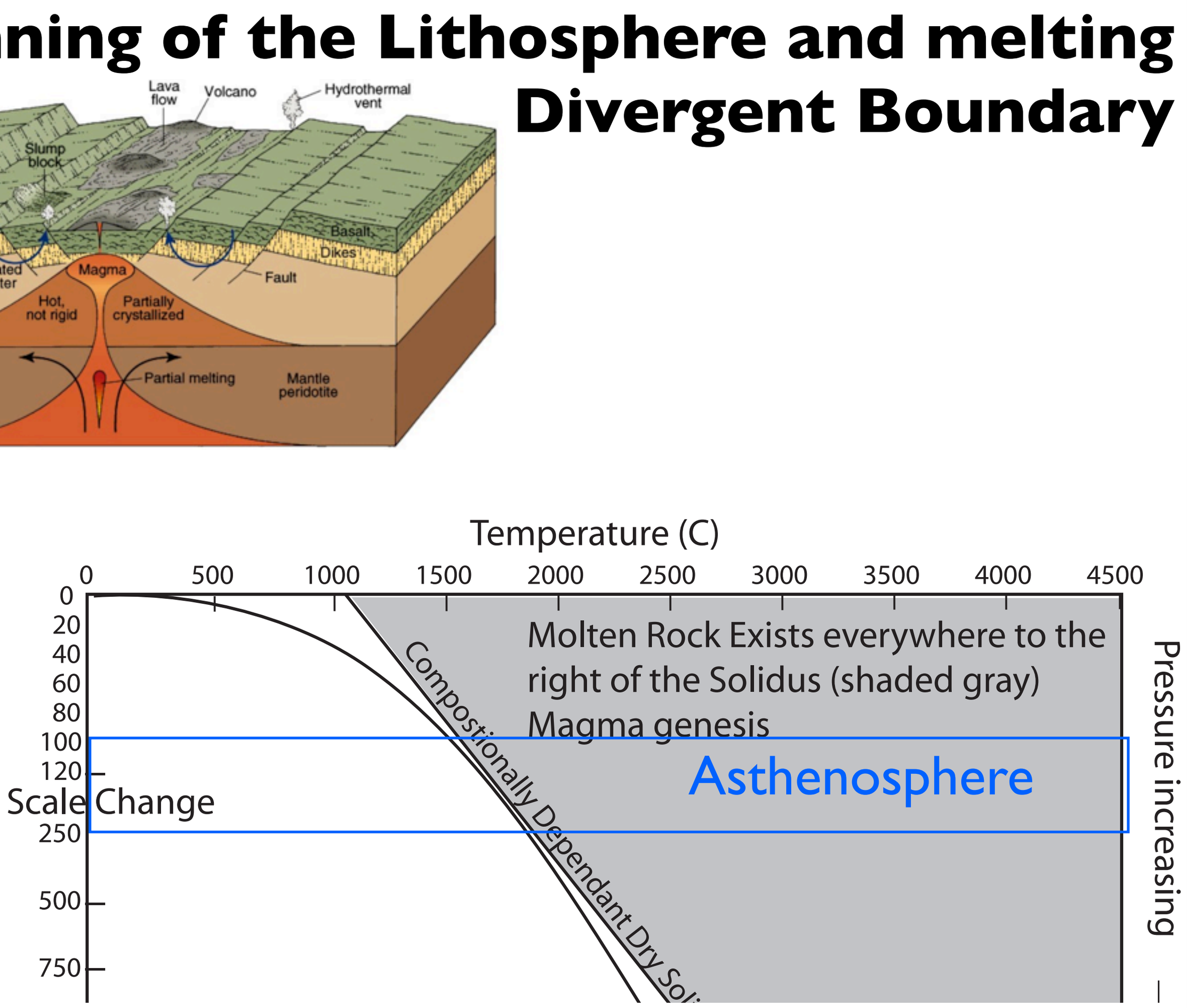
Thinning of the Lithosphere and melting Divergent Boundary



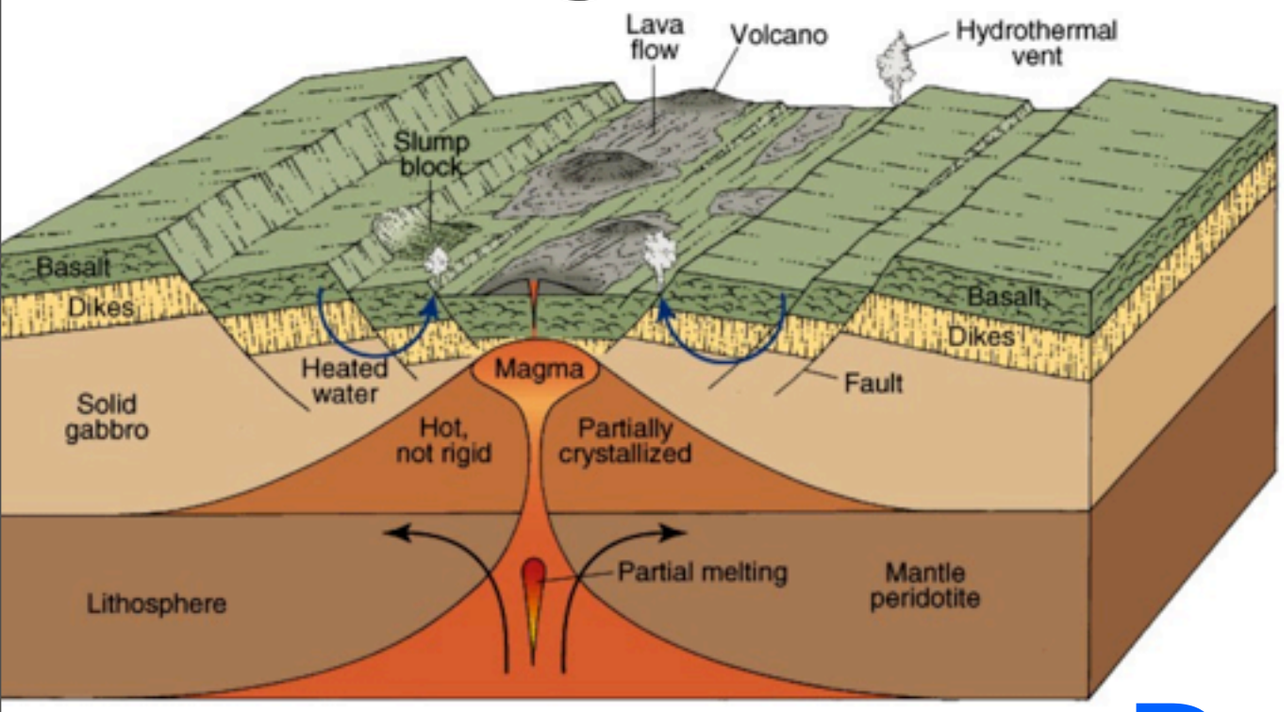


Thinning of the Lithosphere and melting Divergent Boundary

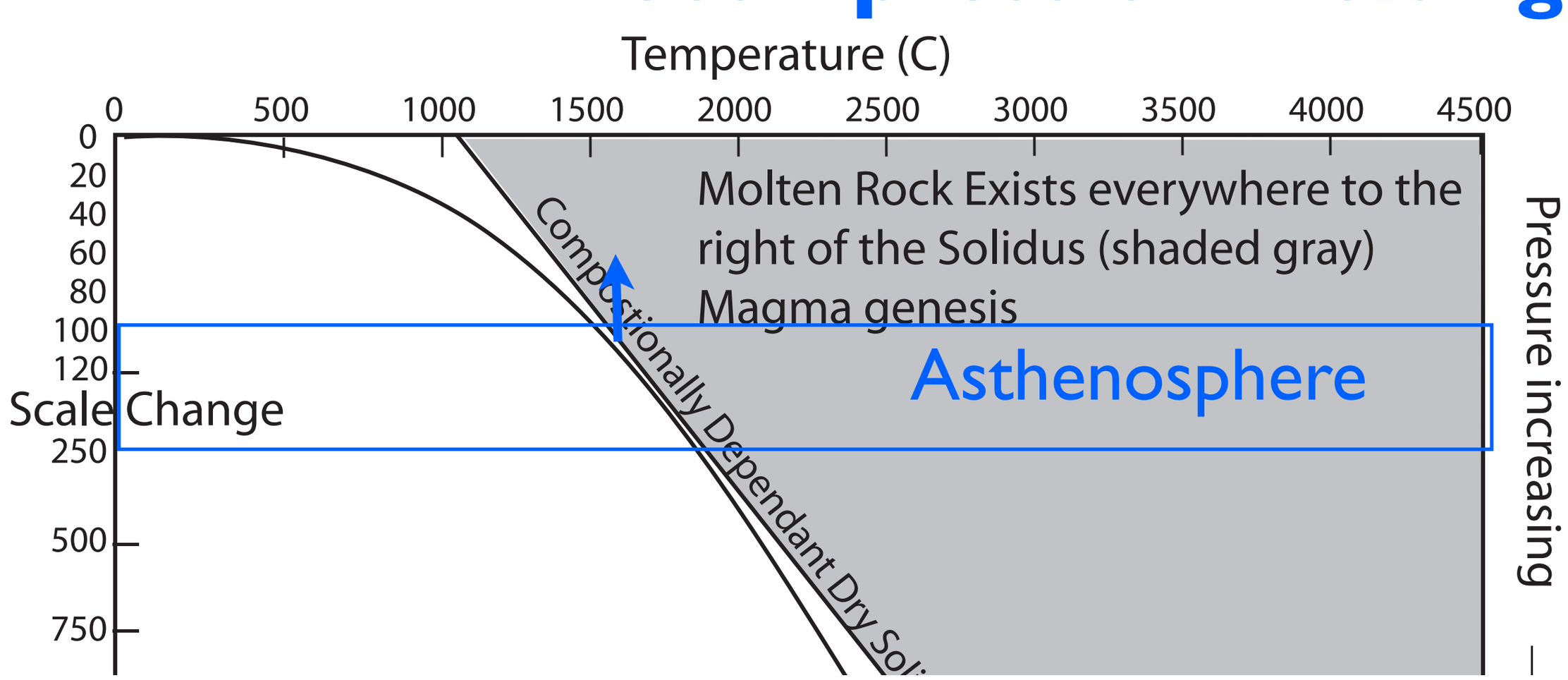




Thinning of the Lithosphere and melting Divergent Boundary

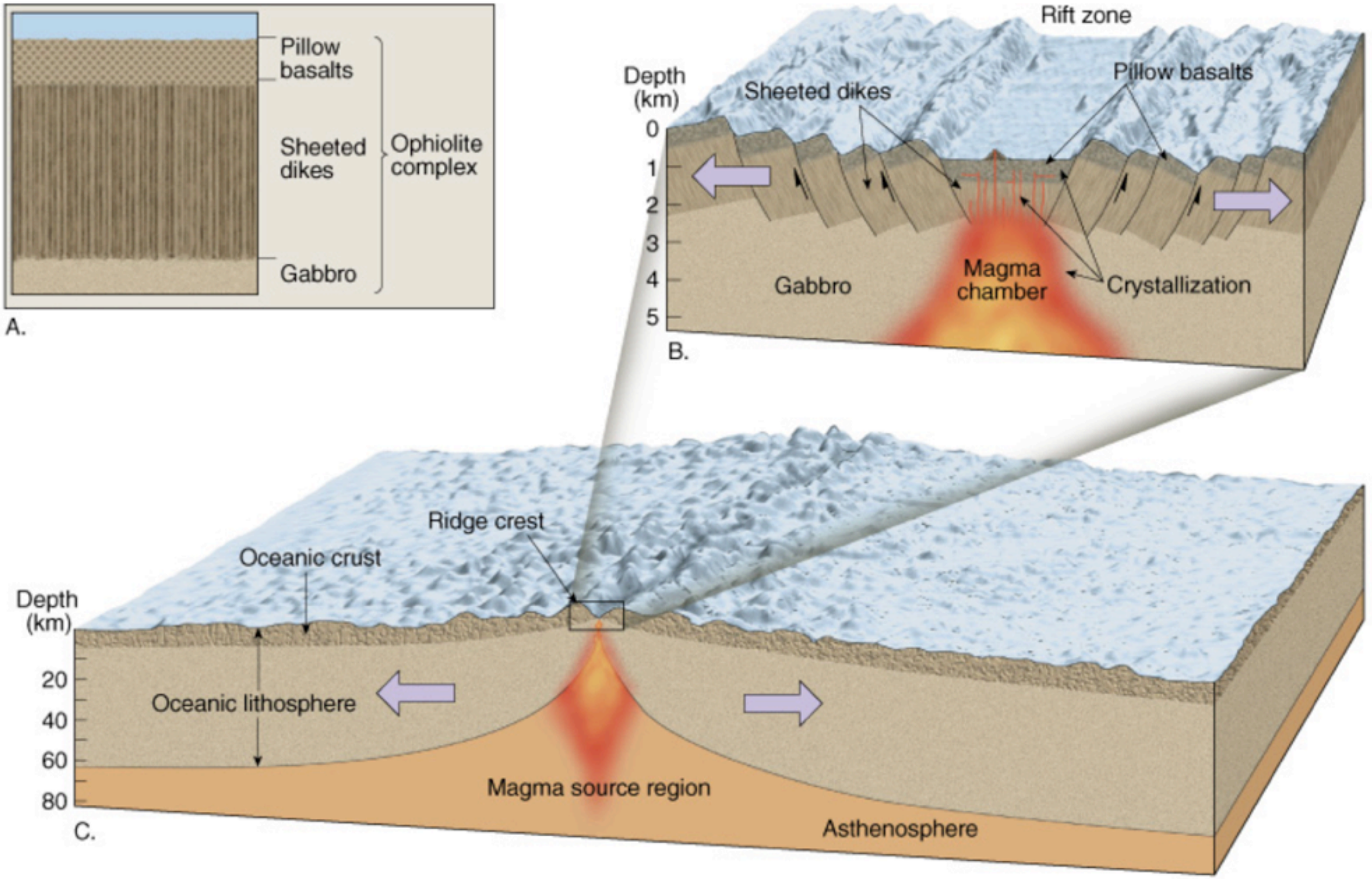


Decompression Melting

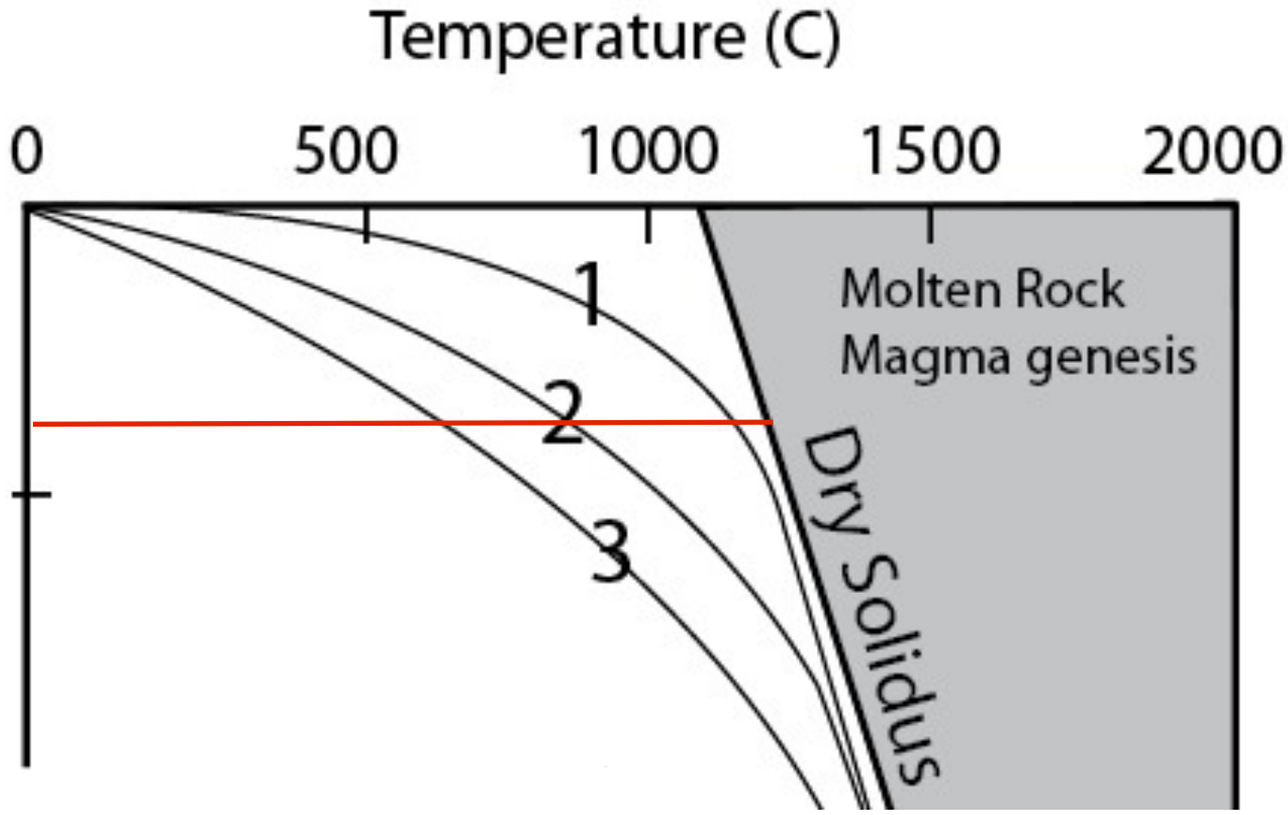


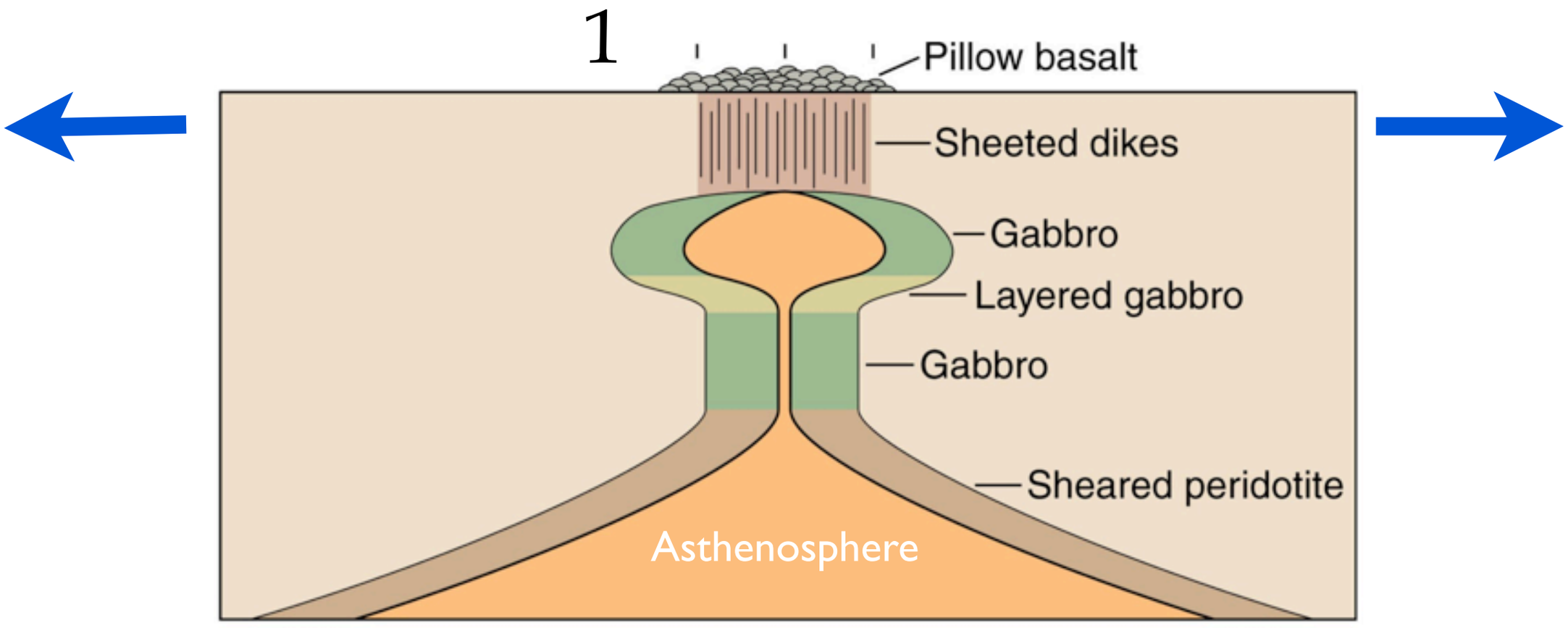
Formation of Oceanic Crust at Divergent Boundaries

A.

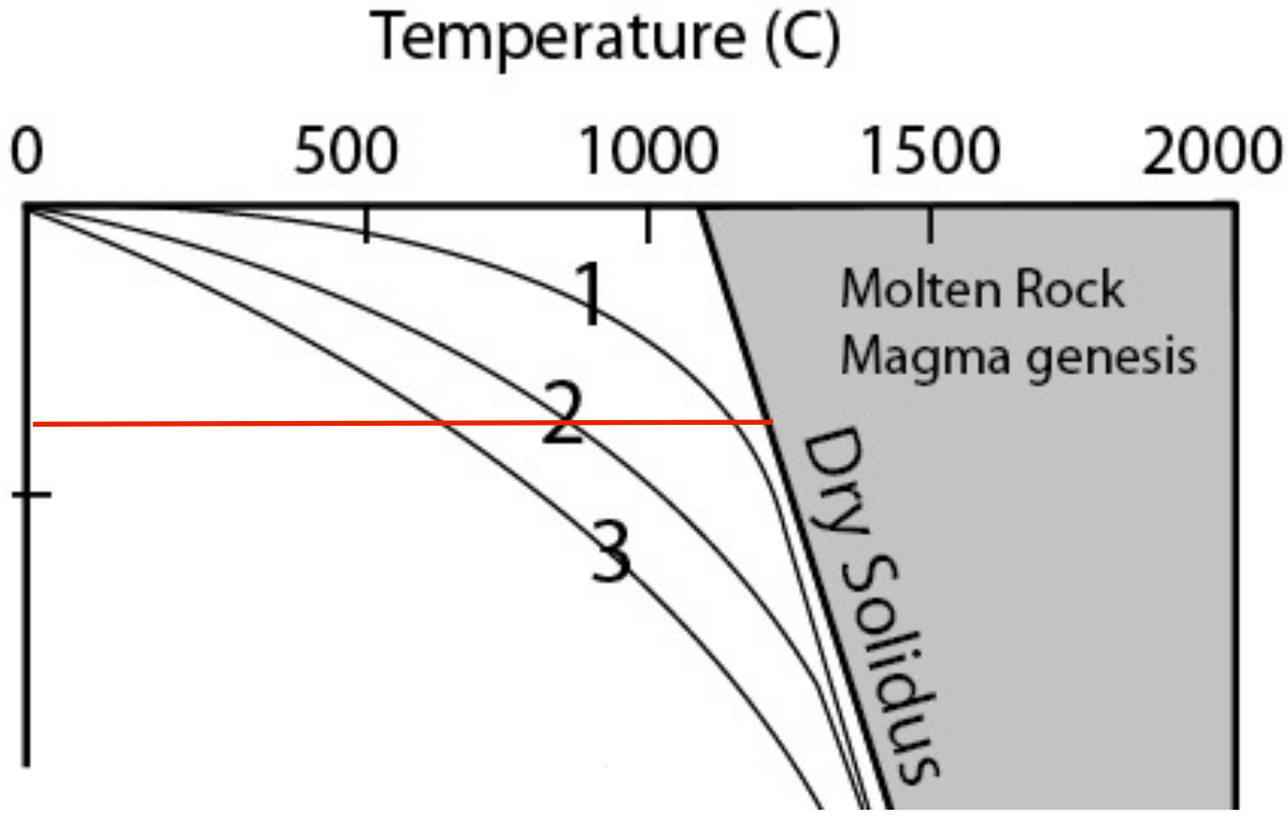


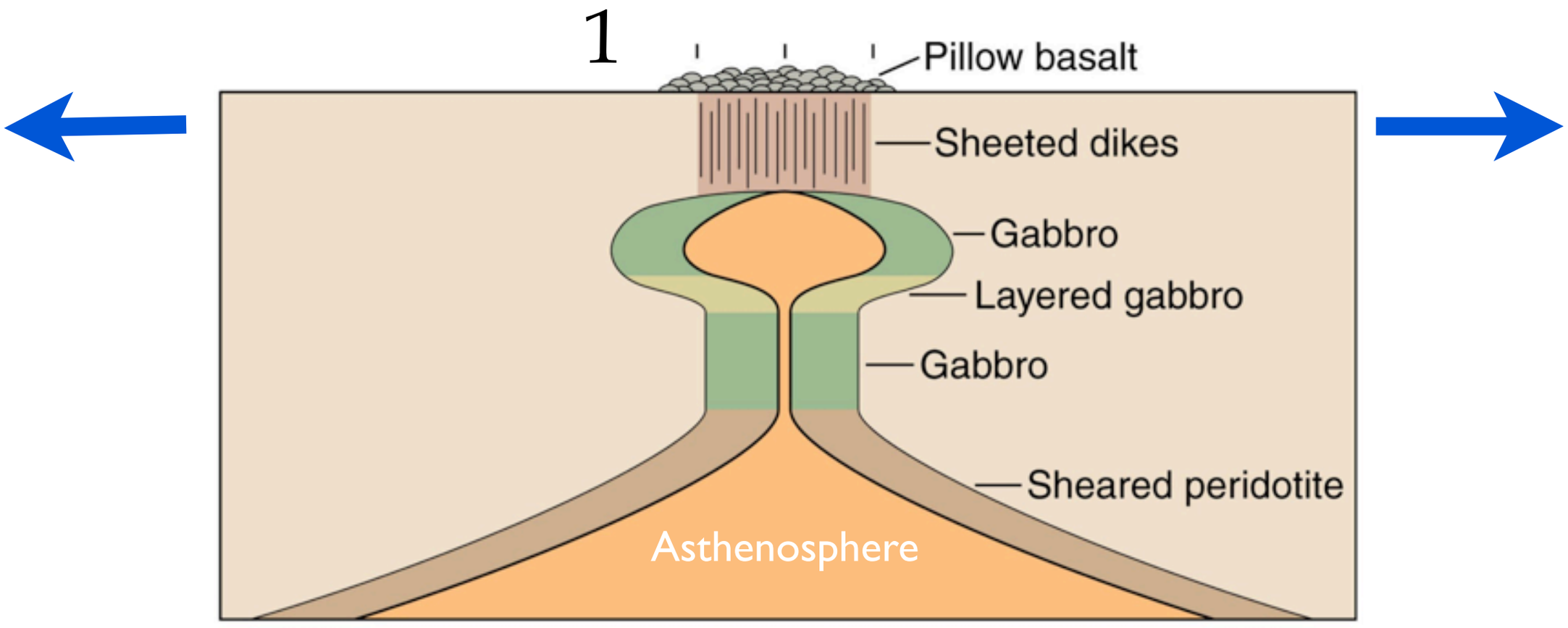
Formation of Oceanic Lithosphere at Divergent Boundaries



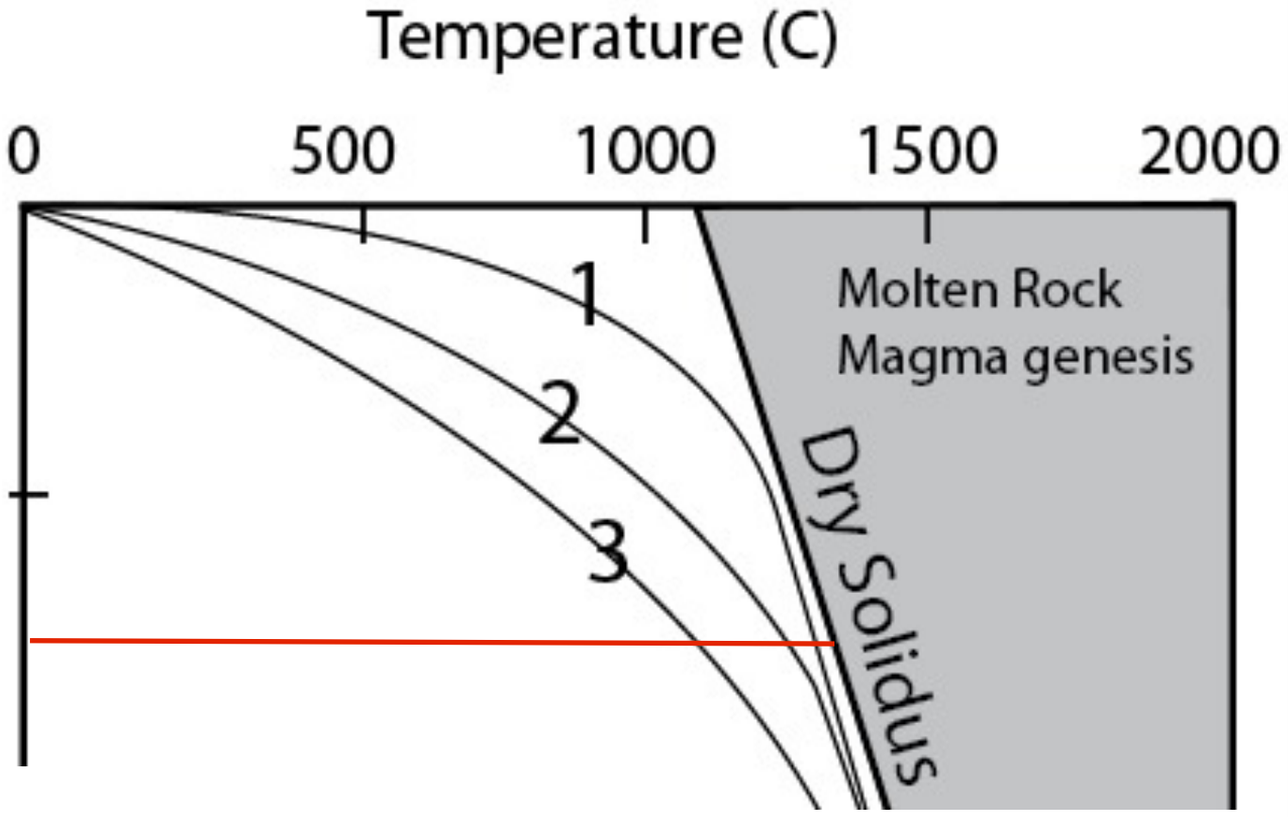


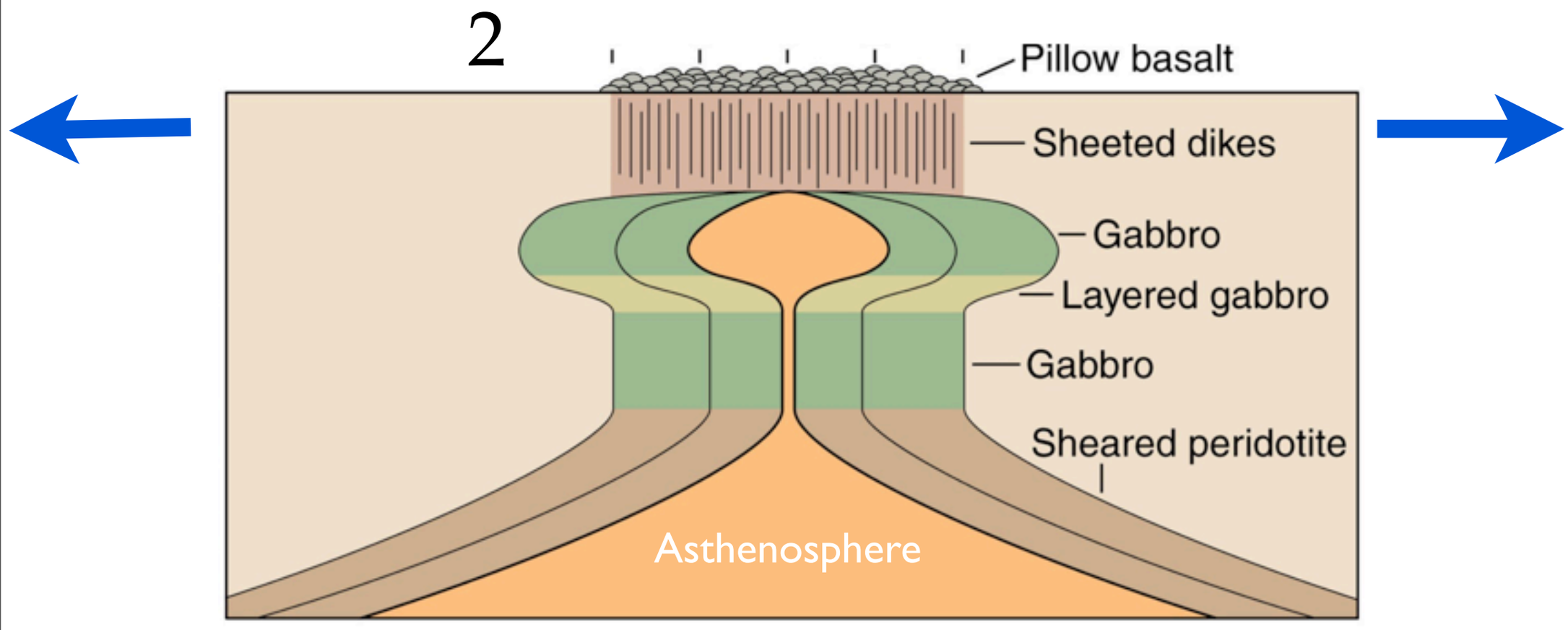
Formation of Oceanic Lithosphere at Divergent Boundaries



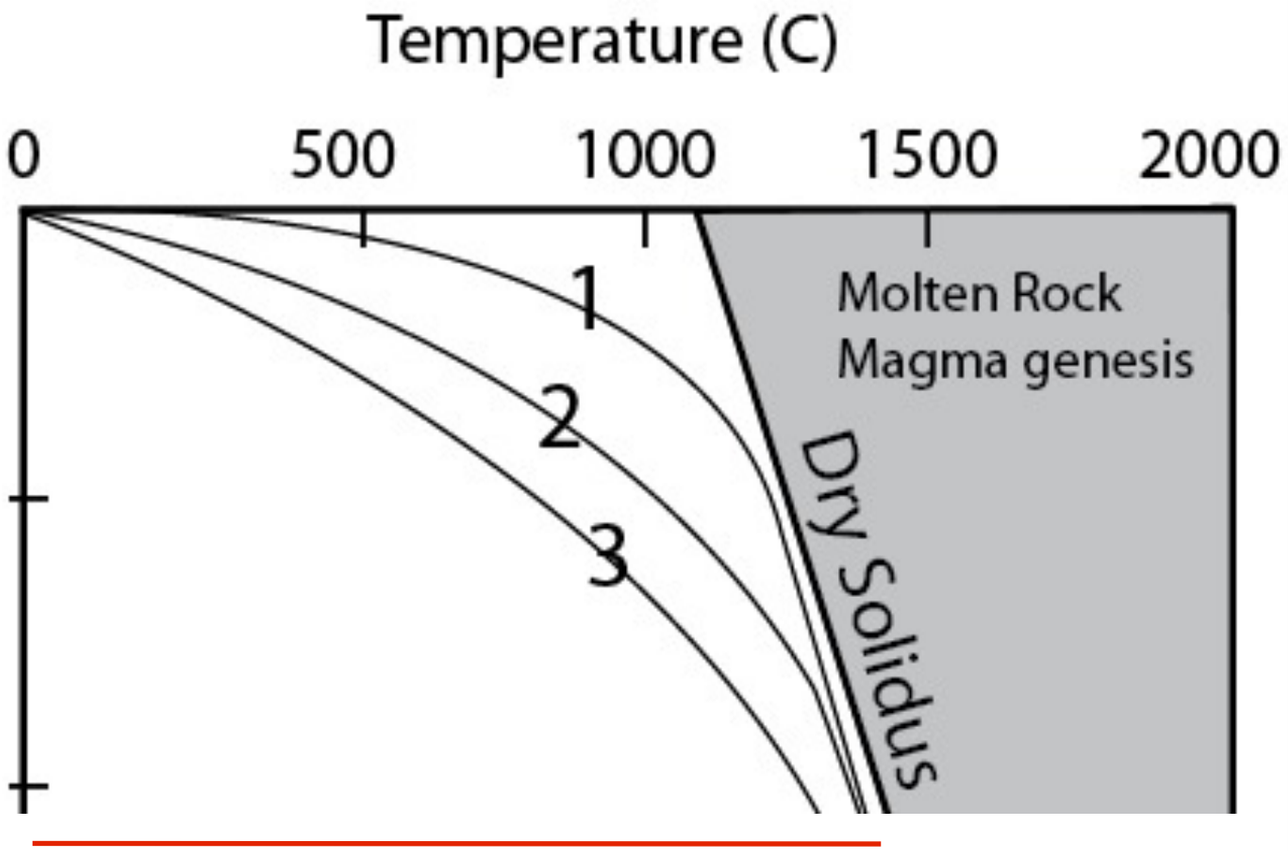


Formation of Oceanic Lithosphere at Divergent Boundaries





Formation of Oceanic Lithosphere at Divergent Boundaries



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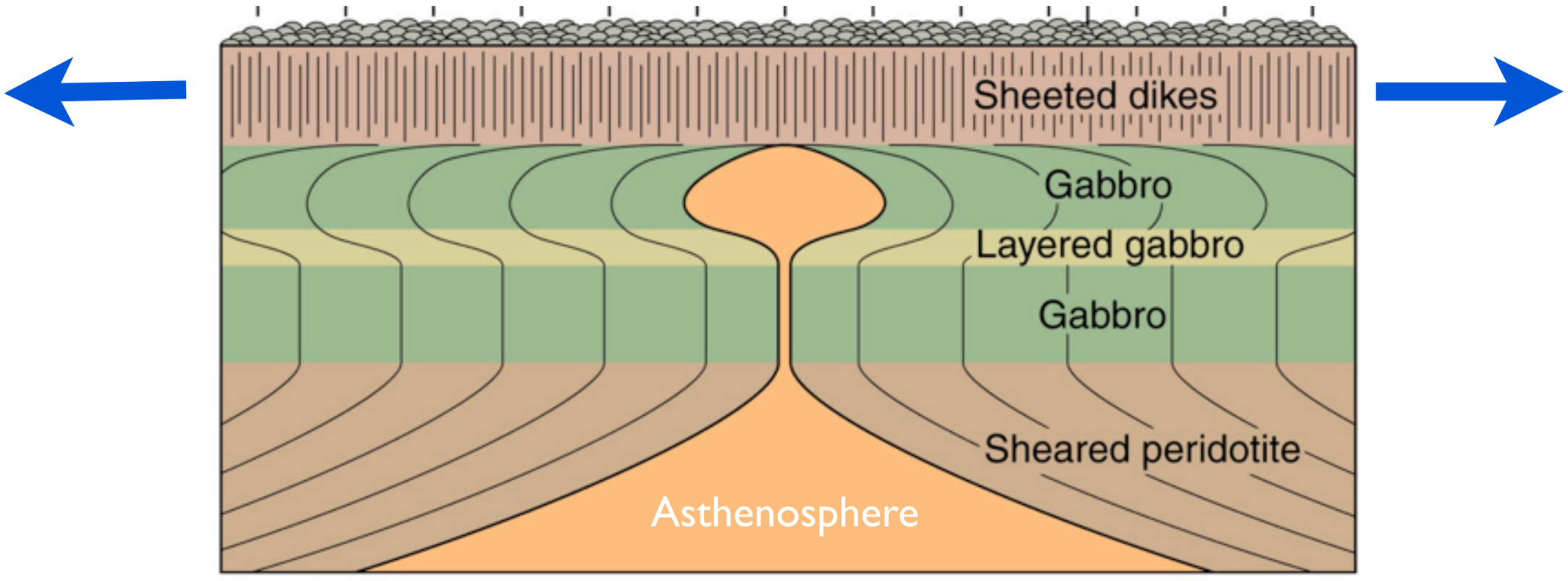
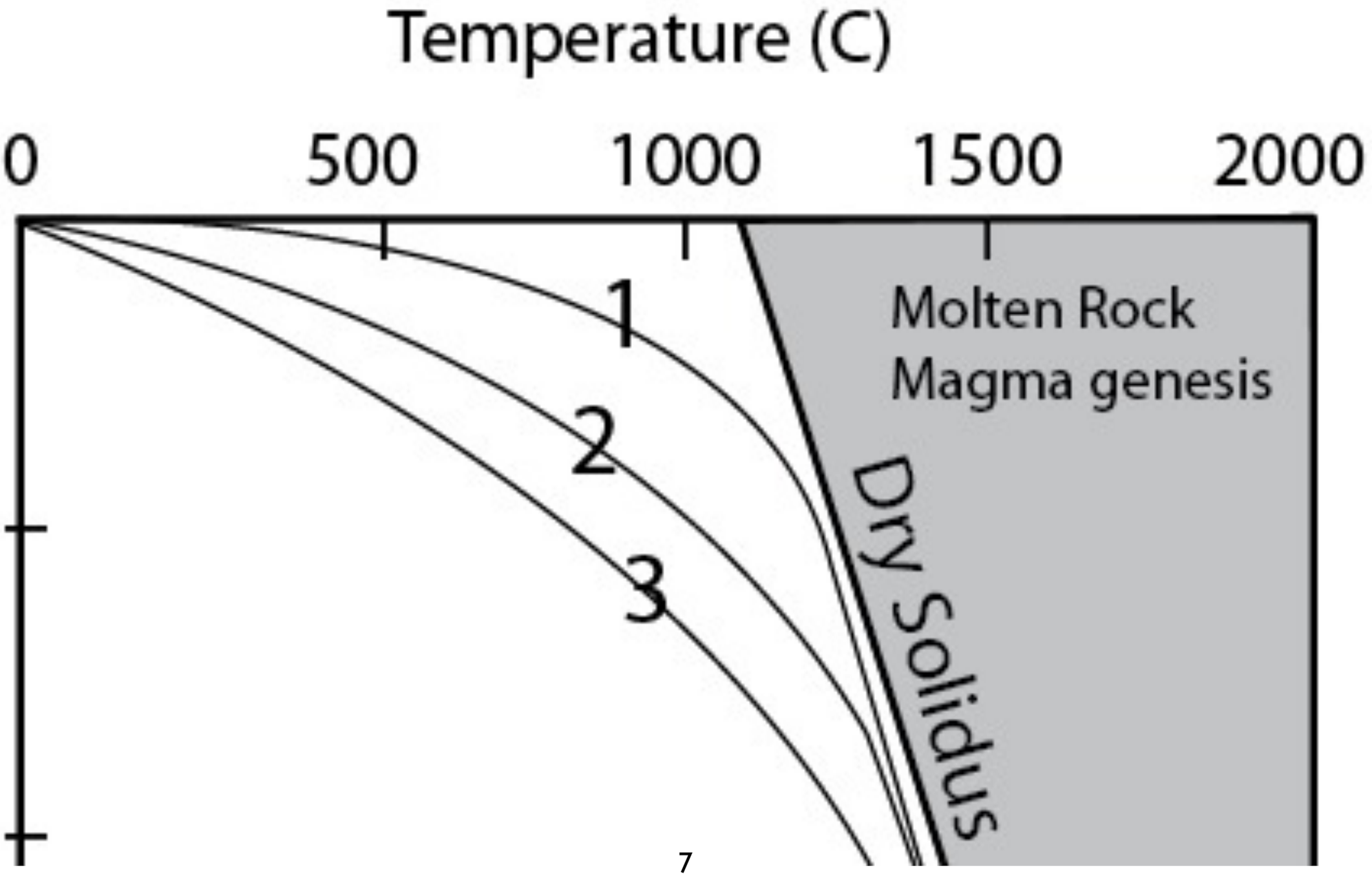


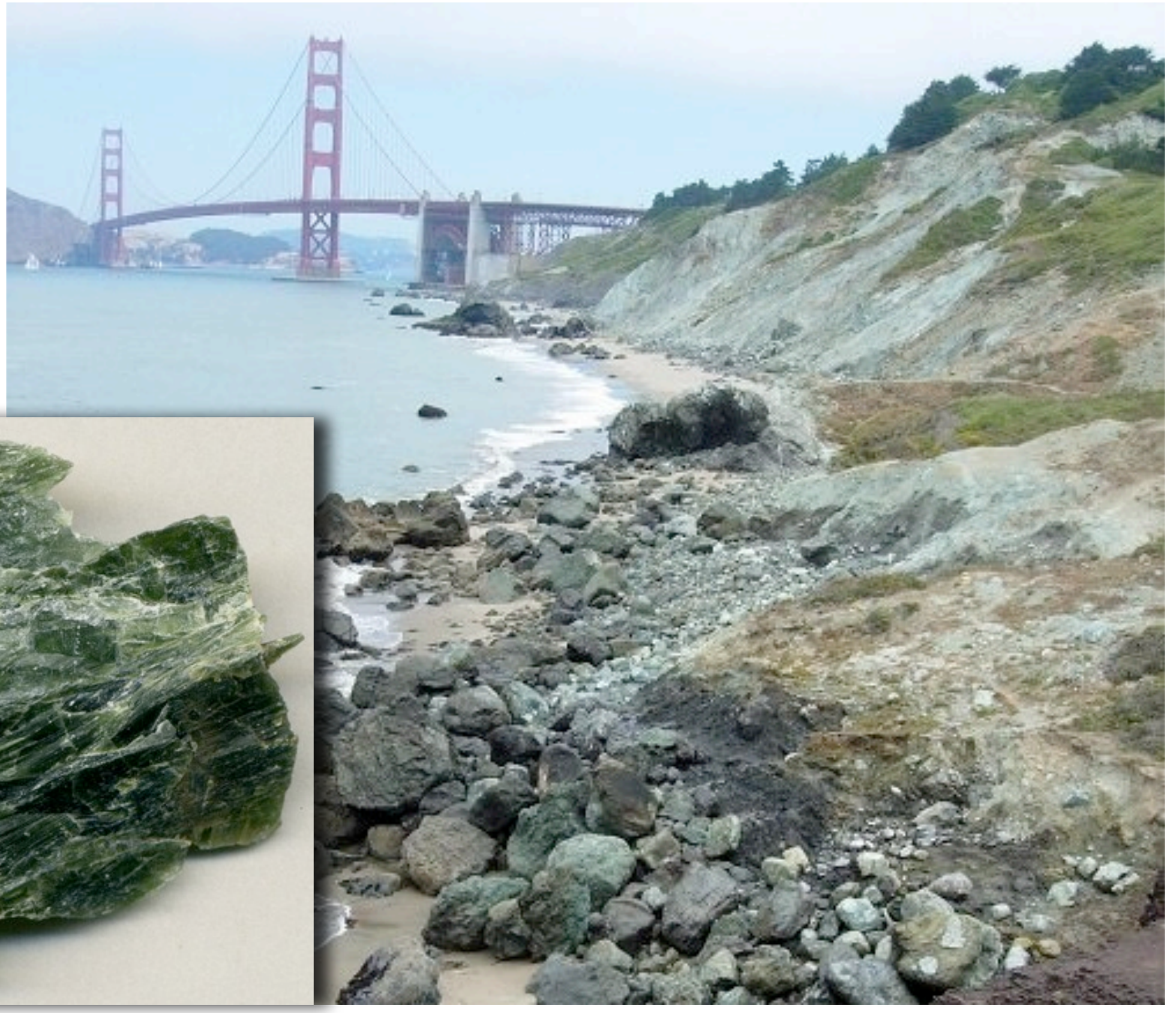
Which geothermal gradient line (1-3) most likely represents a divergent plate boundary



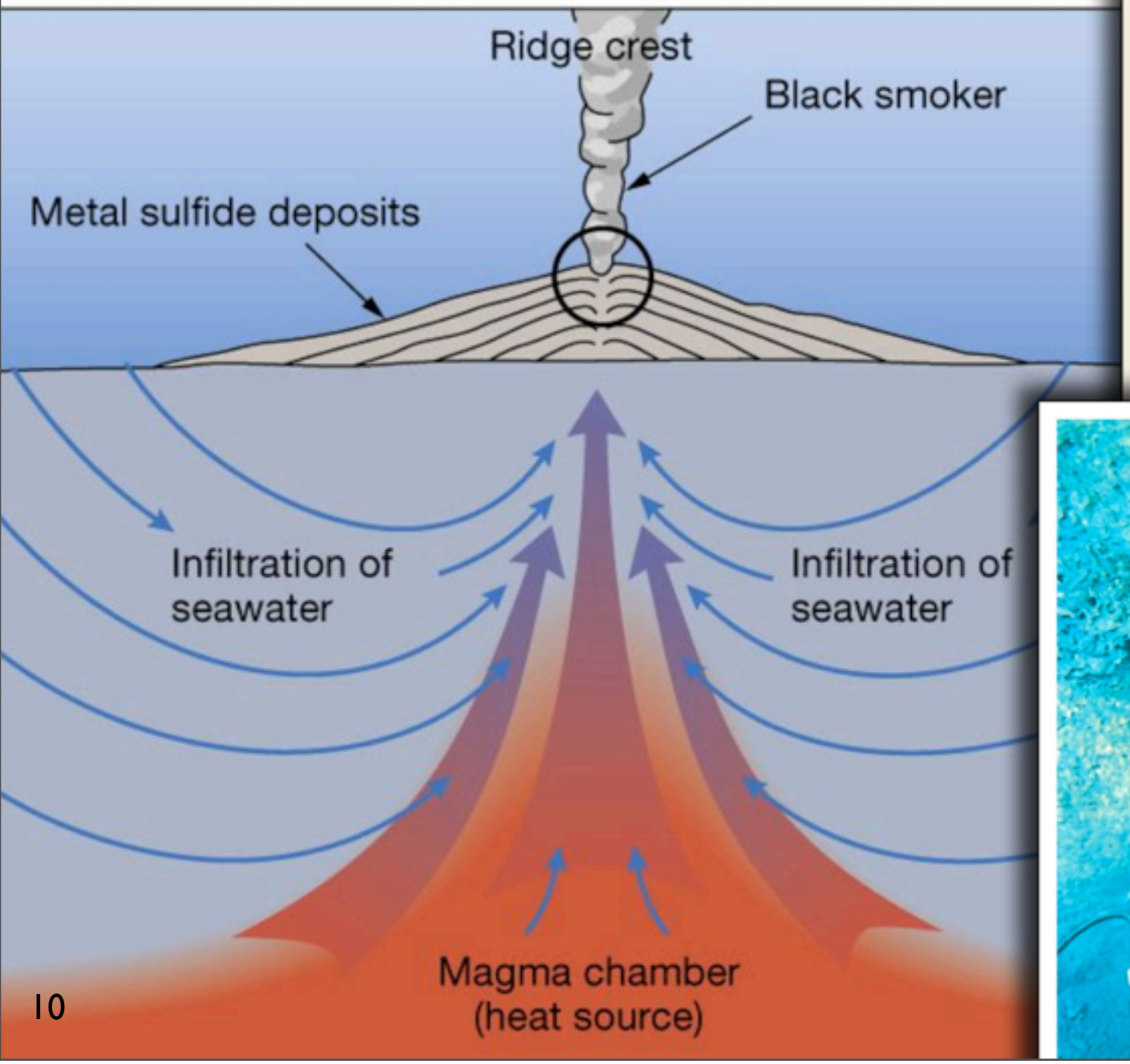
Pillow Basalt accreted to the curst of the North Bay 150 Ma

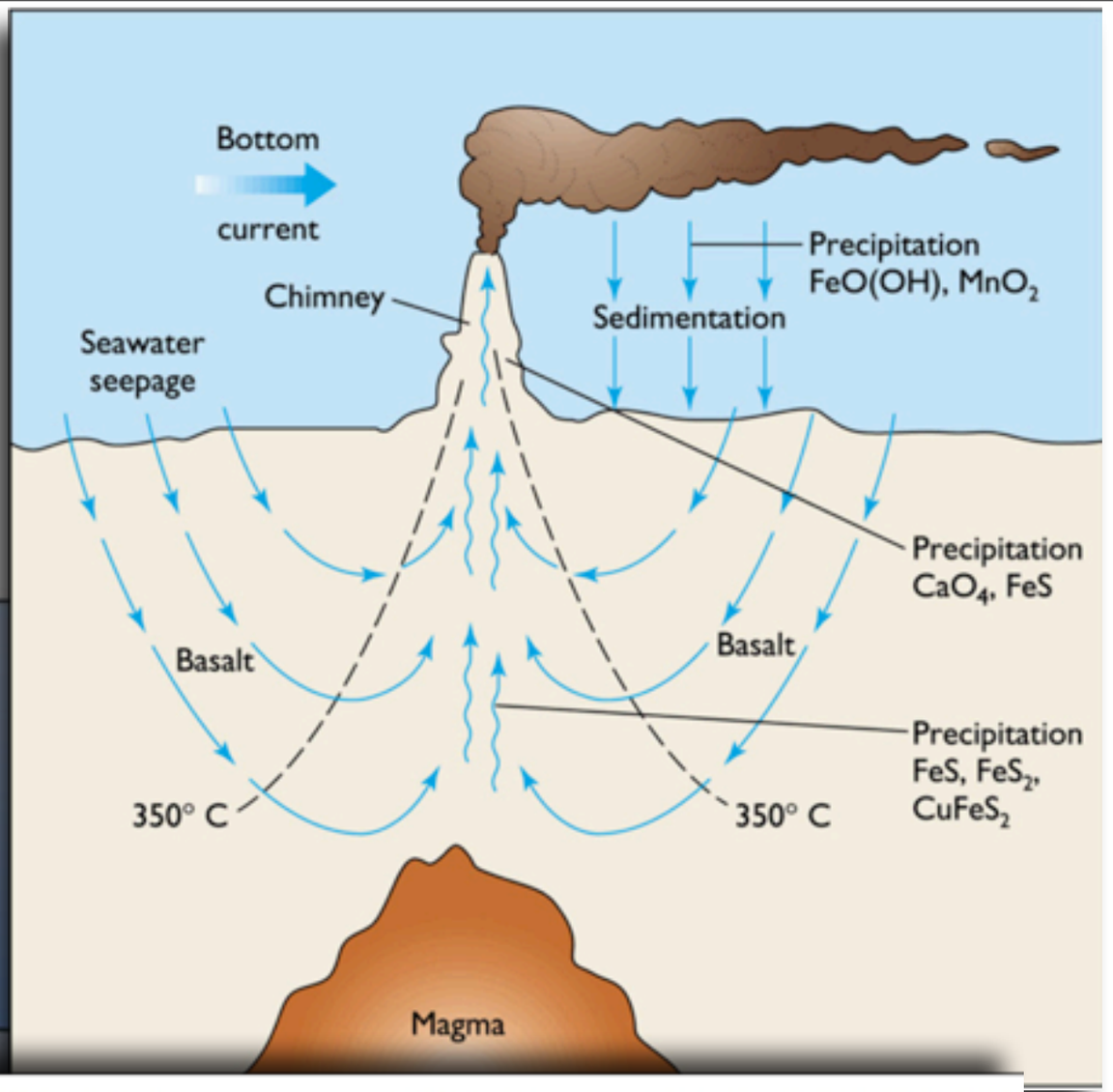
Pillow Basalt at Point Bonita, Marin Headlands

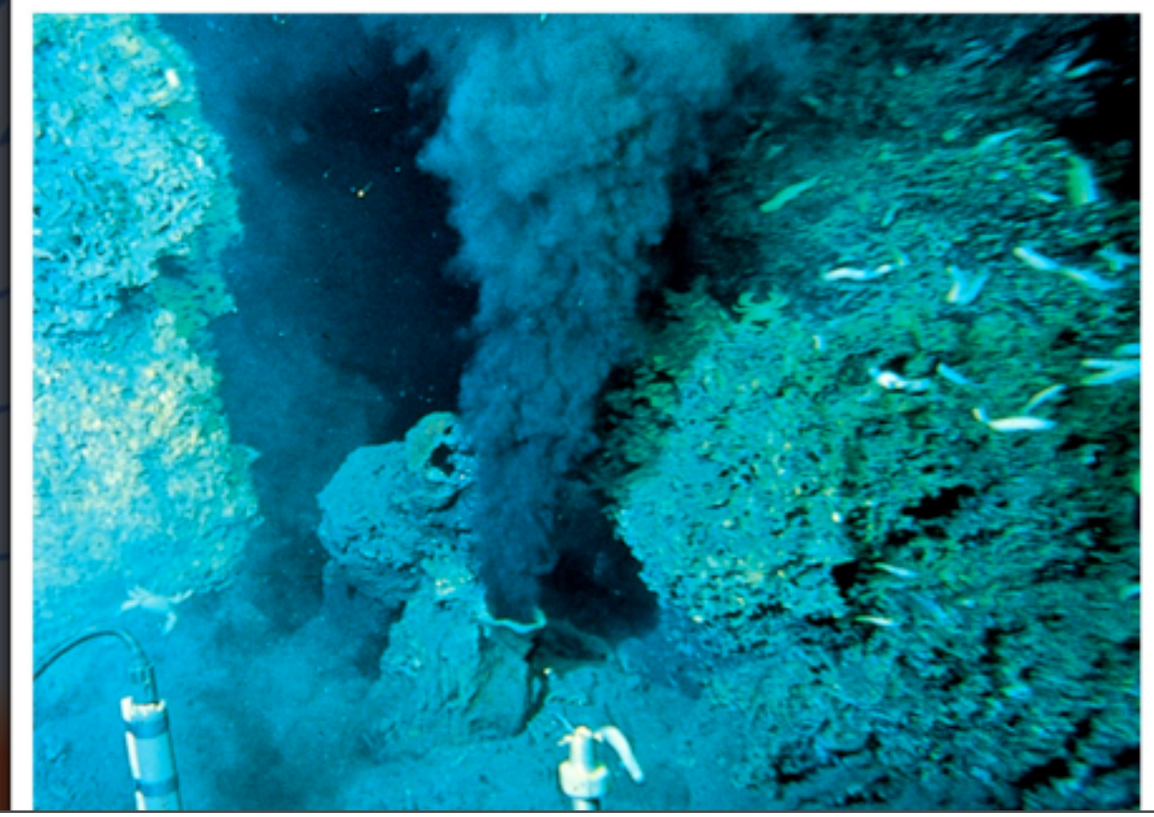
Serpentinite at Baker Beach



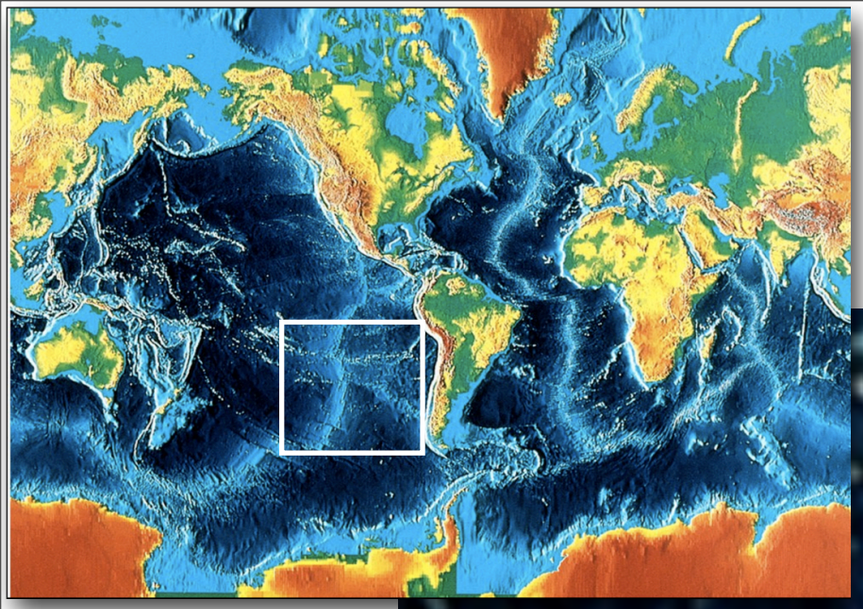
Hydrothermal Alteration of Oceanic Lithosphere at Mid-ocean Ridge

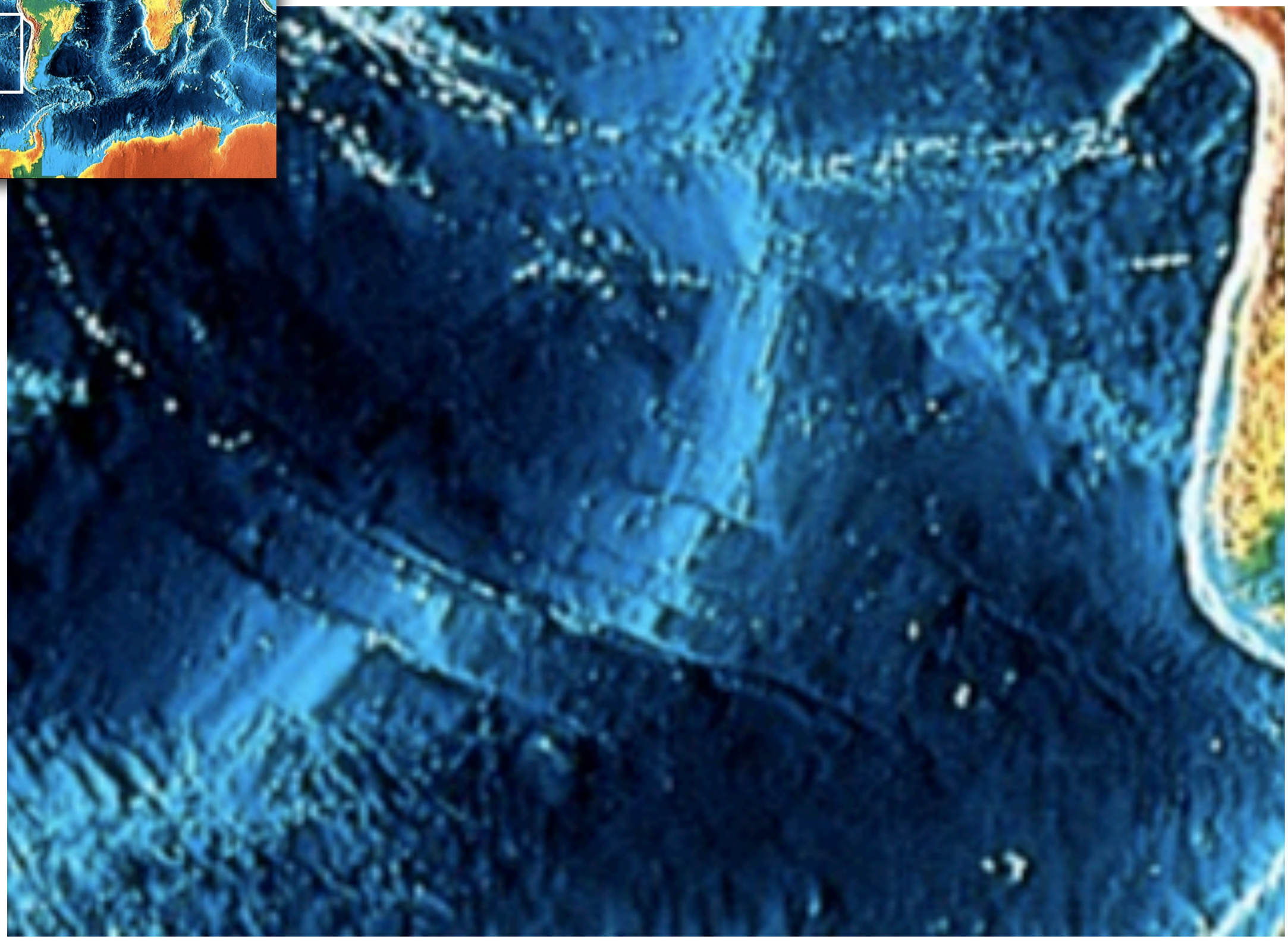






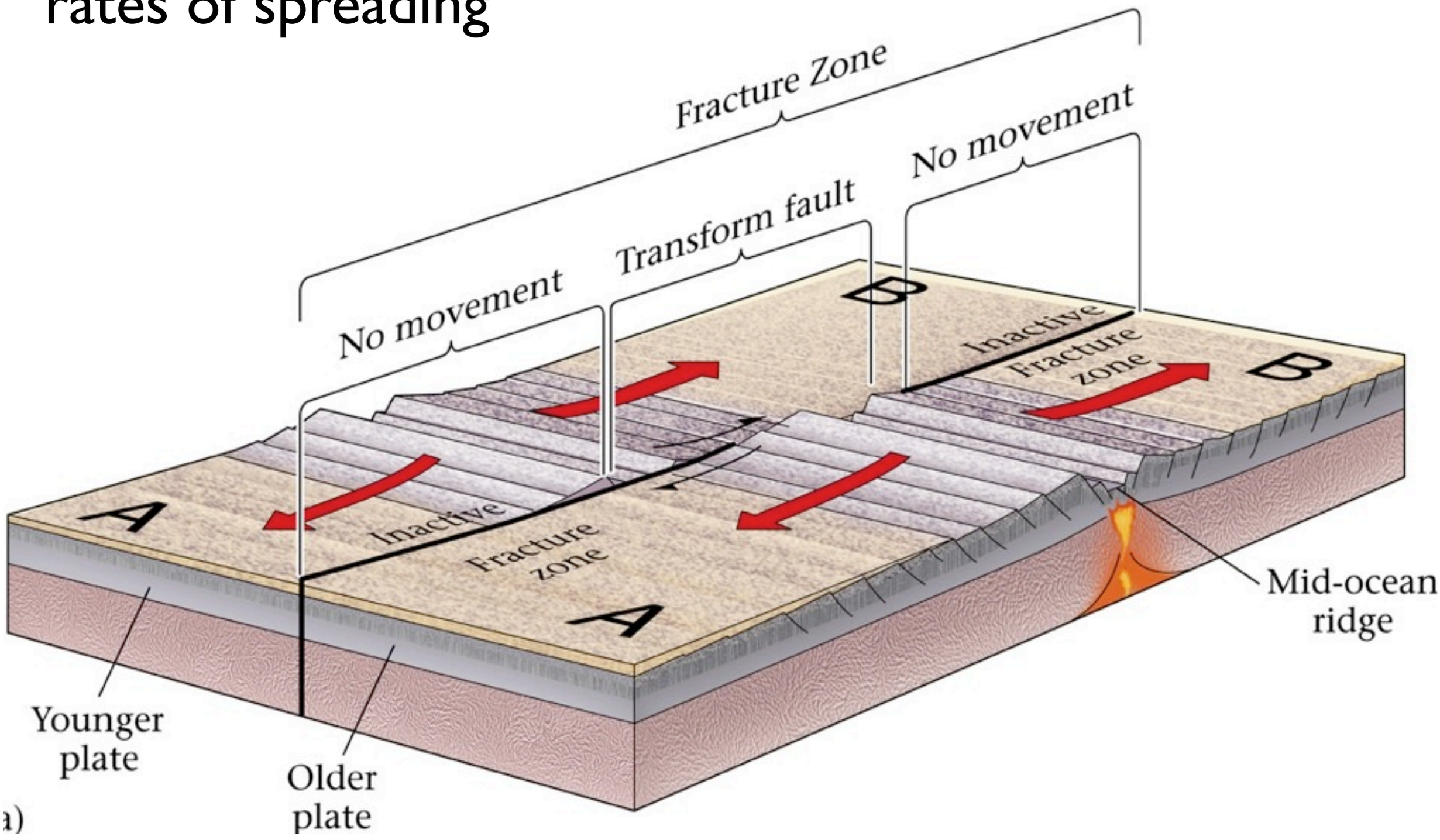
Anatomy of Transform Plate Boundaries



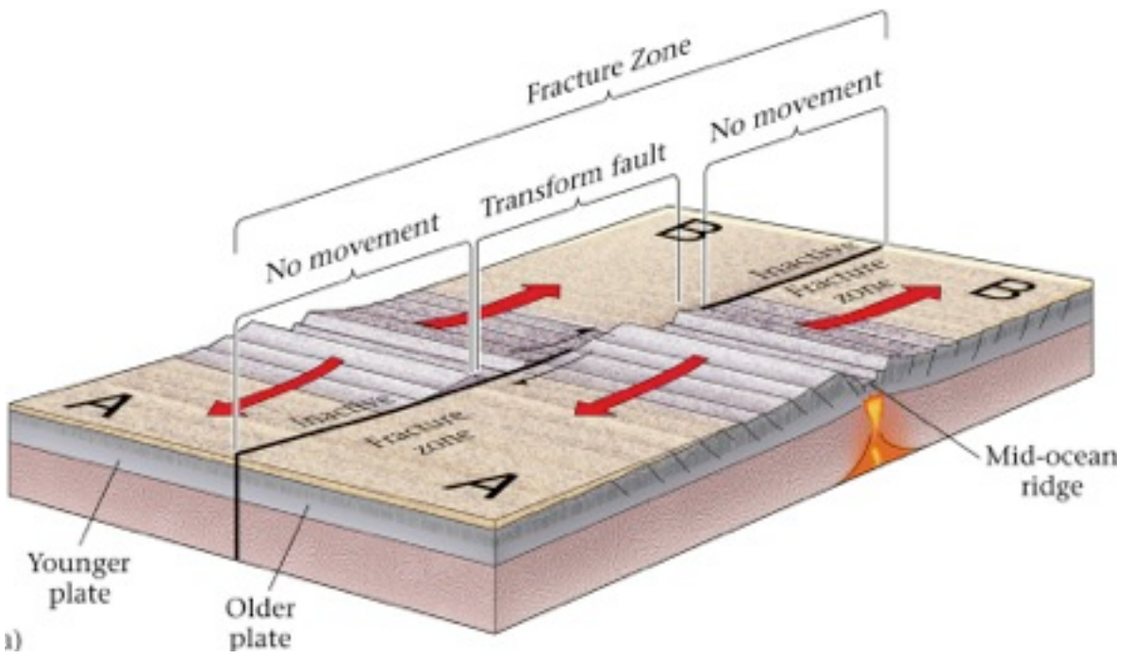


Transform Plate Boundary

Accommodate variable rates of spreading



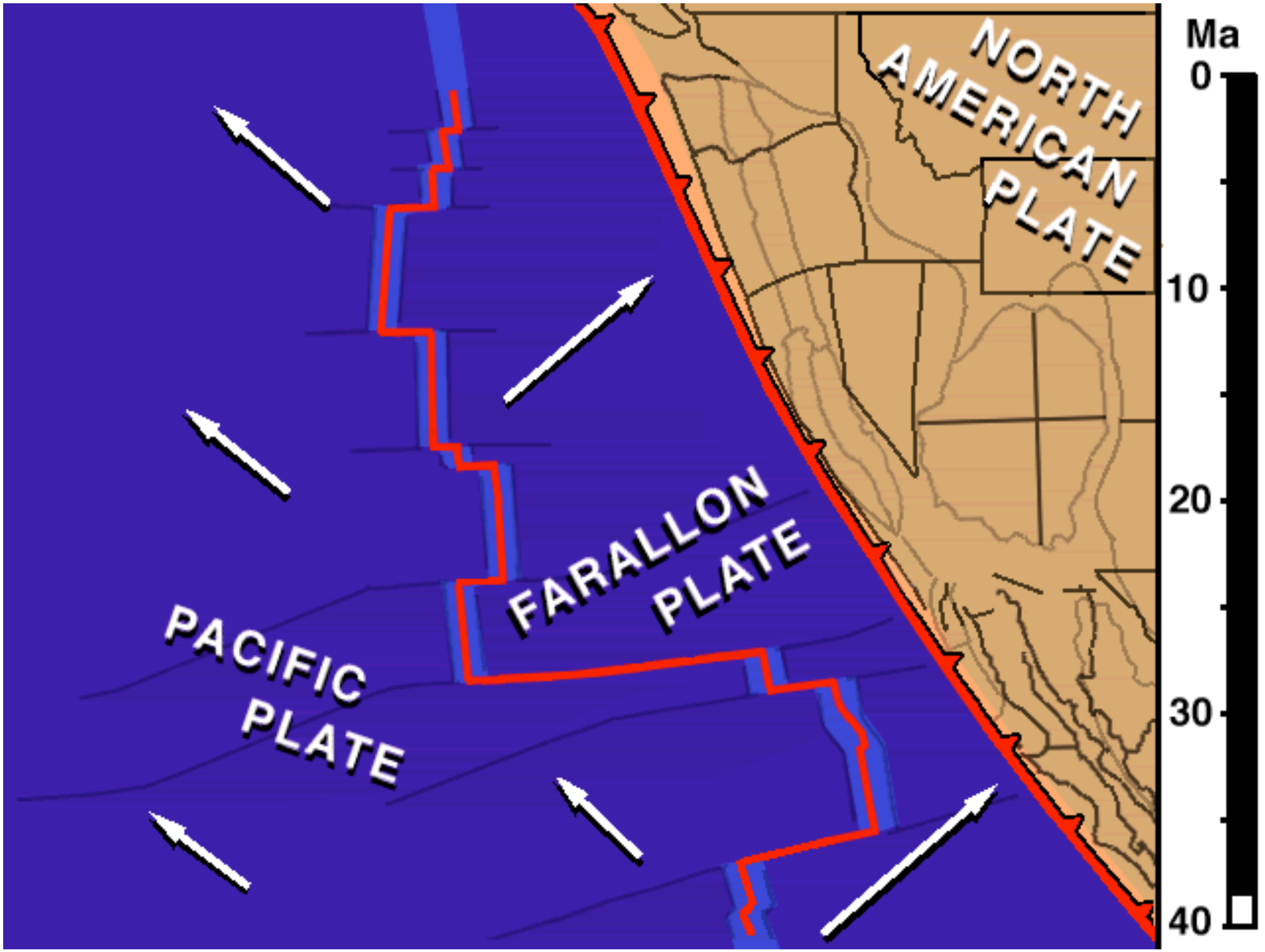
Continental Transform



Continental Transform
Formation of the San Andreas fault

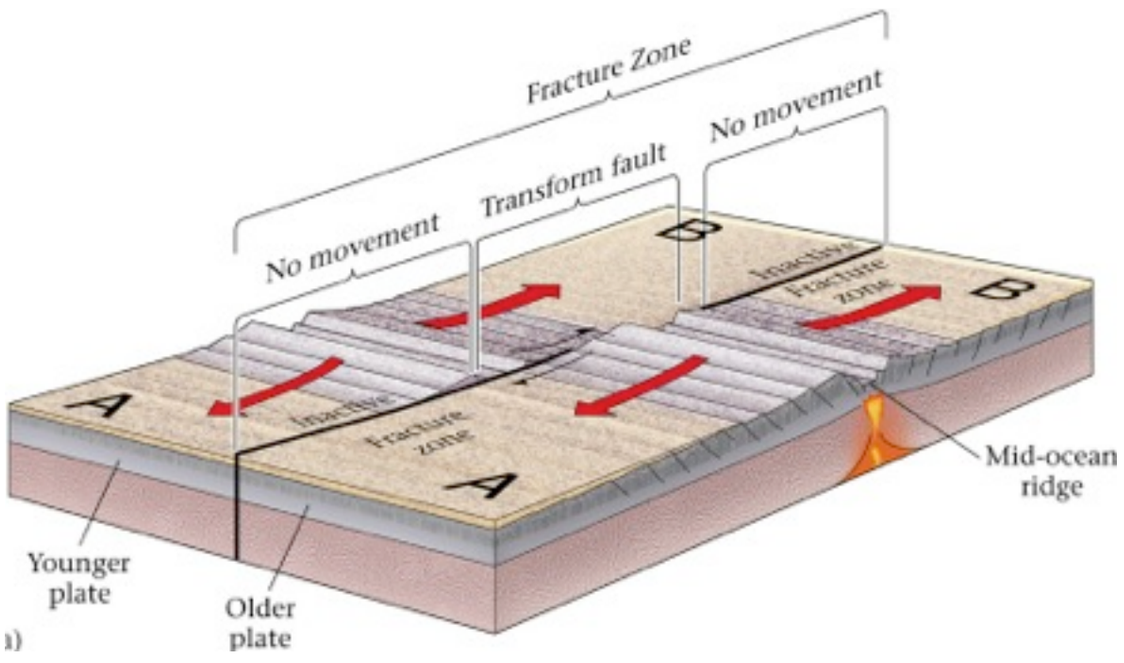
Atwater Animation

Continental Transform
Formation of the San Andreas fault

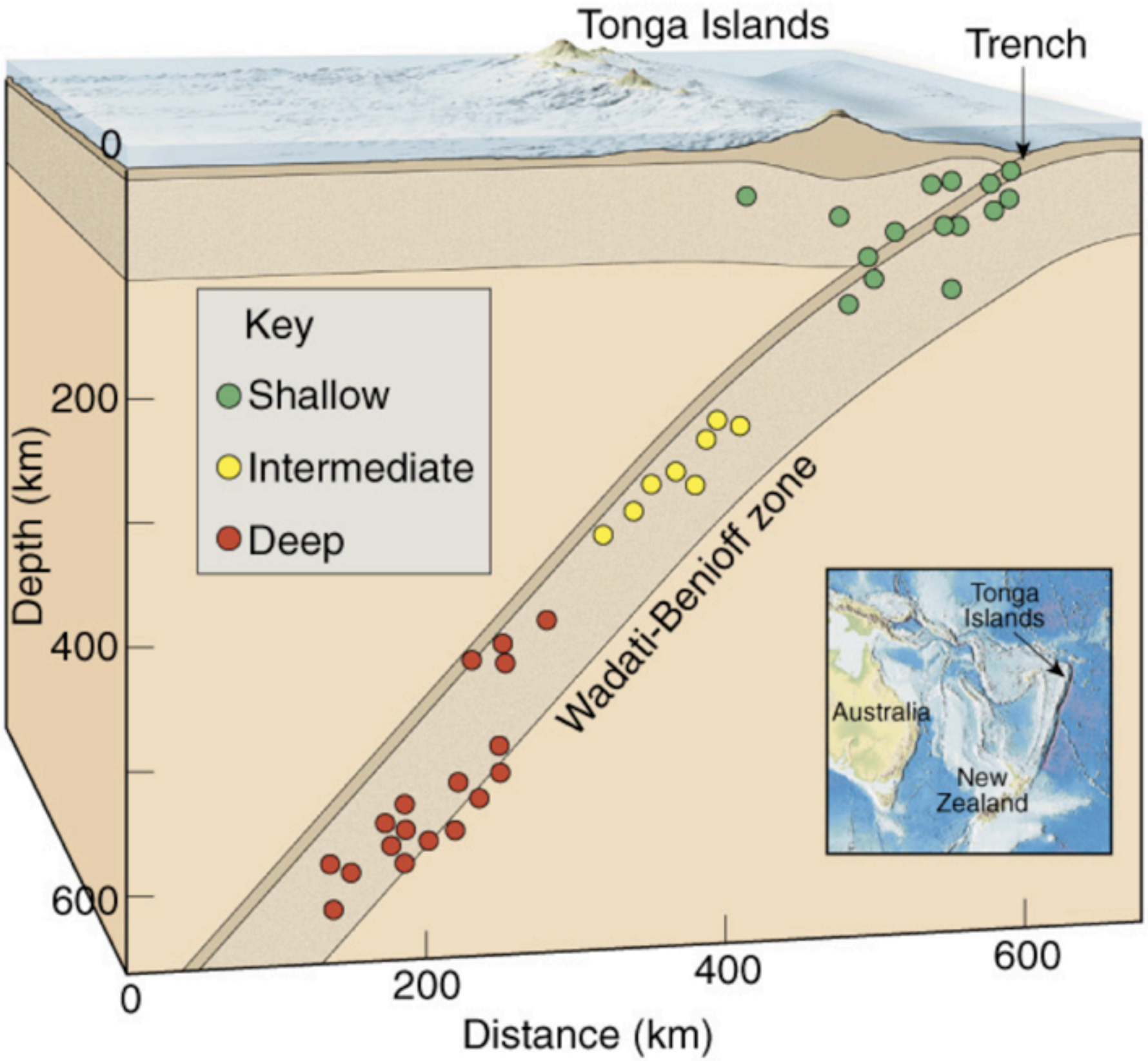


Atwater Animation

Continental Transform



Seismic Evidence of Subduction



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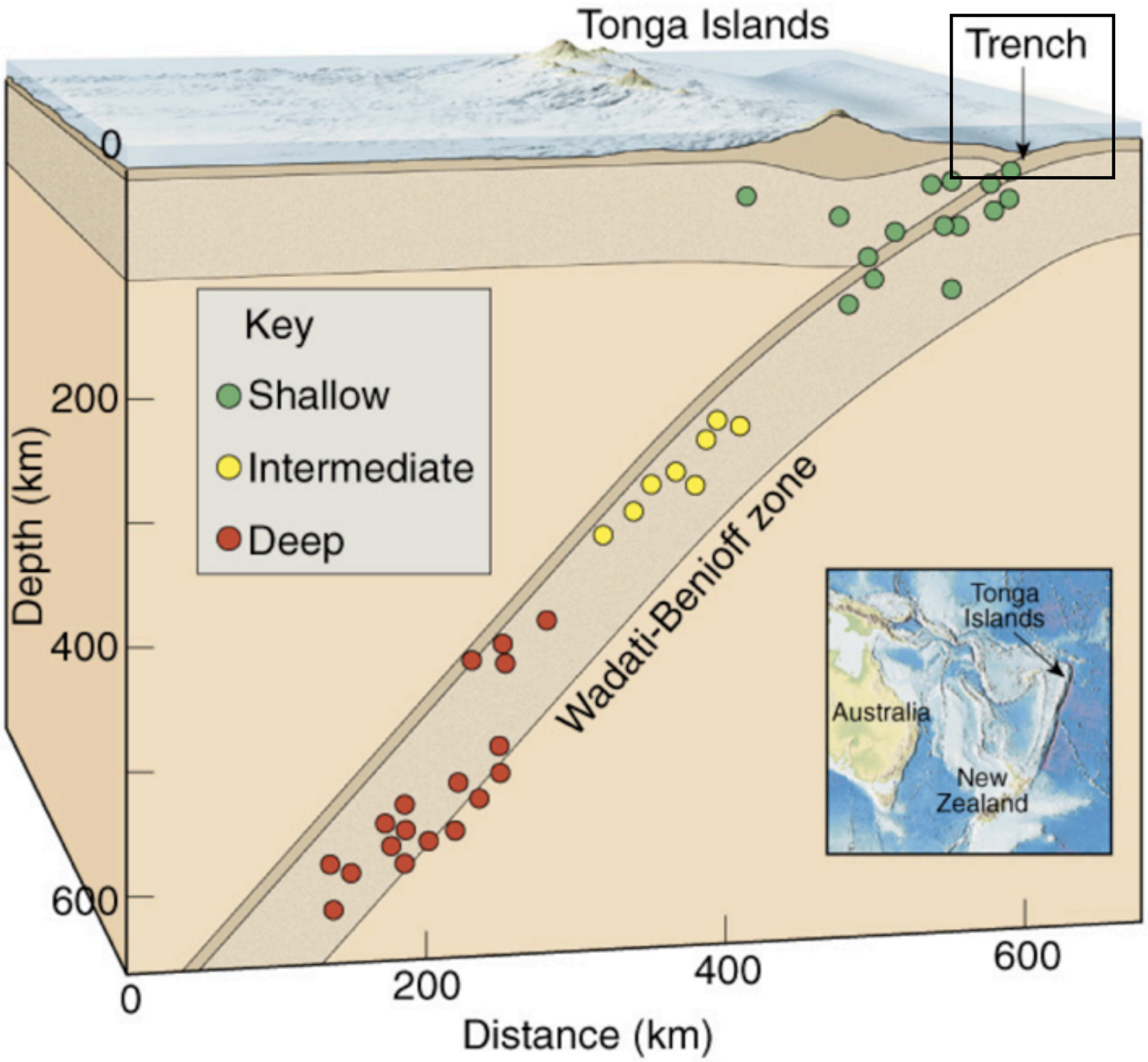
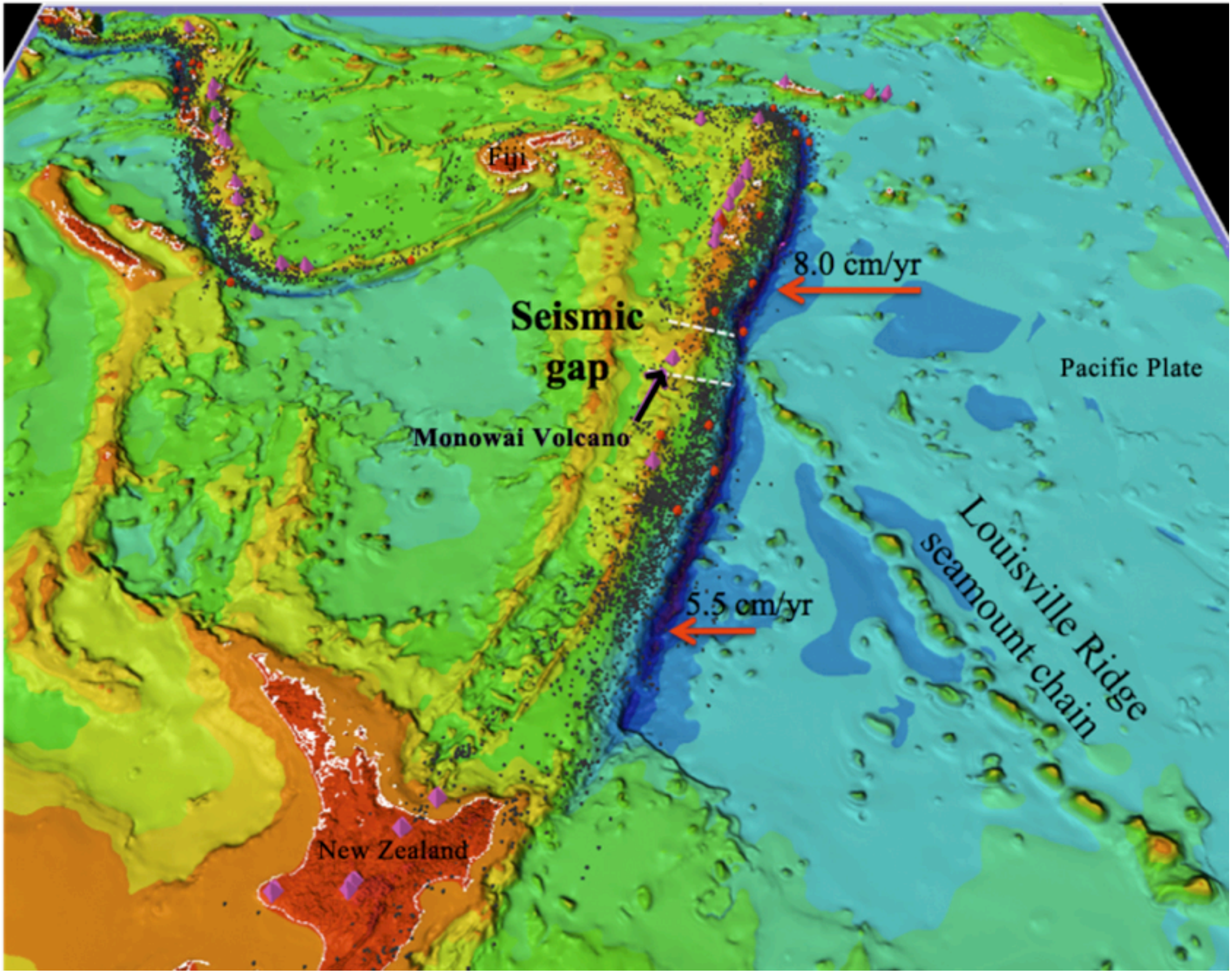
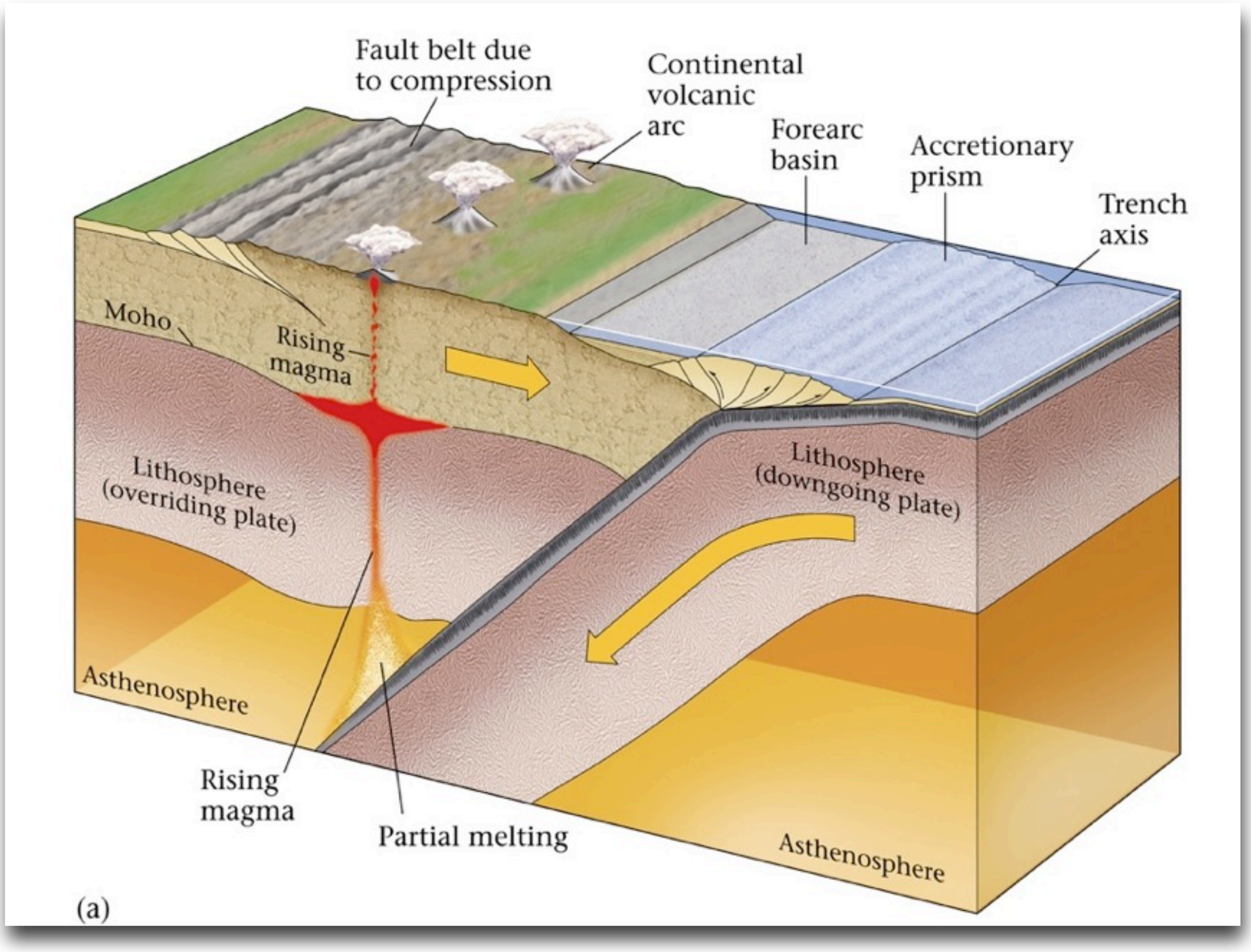


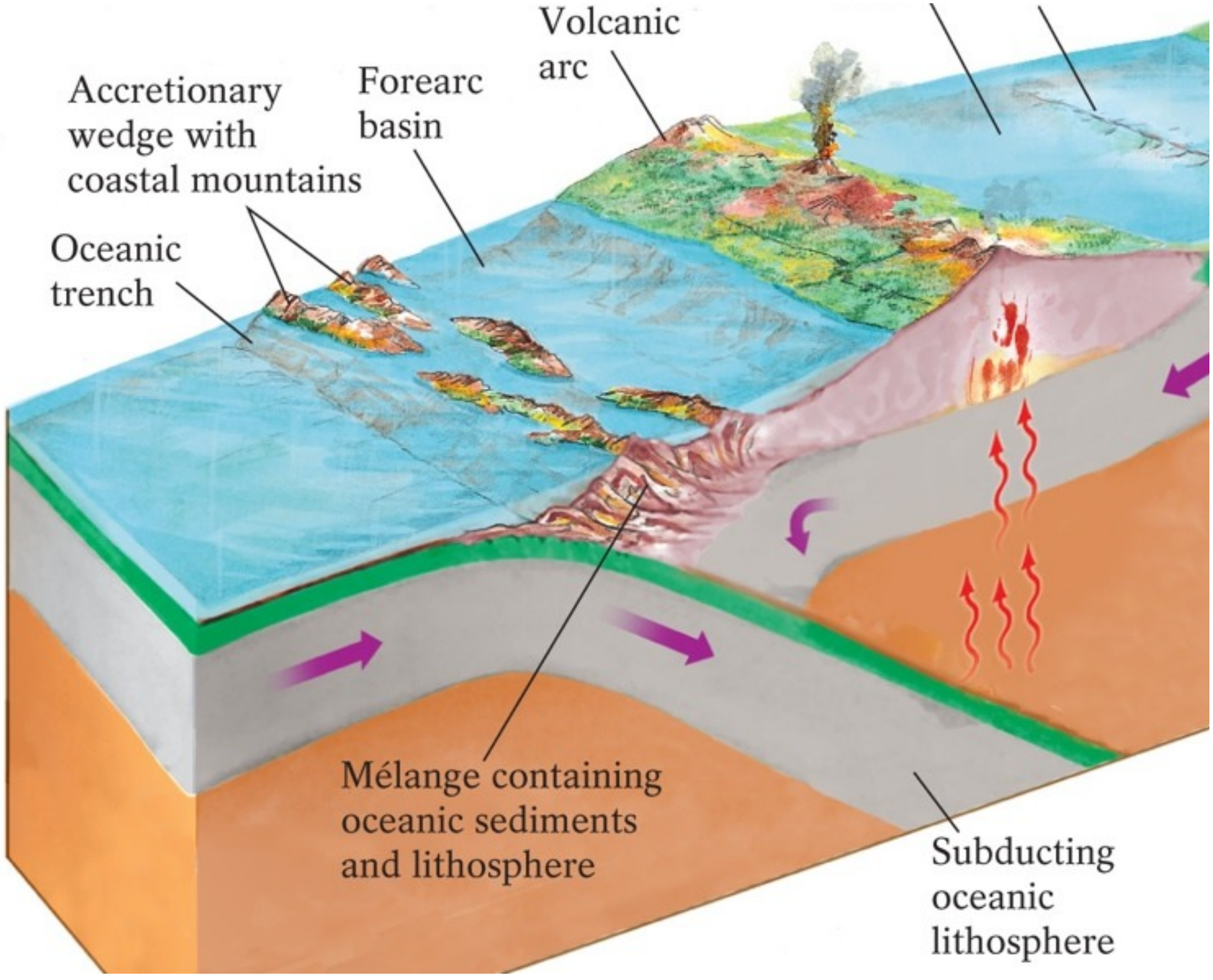
Subduction Trench



Anatomy of a Subduction zone



Anatomy of a Subduction zone Accretionary Wedge (Prism)



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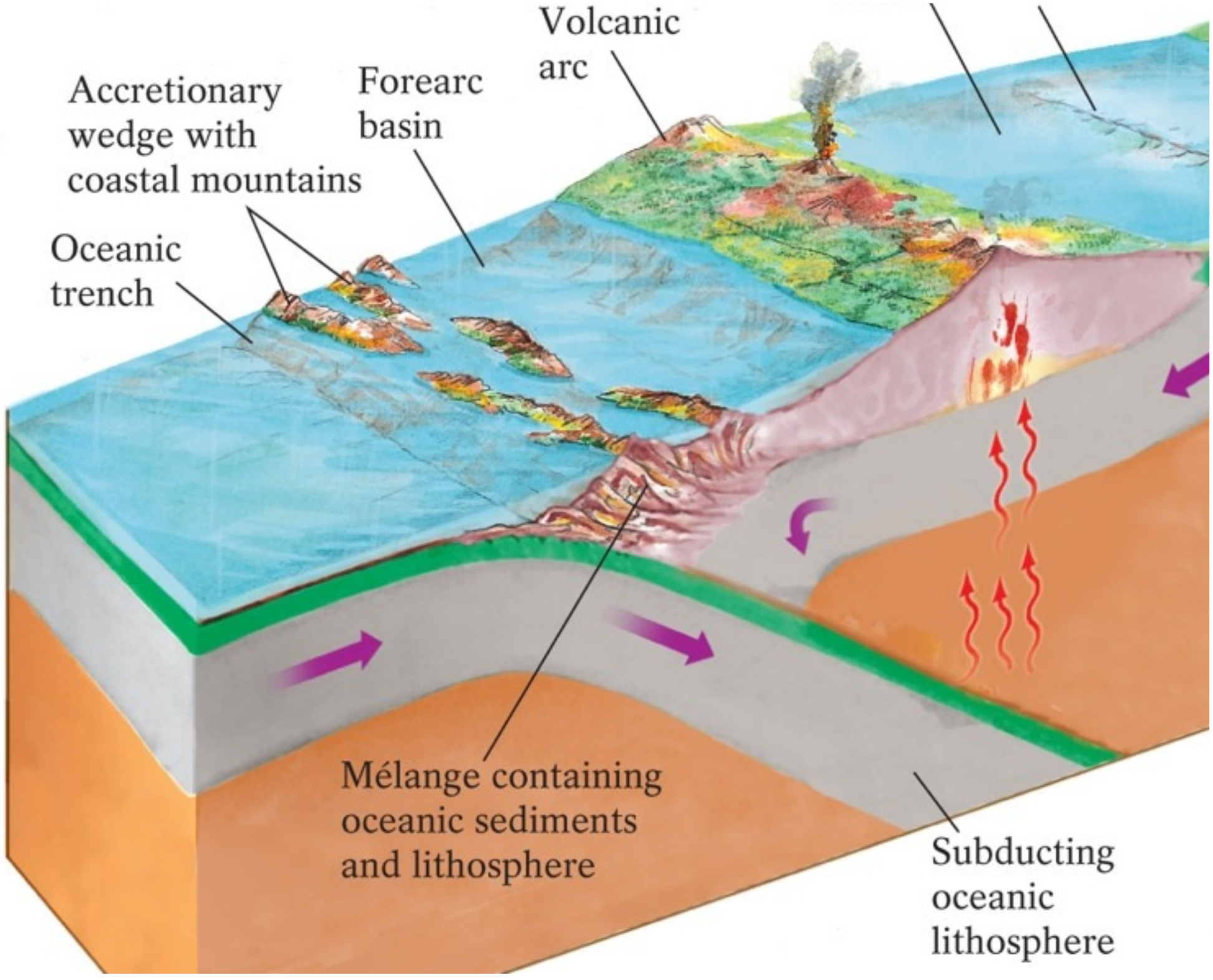

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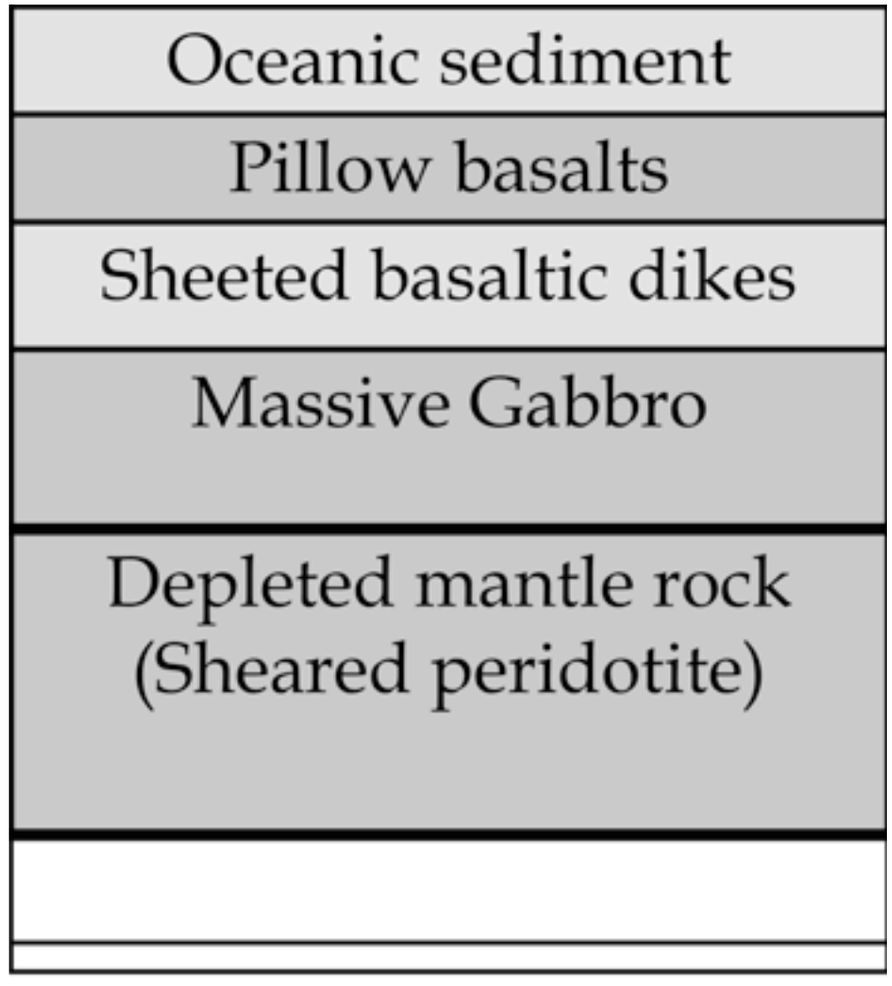
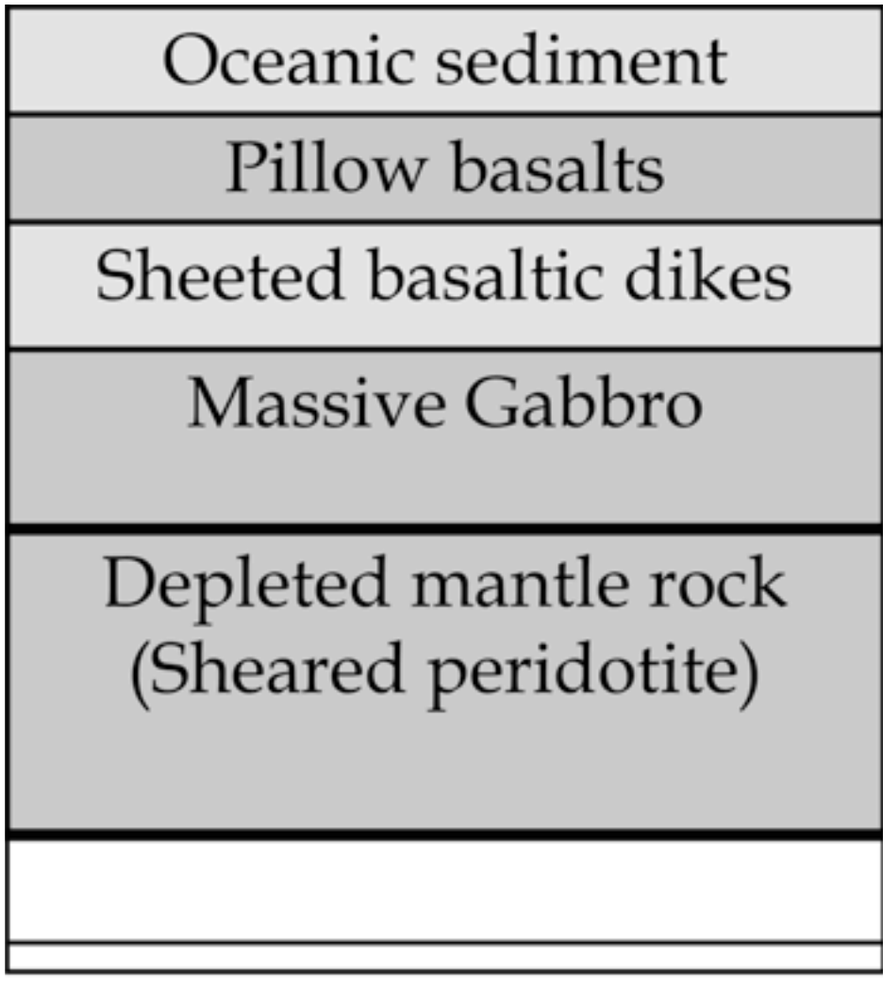


Anatomy of a Subduction zone Accretionary Wedge (Prism)

Ophiolite suite



Anatomy of a Subduction zone Accretionary Wedge (Prism)

Ophiolite suite

Oceanic sediment
Pillow basalts
Sheeted basaltic dikes
Massive Gabbro
Depleted mantle rock (Sheared peridotite)

Anatomy of a Subduction zone Accretionary Wedge (Prism)

Ophiolite suite

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Sheeted basaltic dikes
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Anatomy of a Subduction zone
Accretionary Wedge (Prism)


Marine Headlands


Pillow Basalt at Point Bonita, Marin Headlands


Baker Beach

Ophiolite suite

Oceanic sediment
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Sheeted basaltic dikes
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Anatomy of a Subduction zone Accretionary Wedge (Prism)


Marine Headlands


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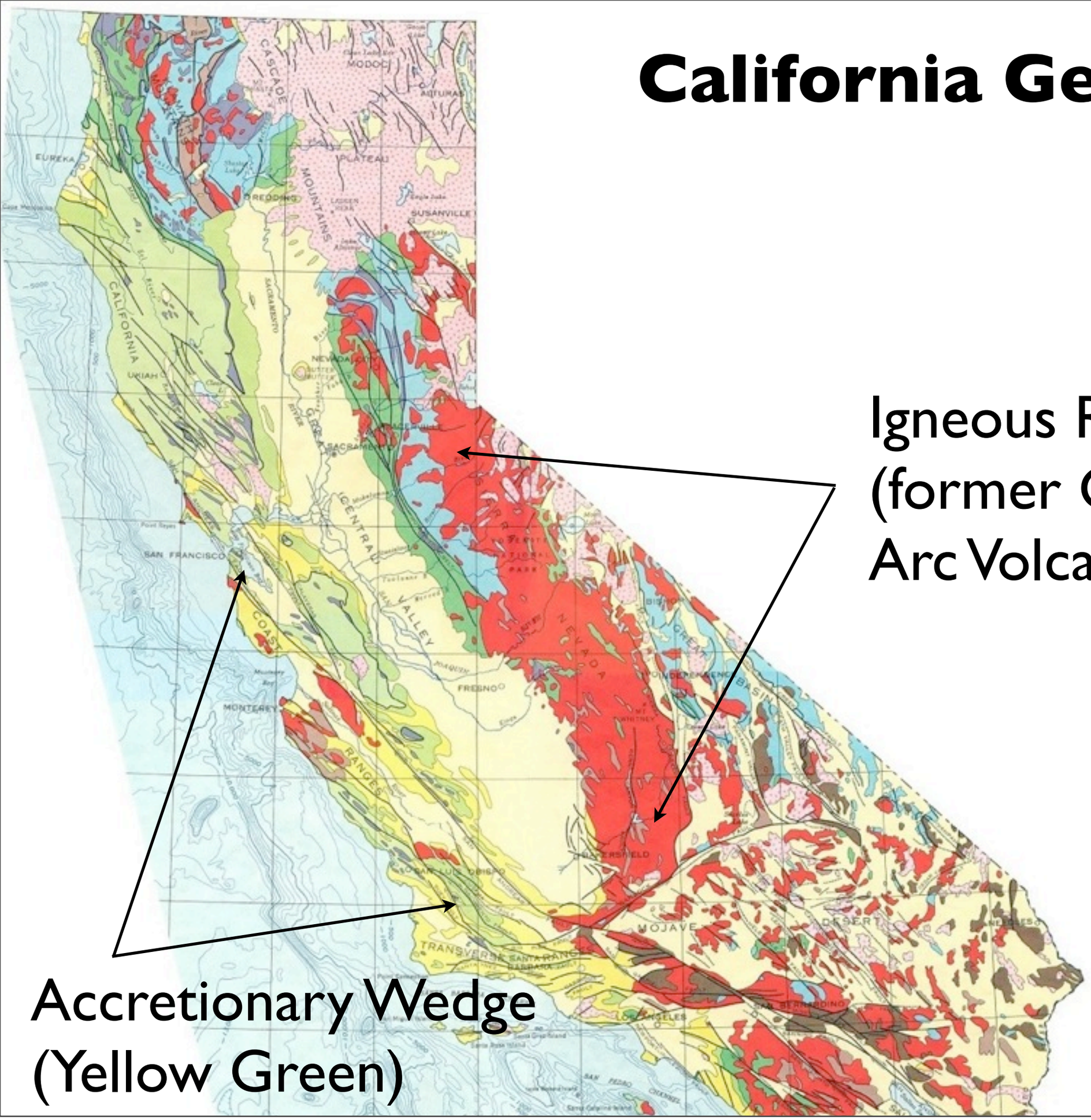
Baker Beach

Ophiolite suite

Oceanic sediment
Pillow basalts
Sheeted basaltic dikes
Massive Gabbro
Depleted mantle rock (Sheared peridotite)

Bay Area Geology tells us there was a Subduction zone here 160 Ma to 20 Ma

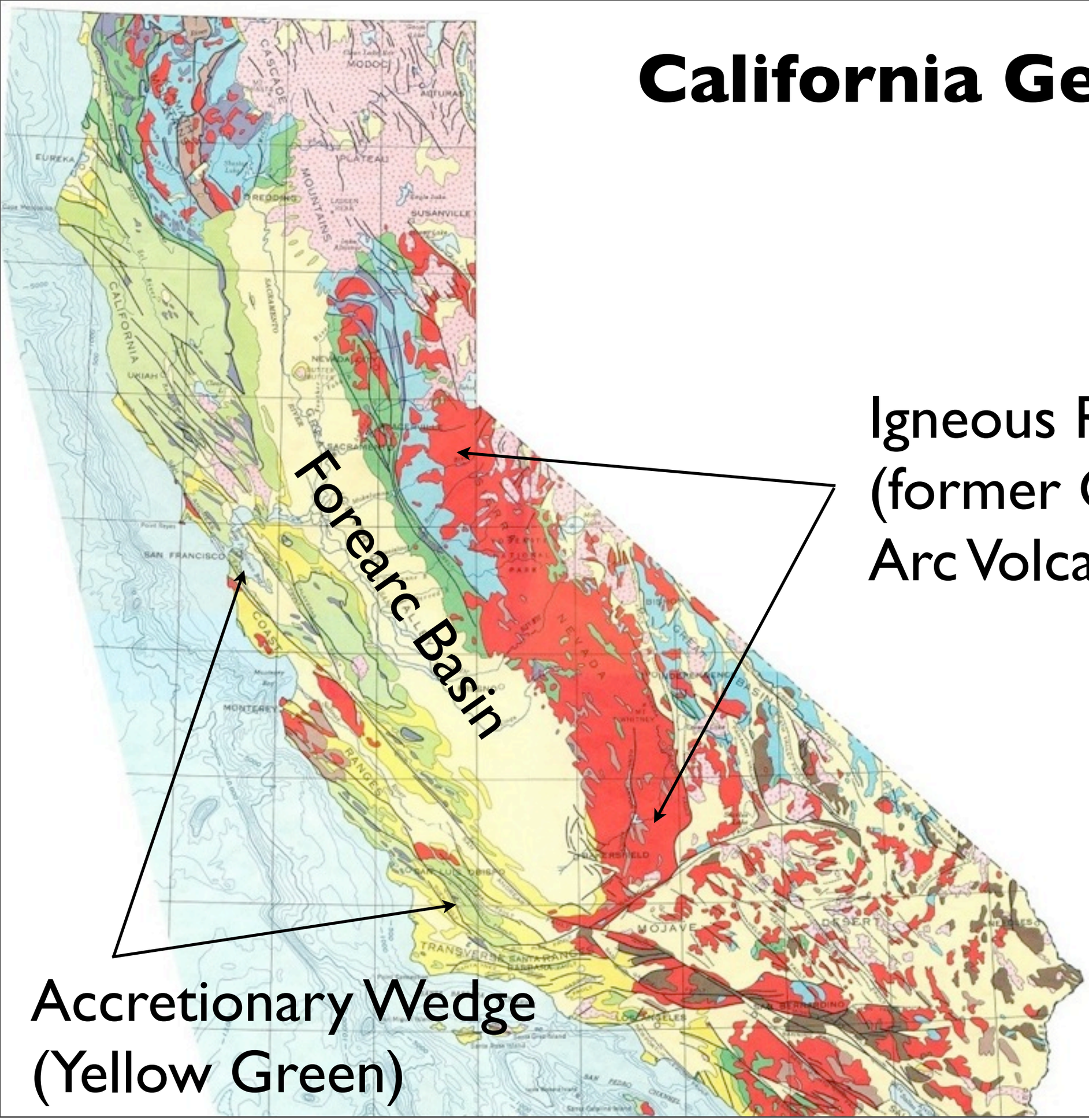
California Geology



Igneous Rocks in red (former Continental Arc Volcanoes)

Accretionary Wedge (Yellow Green)

California Geology



Igneous Rocks in red (former Continental Arc Volcanoes)

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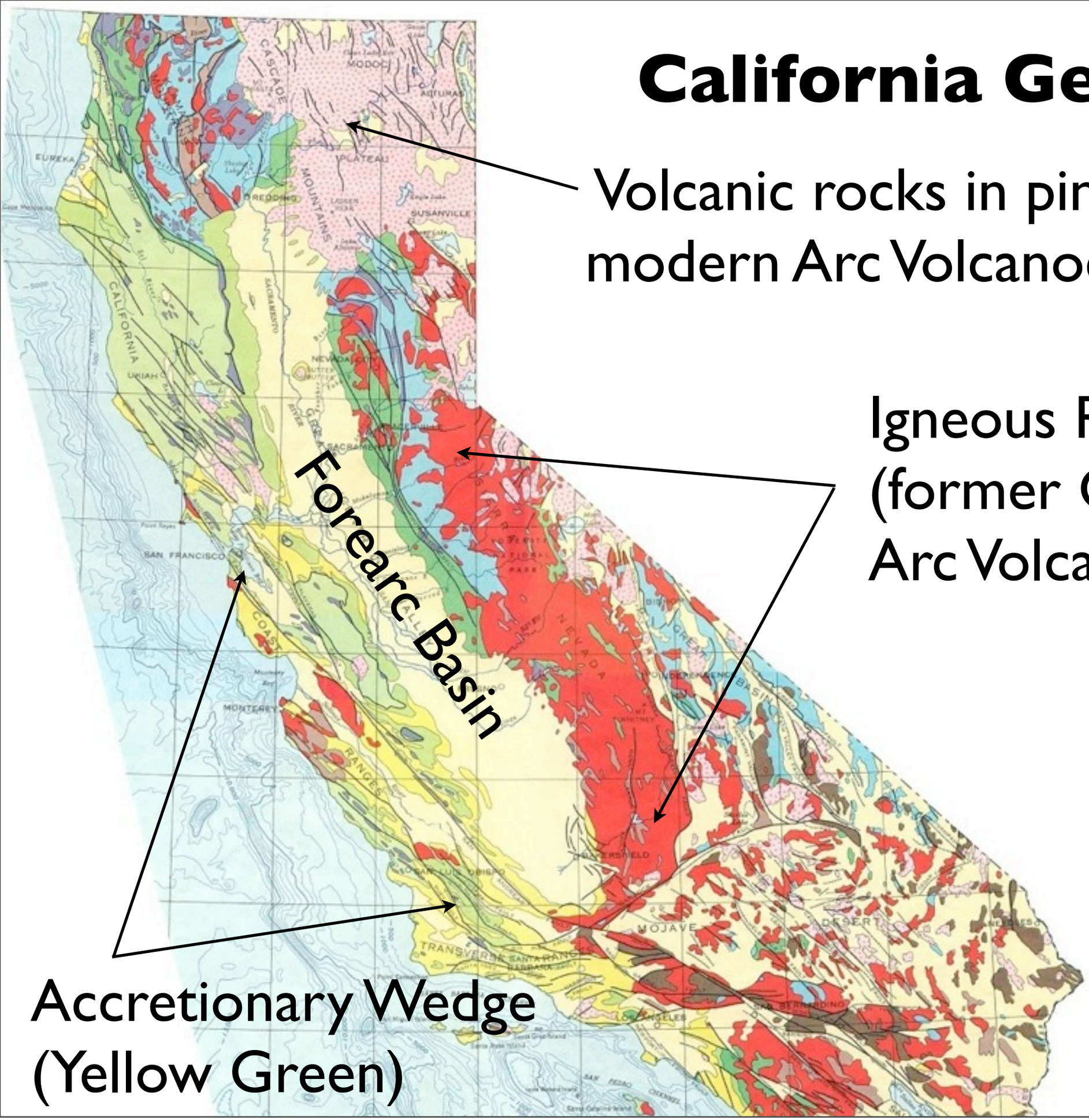
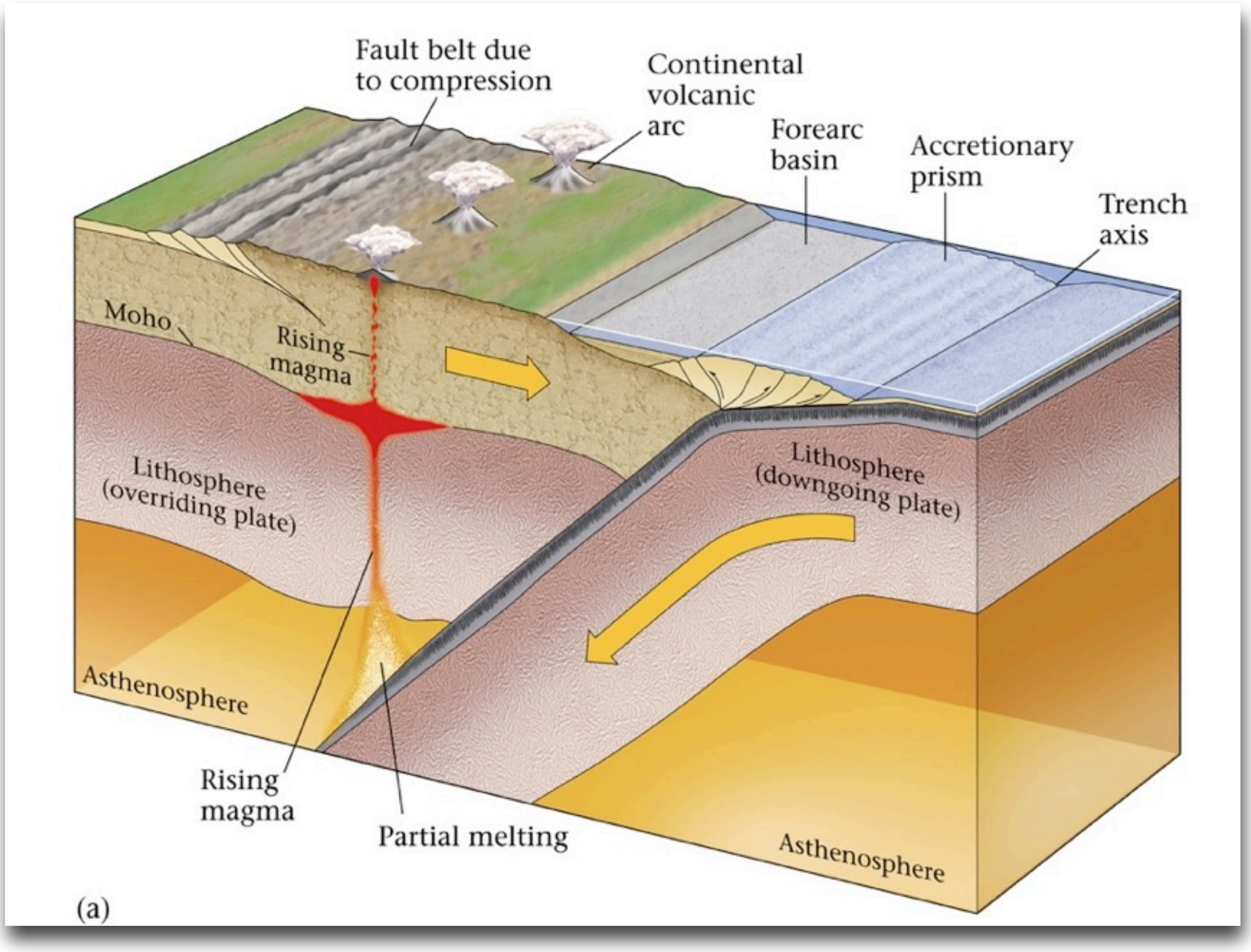


Volcanic rocks in pink
modern Arc Volcanoes

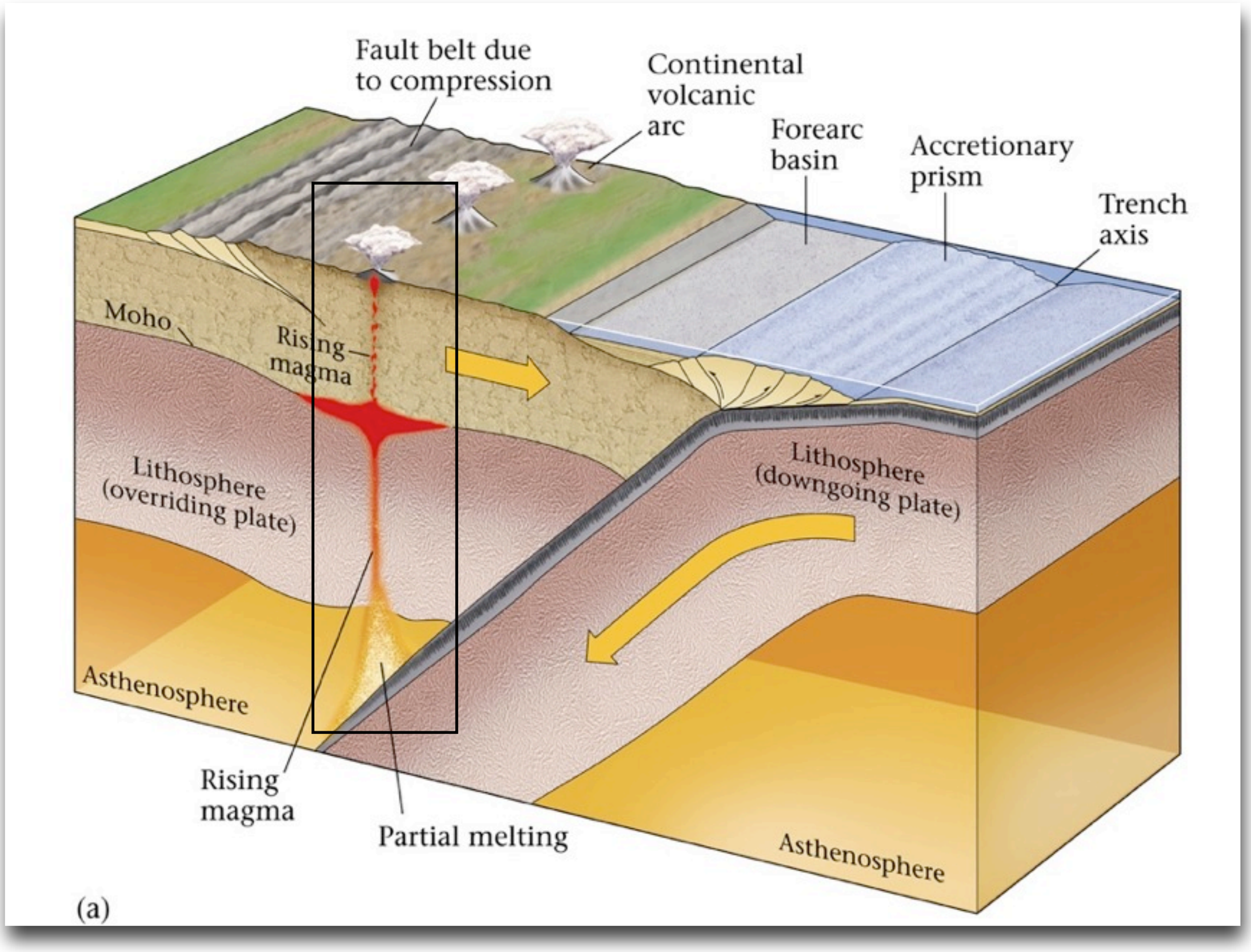
Igneous Rocks in red
(former Continental
Arc Volcanoes)

Accretionary Wedge
(Yellow Green)

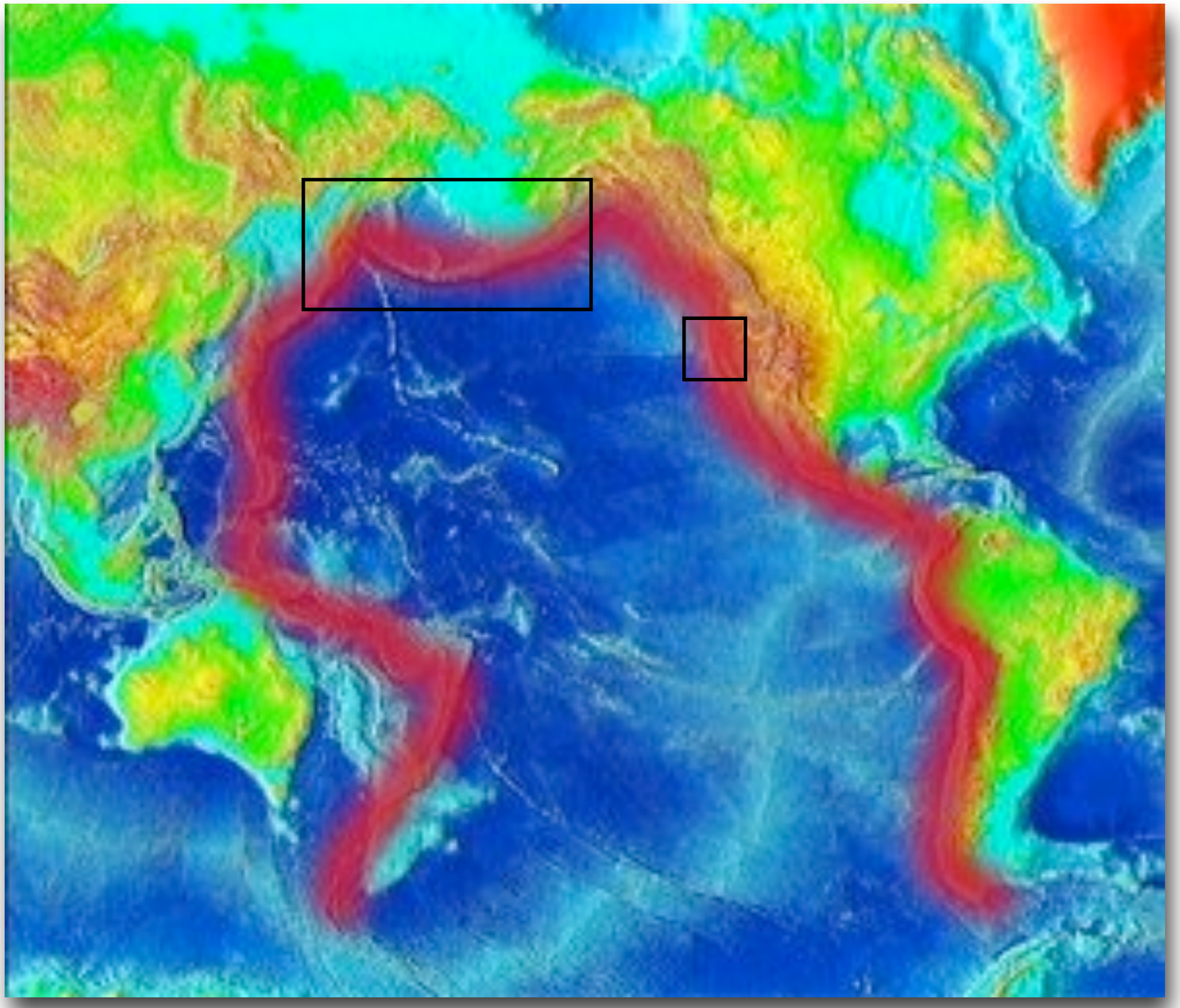
Anatomy of a Subduction zone



Anatomy of a Subduction zone

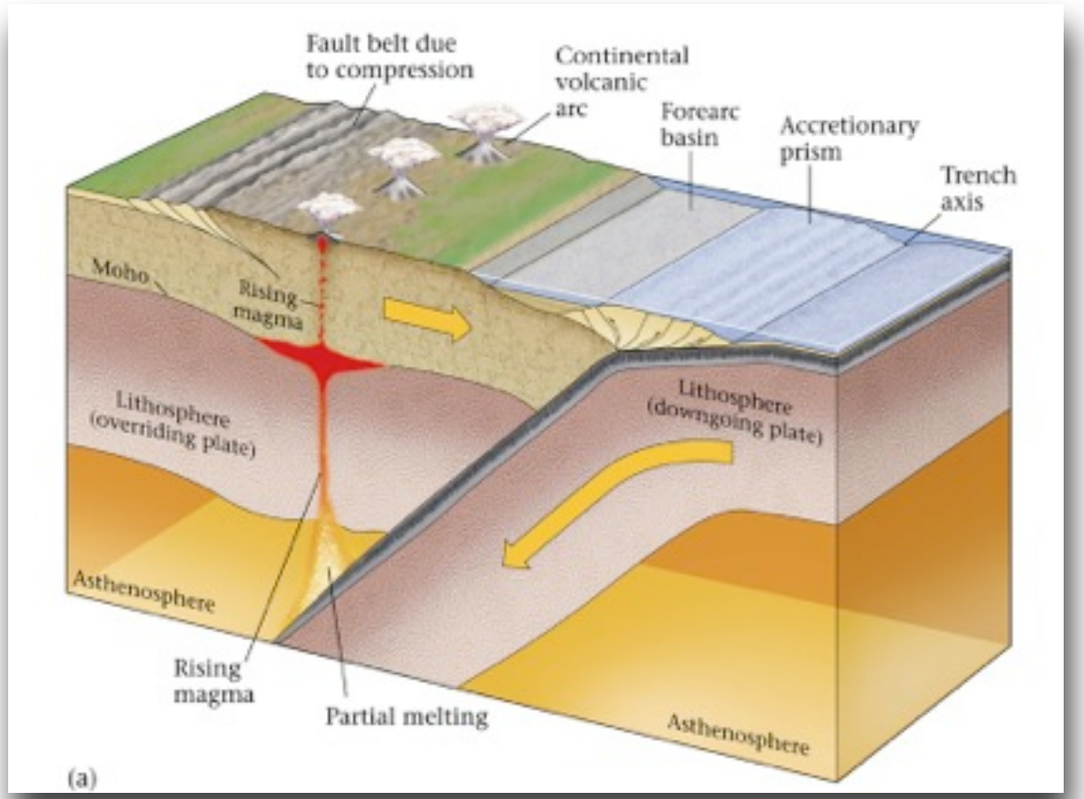


The “Ring of Fire” Subduction Zones at Convergent Boundaries



Why we have Arc Volcanoes

What is going down?



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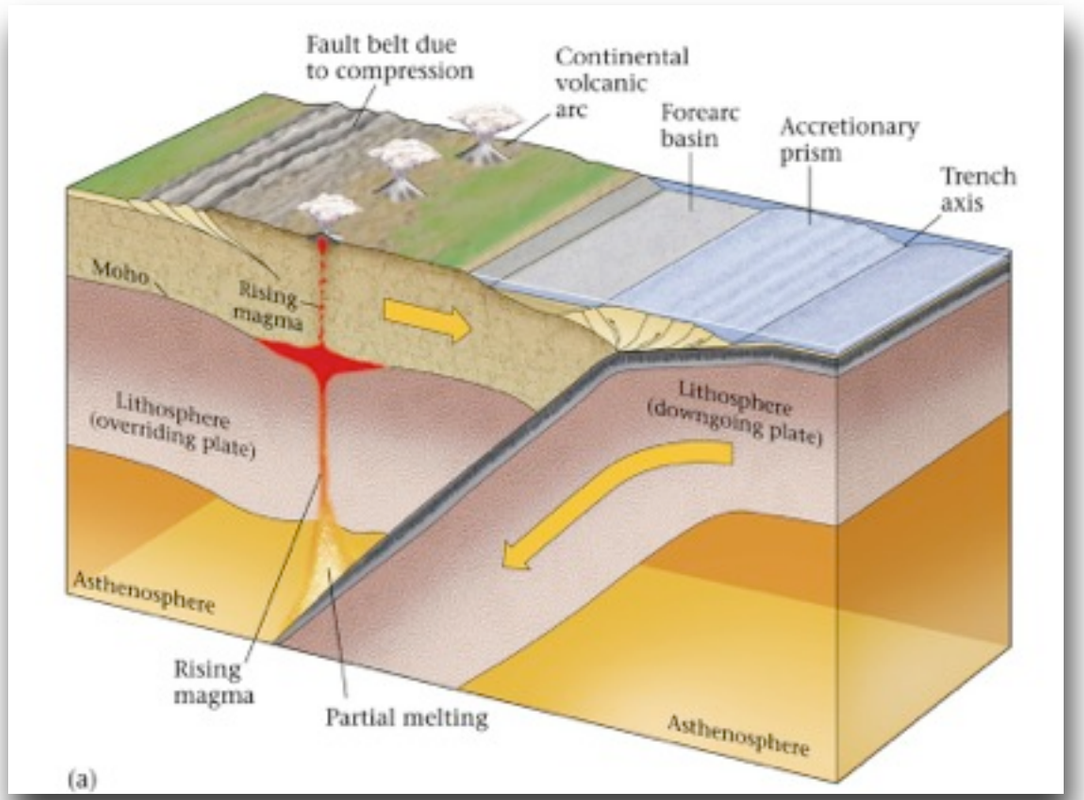


What is going down?

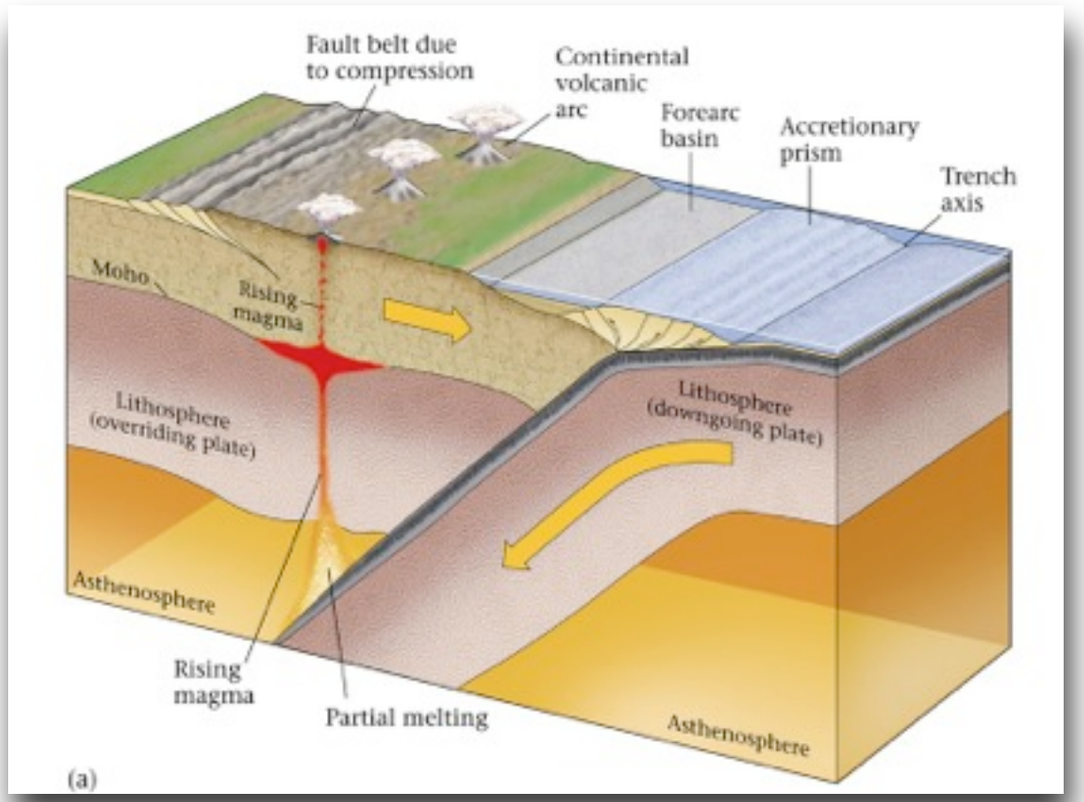
↓

Oceanic lithosphere

↓

What hydrothermally altered rock is in the lithosphere?

Why we have Arc Volcanoes



What is going down?

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Oceanic lithosphere

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What hydrothermally altered rock is in the lithosphere?

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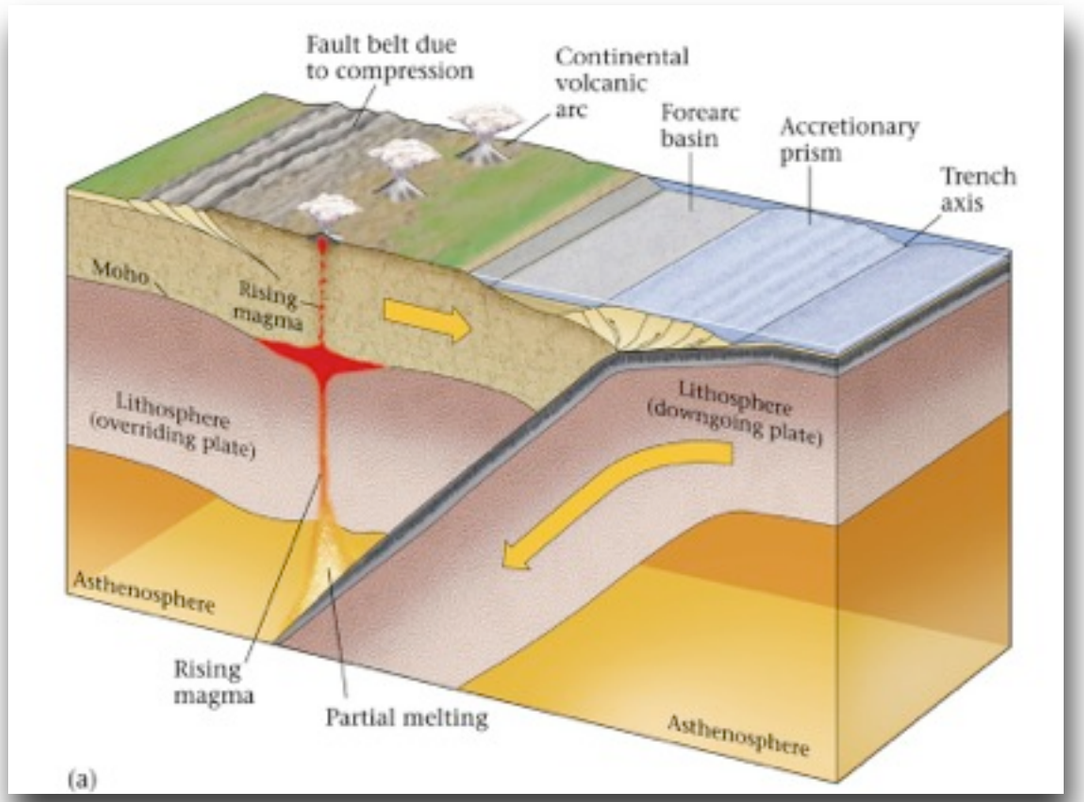
What is special about serpentinite?

Serpentinite

Why we have Arc Volcanoes



What is going down?

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Oceanic lithosphere

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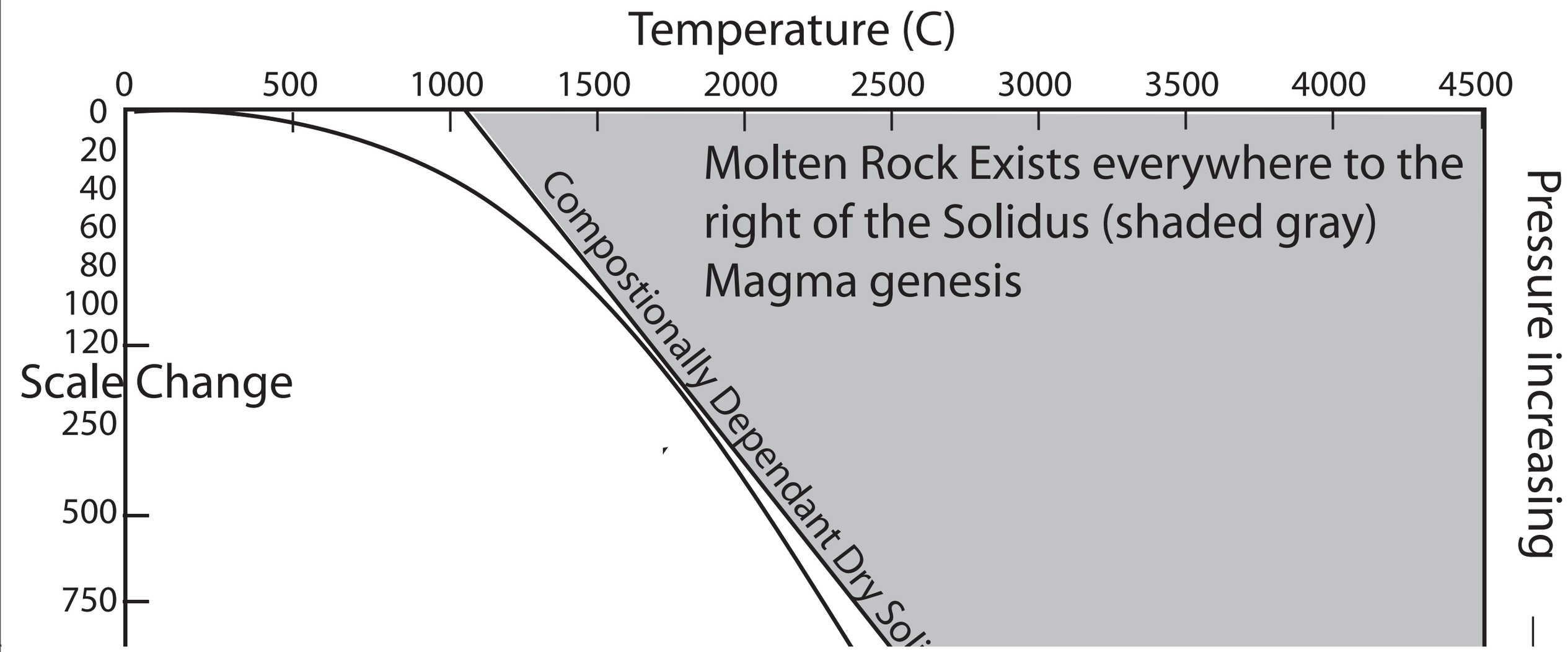
Serpentinite

What is special about serpentinite?

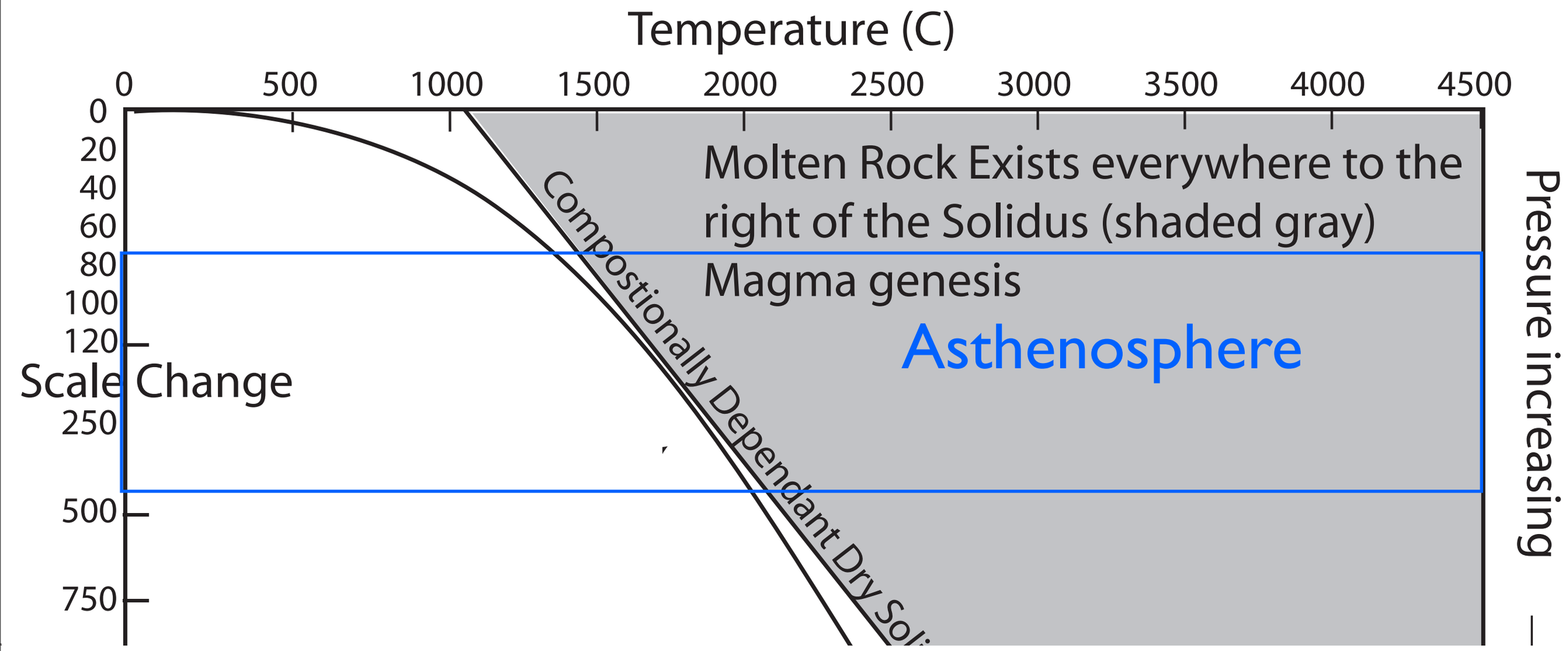
←

12% H2O

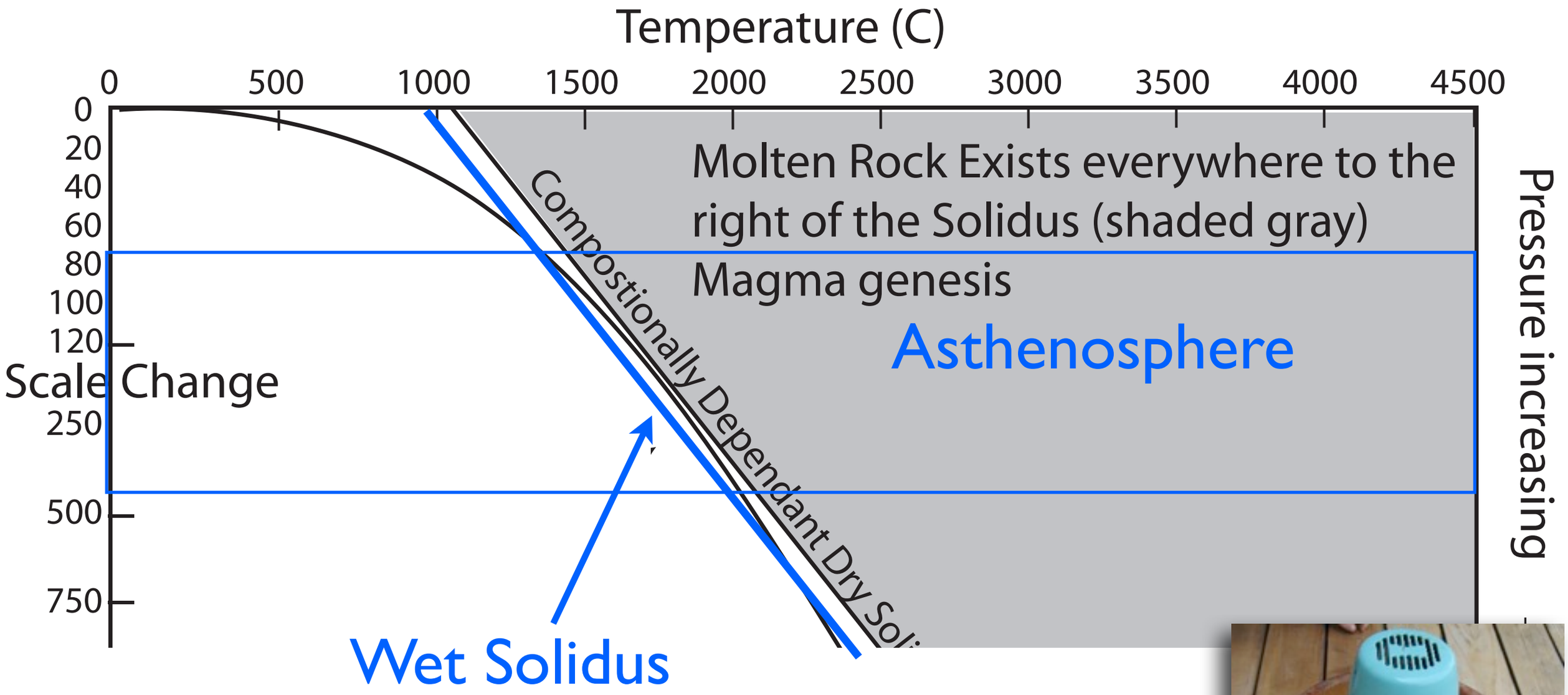
Why we have Arc Volcanoes



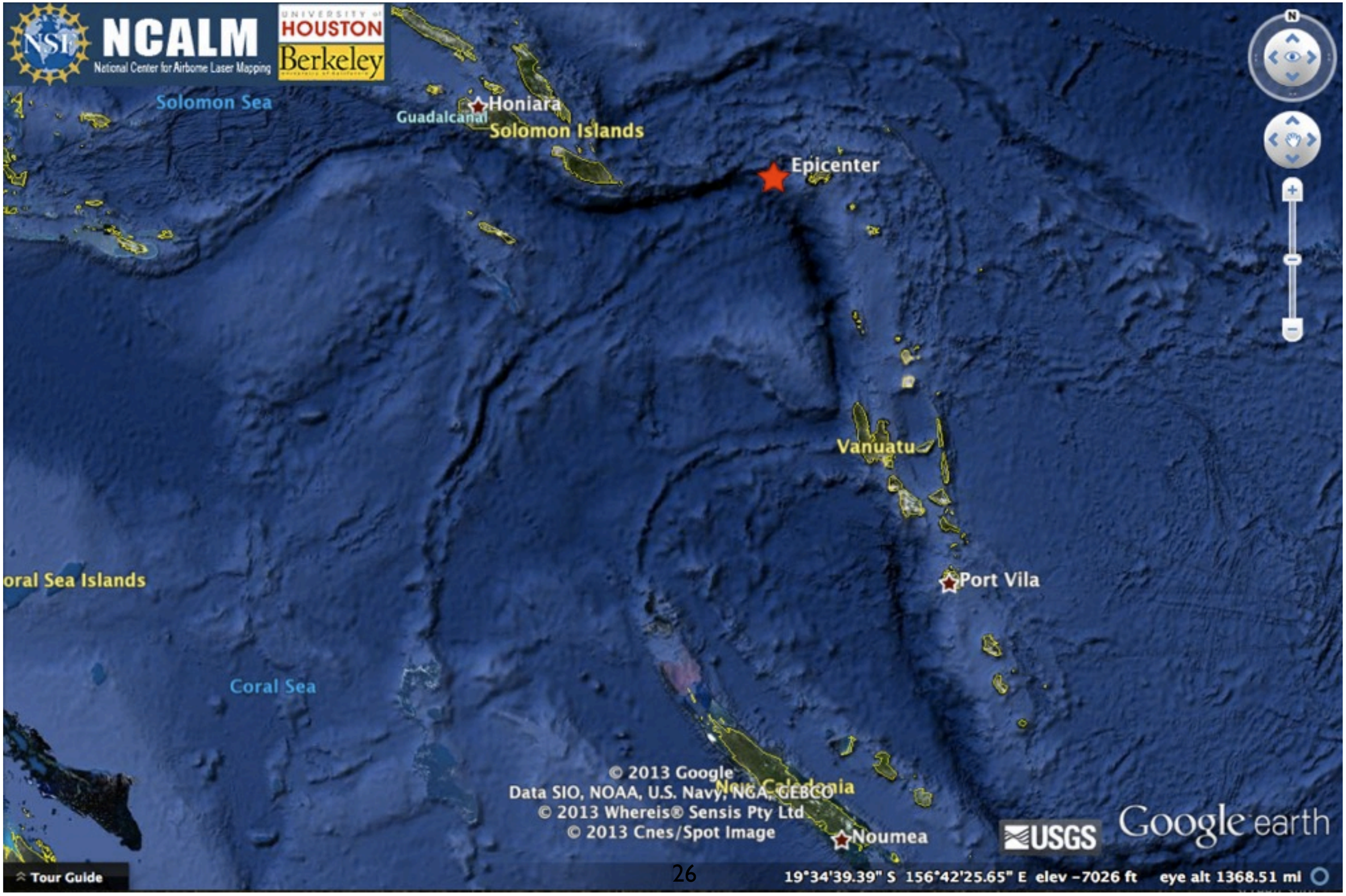
Why we have Arc Volcanoes



Why we have Arc Volcanoes



February 5th, 2013
Magnitude 8.0 Earthquake

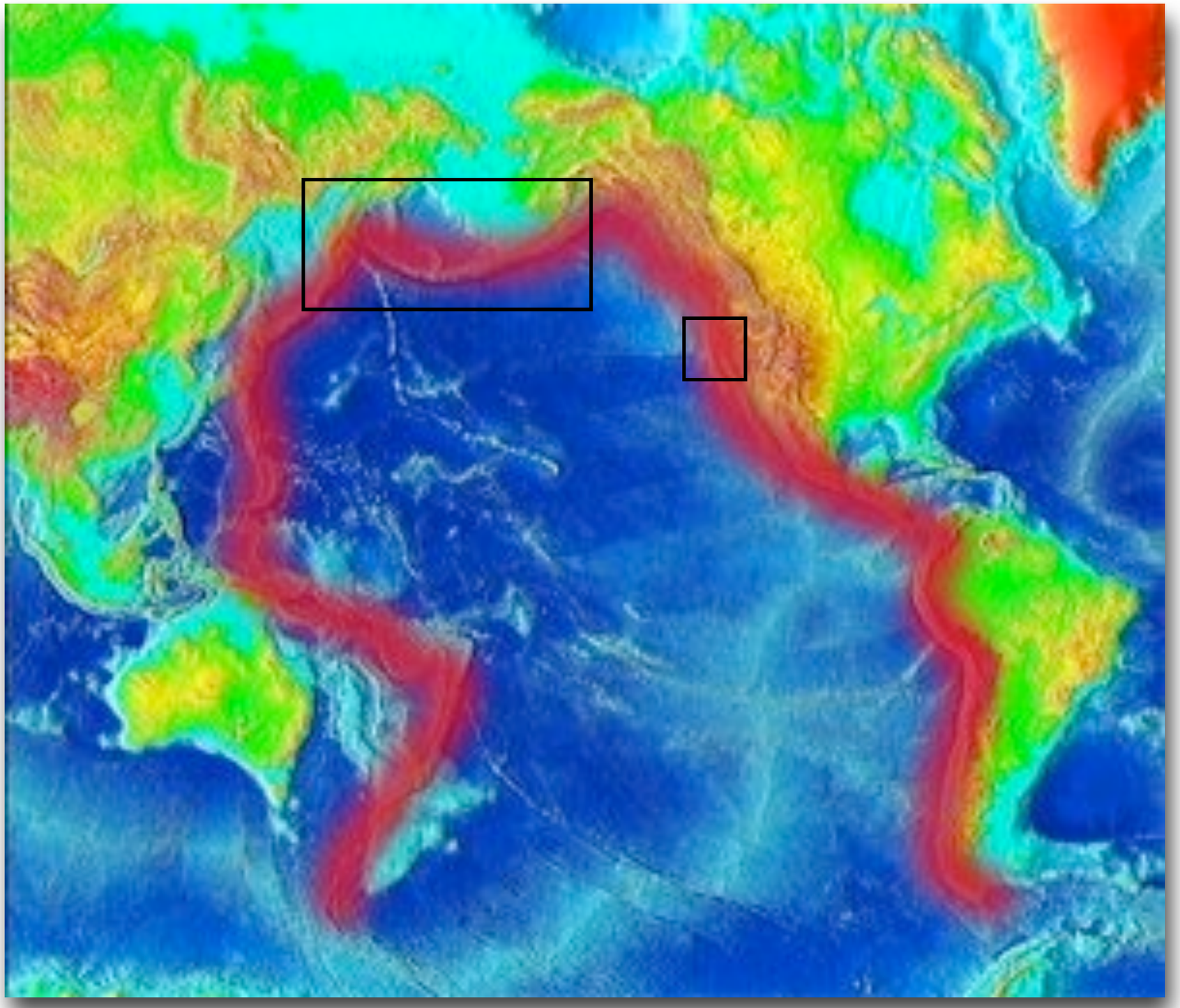


Convergent Boundary (Ocean- Ocean) Subduction zone

Ocean Island Arc Volcanoes

Aleutian Islands

The “Ring of Fire” Subduction Zones at Convergent Boundaries

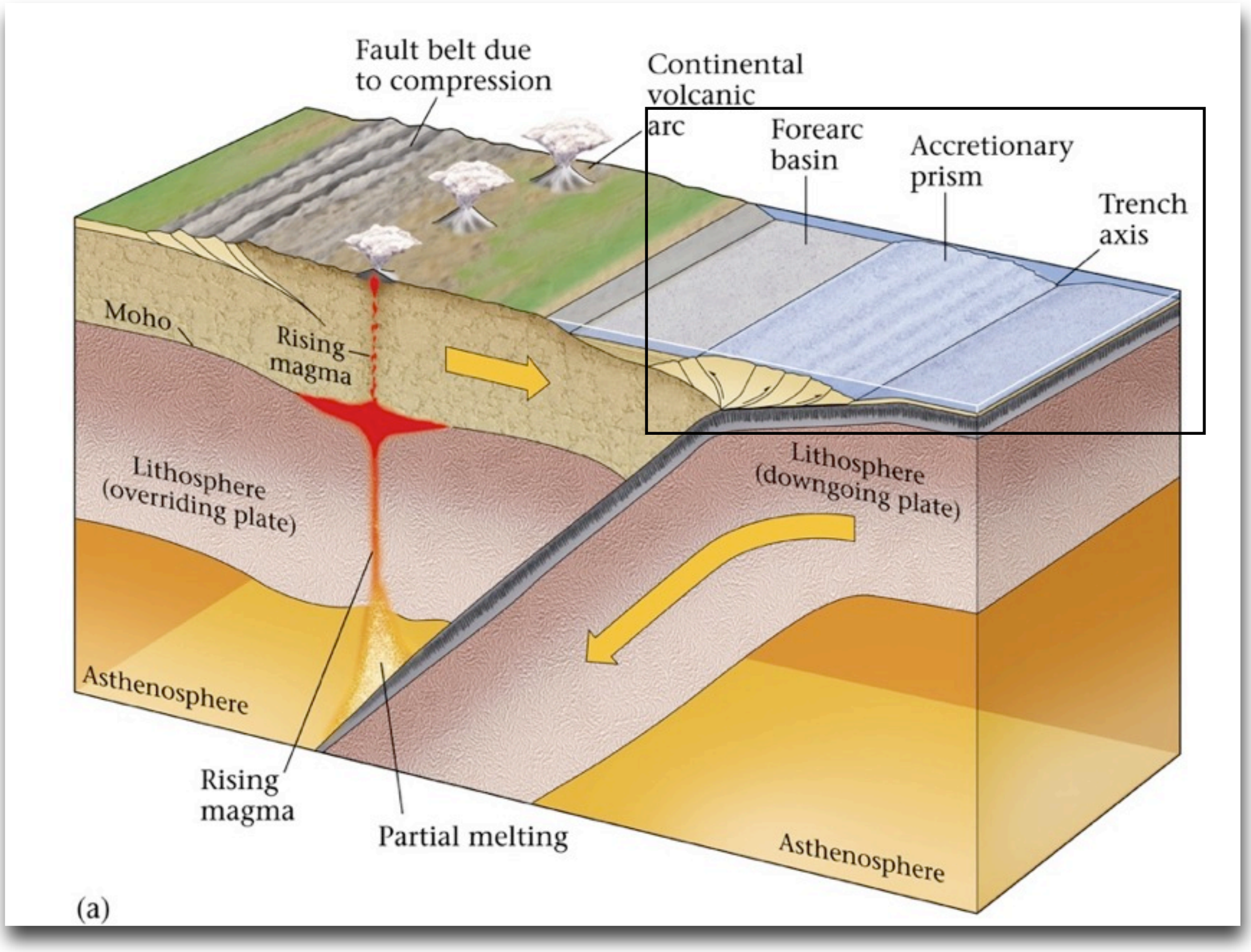


Convergent Boundary Subduction Zone (Ocean- Continent)

Continental Arc Volcanos

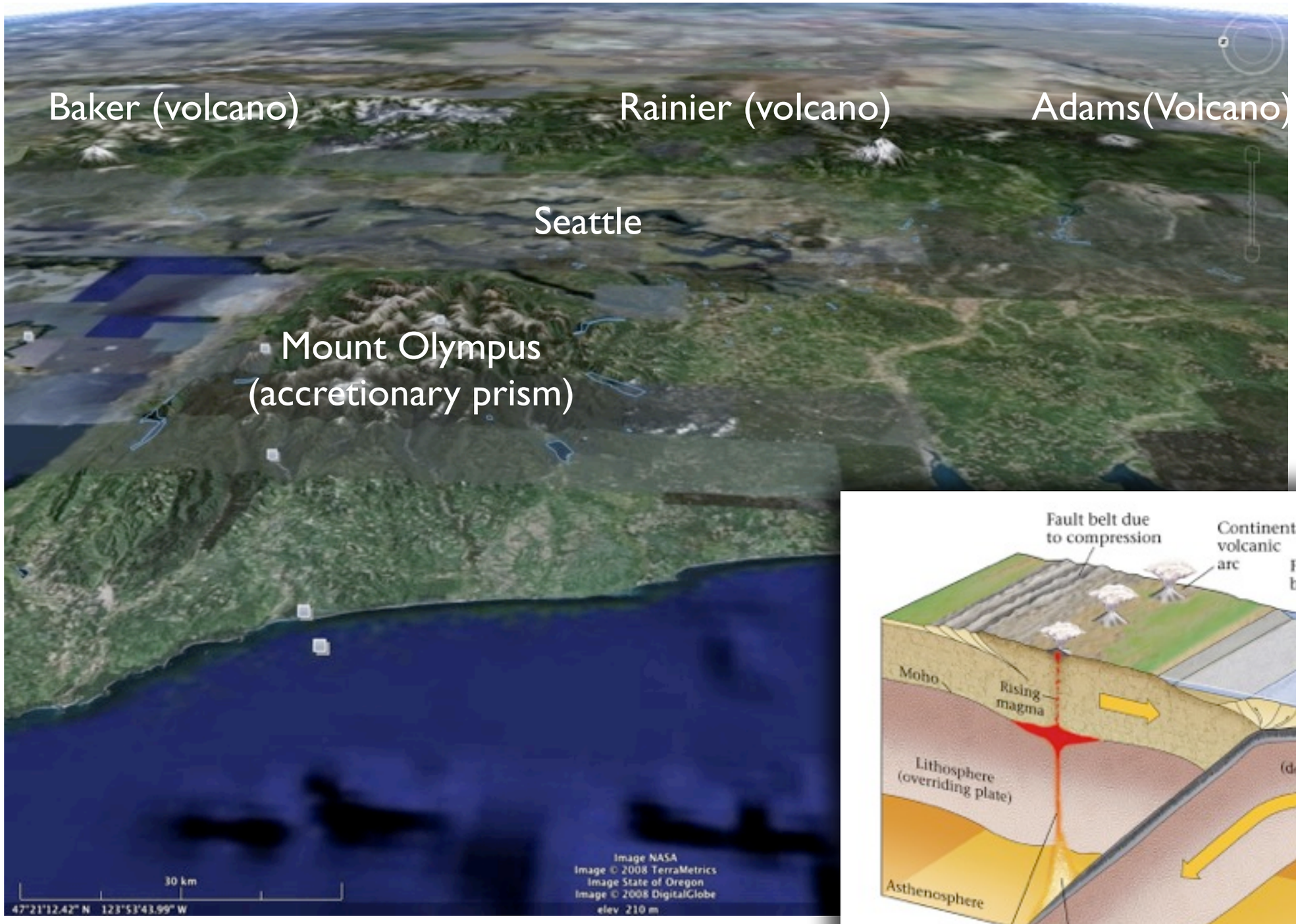
Cascade Range

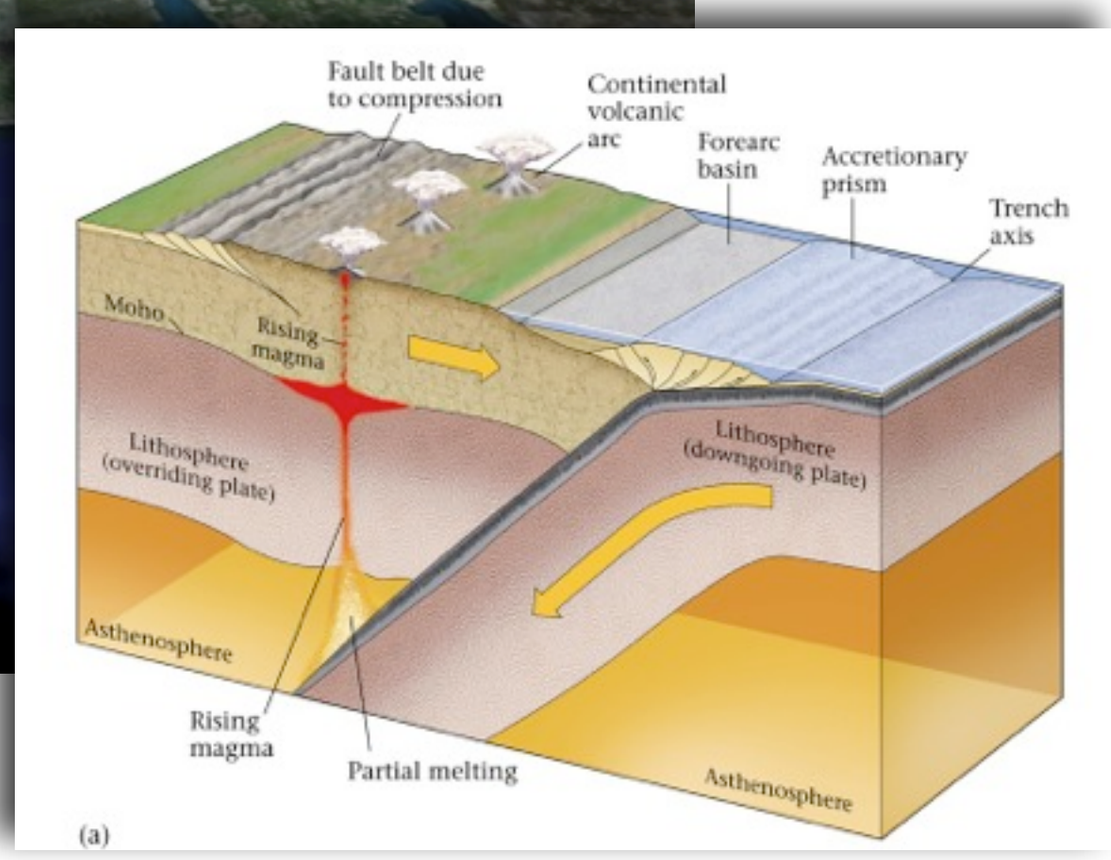
Anatomy of a Subduction zone



Convergent Boundary (Ocean- Continent)

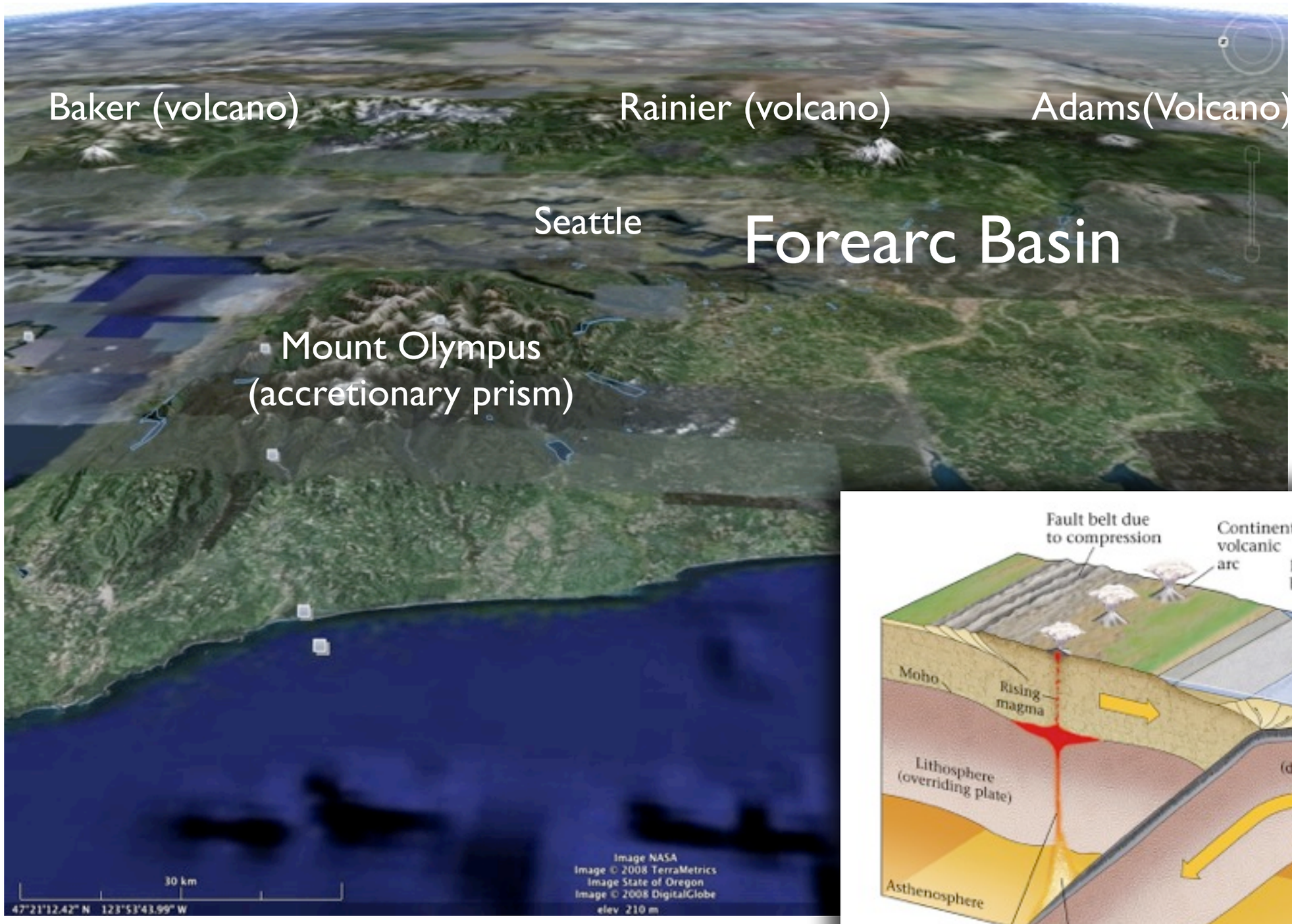
East

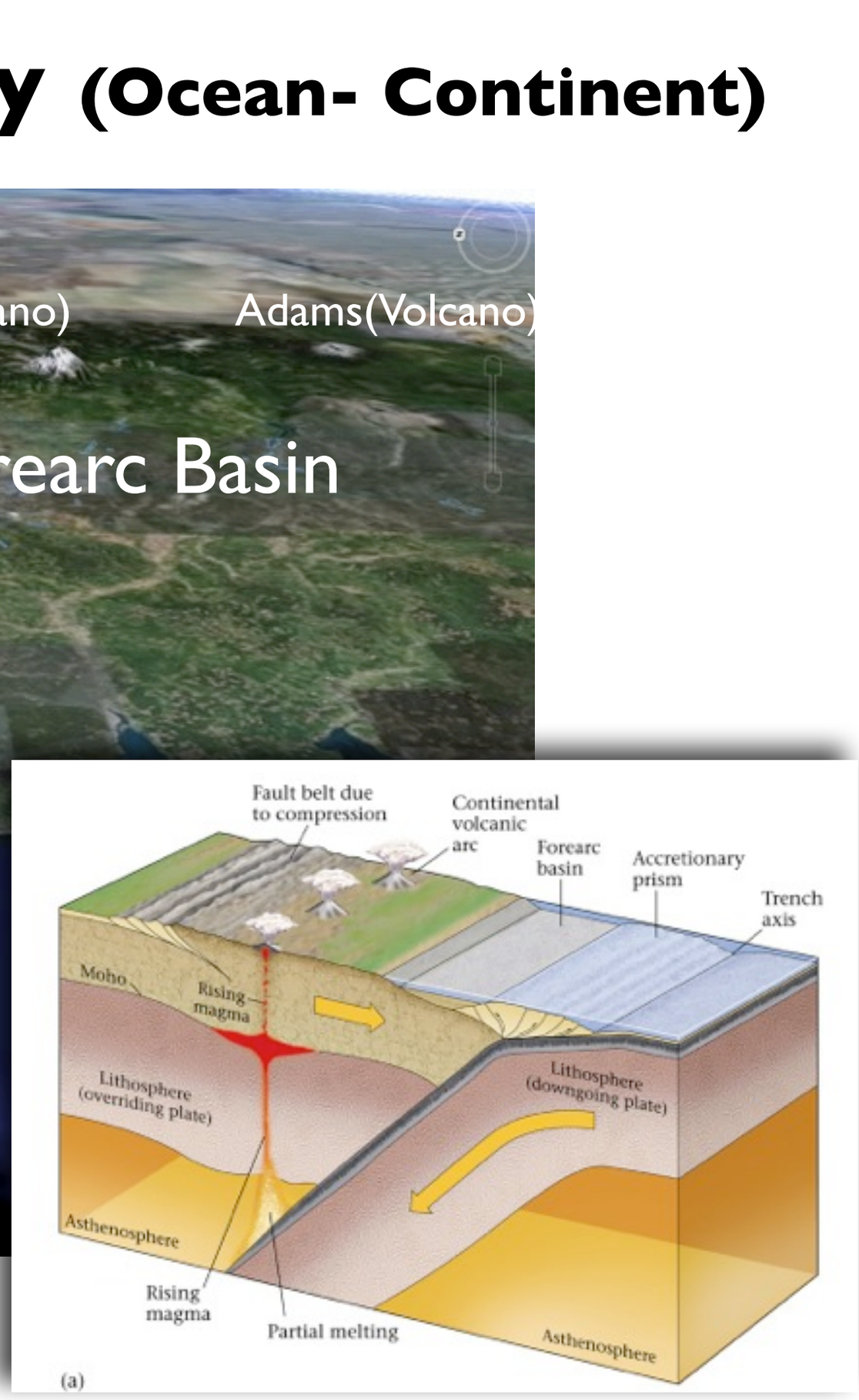




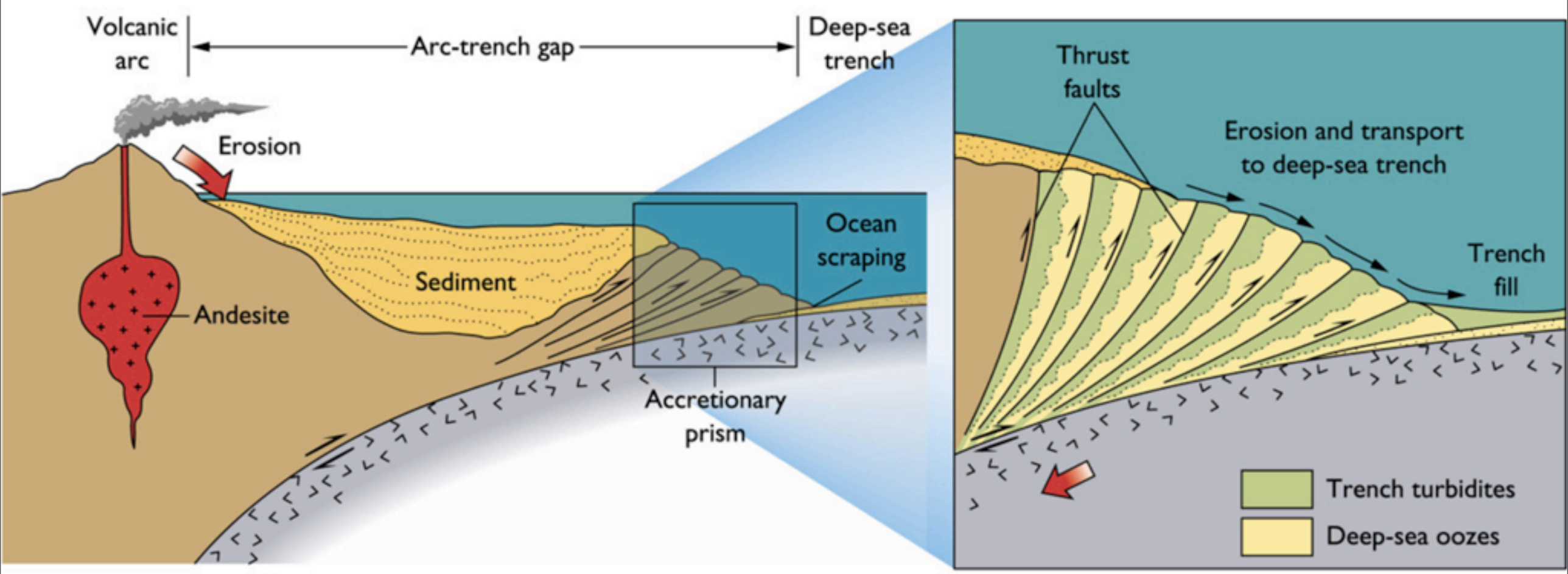
Convergent Boundary (Ocean- Continent)

East





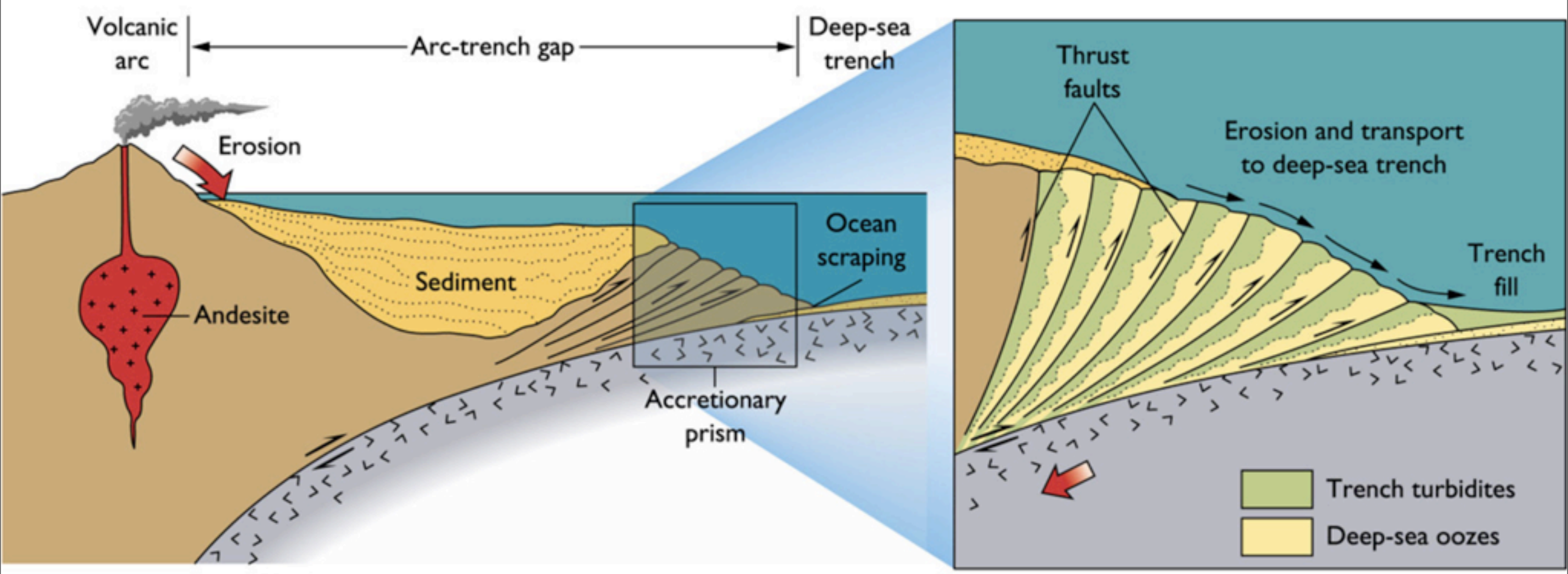
Anatomy of a Subduction zone



(a) VOLCANIC ARC-TRENCH SYSTEM

(b) ACCRETIONARY PRISM

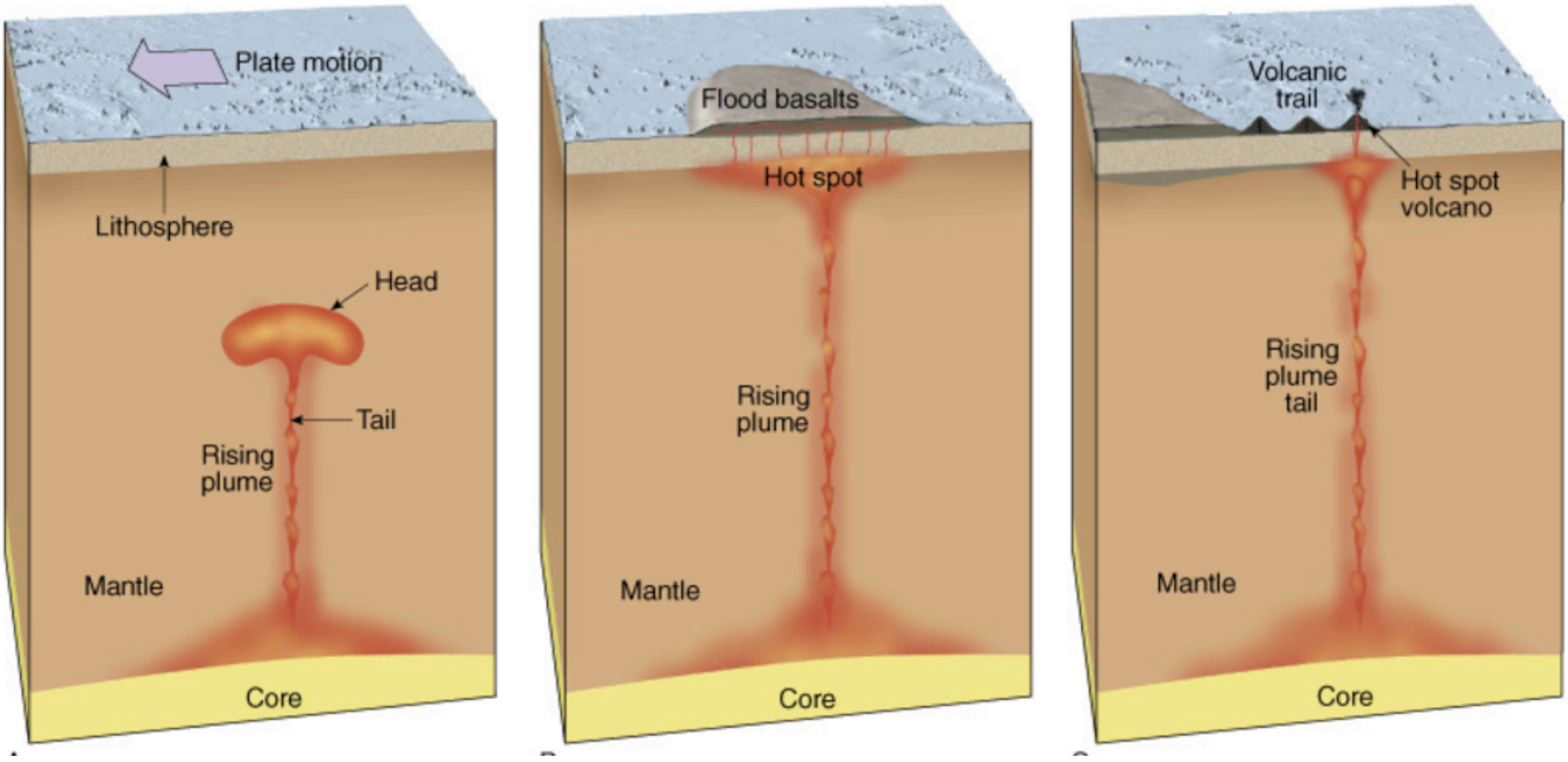
Anatomy of a Subduction zone



(a) VOLCANIC ARC-TRENCH SYSTEM

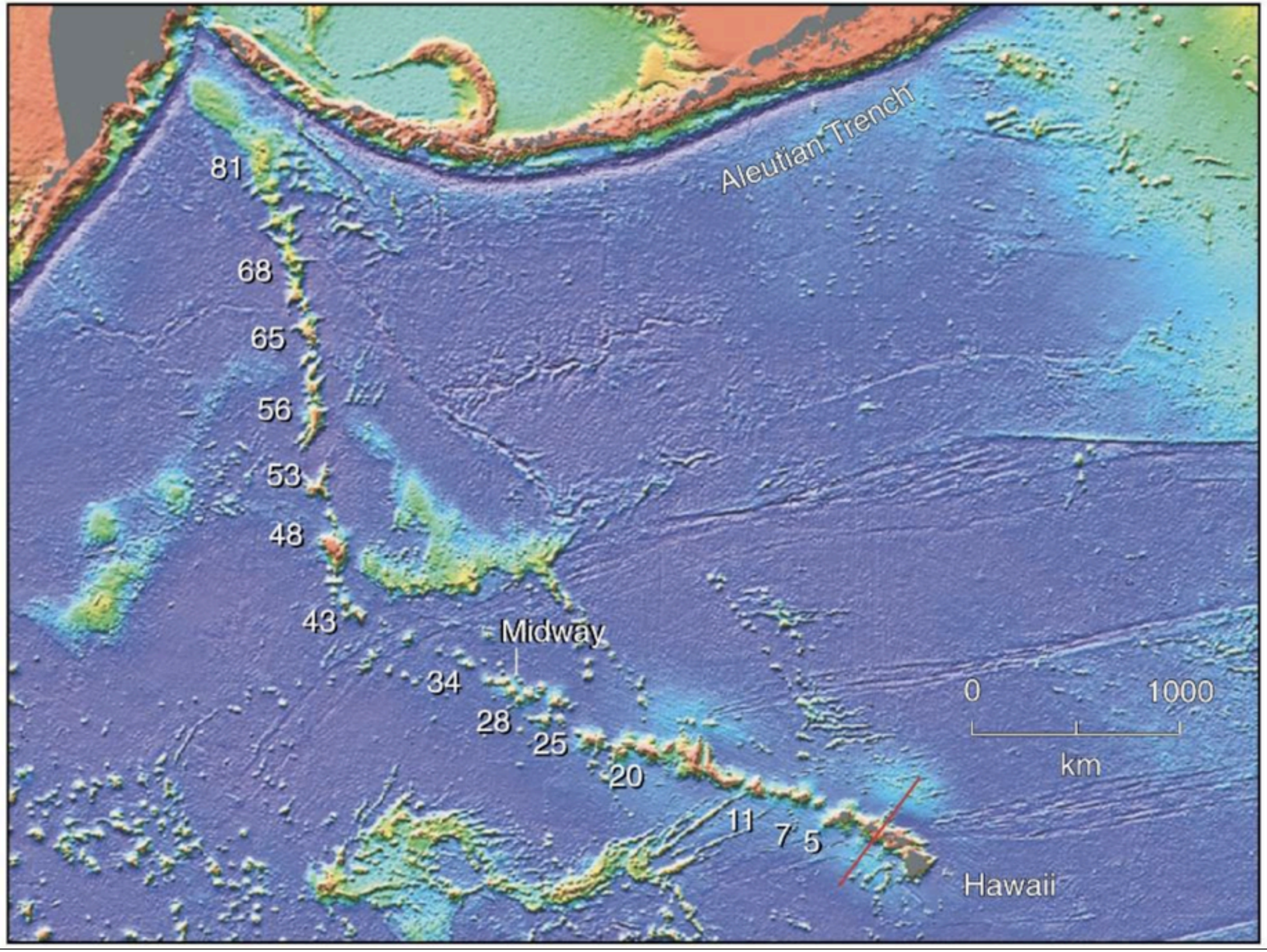
(b) ACCRETIONARY PRISM

Hot Spots:
Absolute Plate Motions
(Plate Tectonic anomaly)

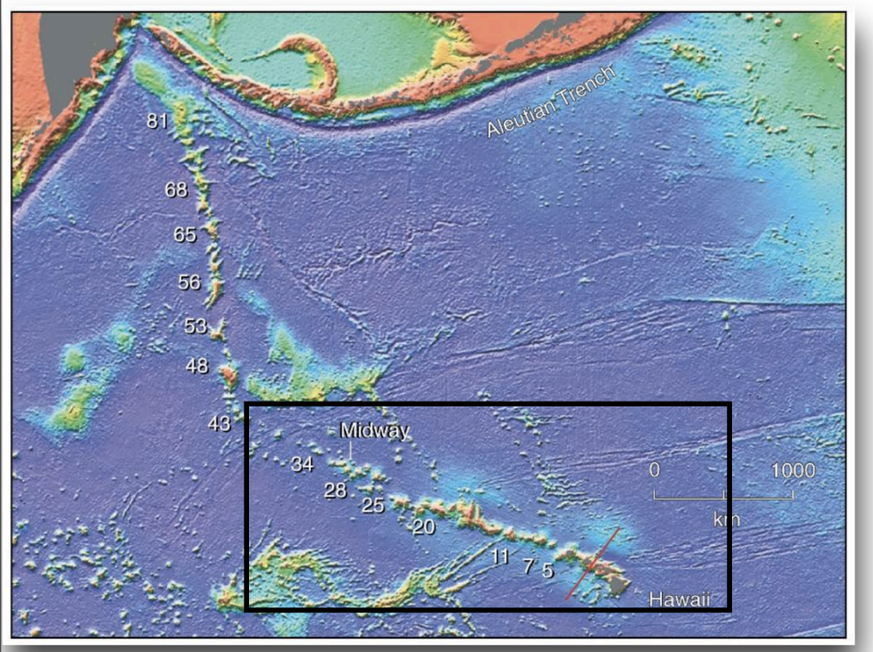


http://www.wwnorton.com/college/geo/egeo2/content/animations/2_6.htm

Emperor Sea Mount Chain

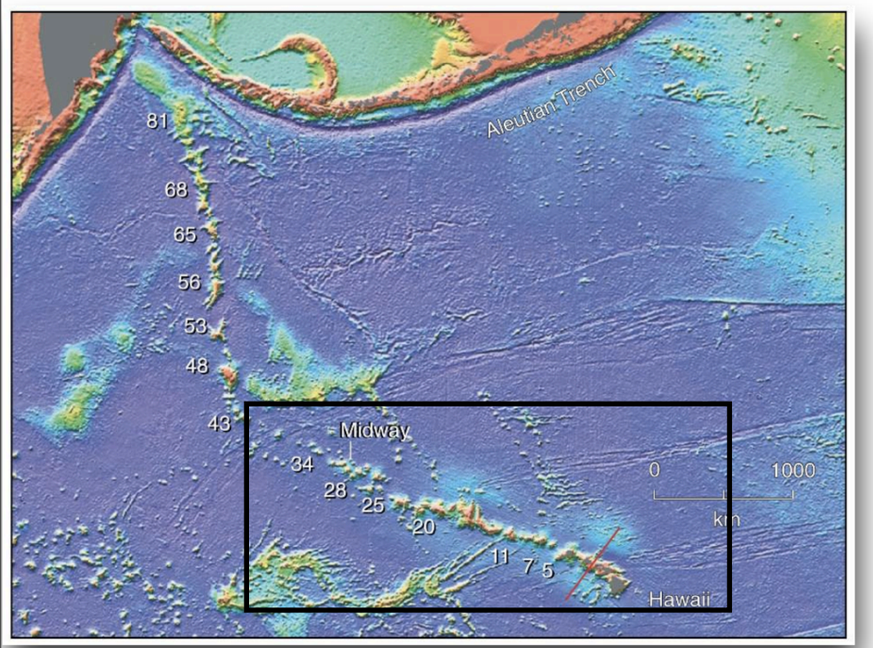


GROUP CLICKER: Which way has the Pacific plate been moving over the past 43 Ma?



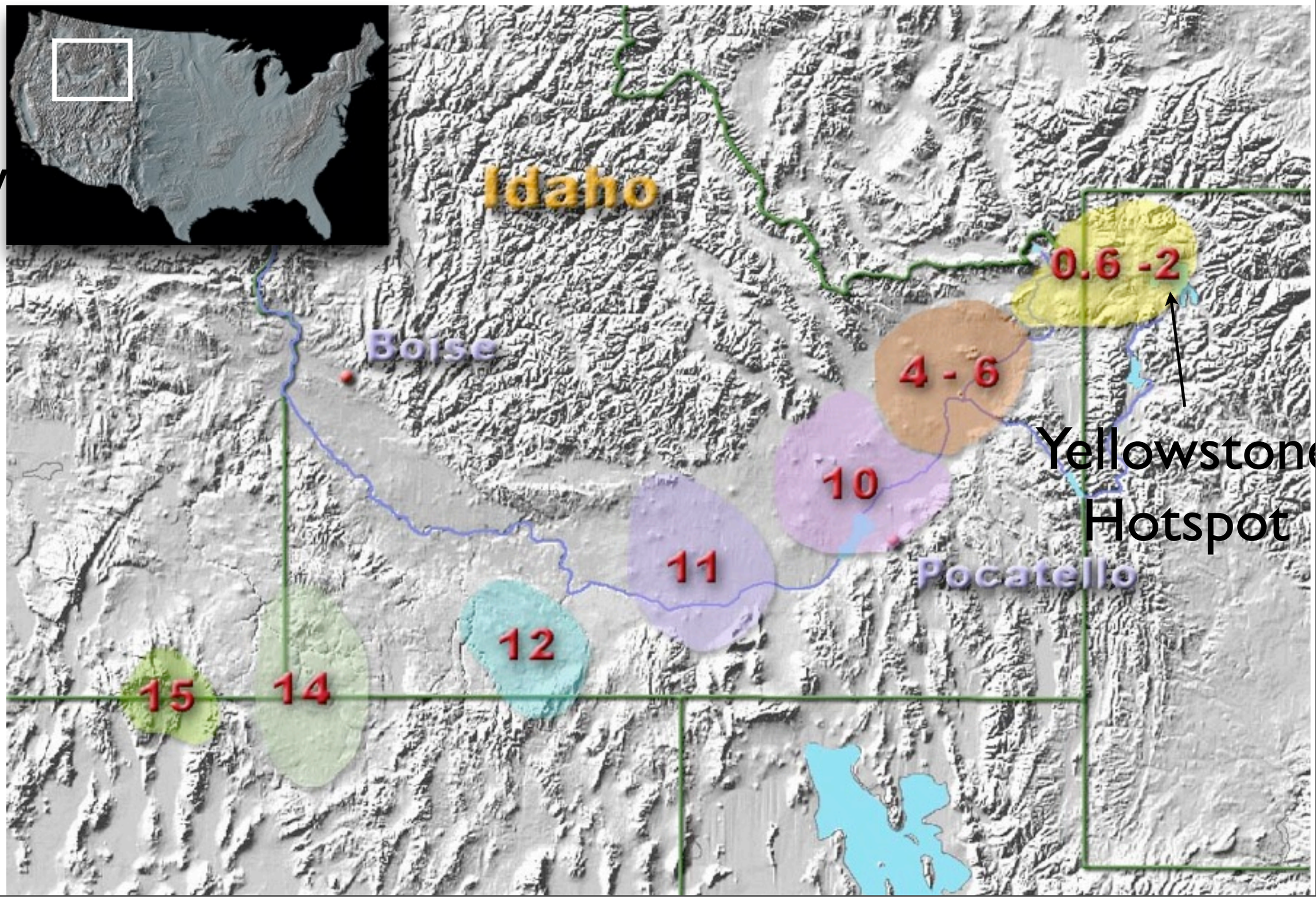
a) SW
b) SE
c) NW
d) NE

Midway Island is approximately 1500 km away from the Big Island of Hawaii. Could you determine the absolute rate the Pacific plate is moving?

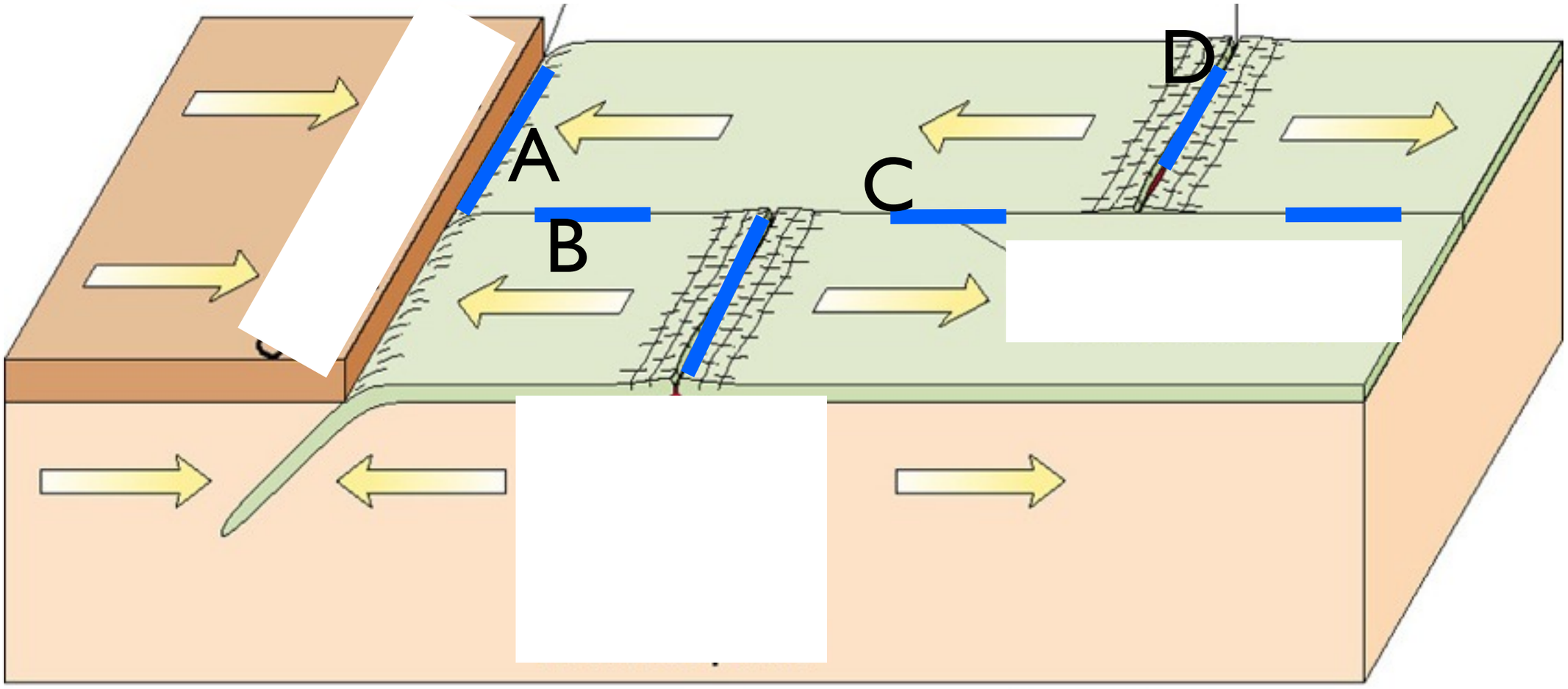


What is the absolute motion of the North American plate since 15 ma?

a) SW
b) SE
c) NW
d) NE

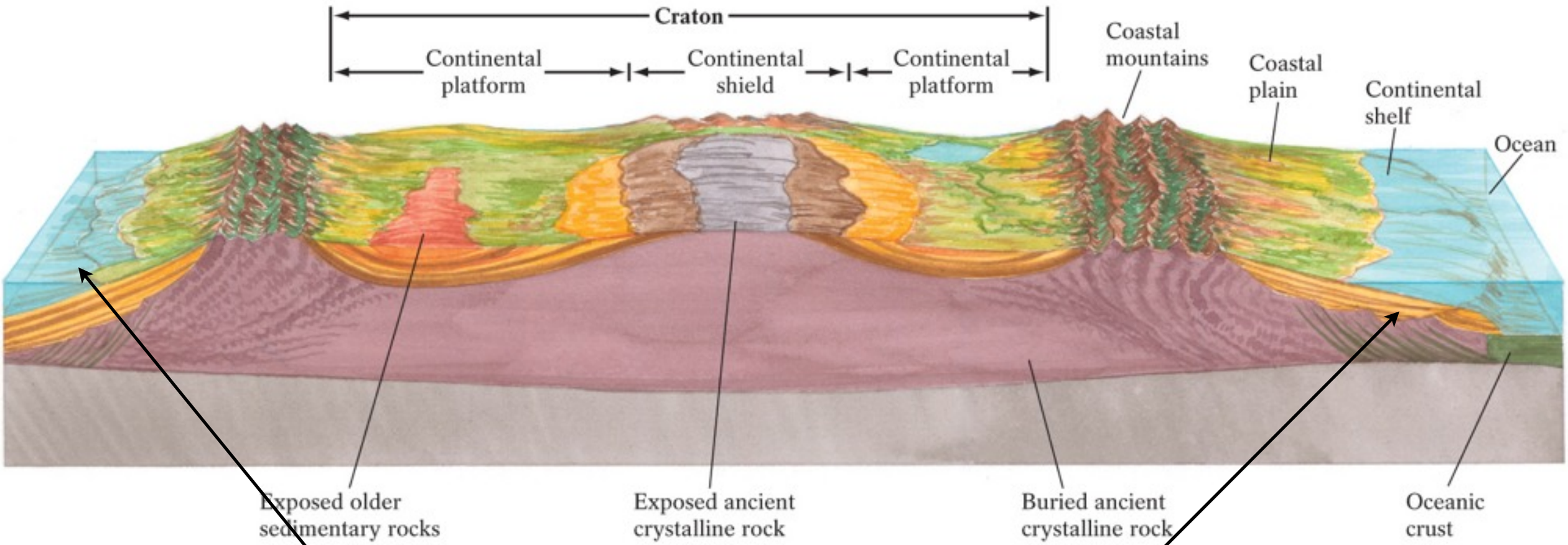


Which, if any of the Blue lines do <u>not</u> lie on a plate boundary?



E) all are plate boundaries

Anatomy and Growth of Continents

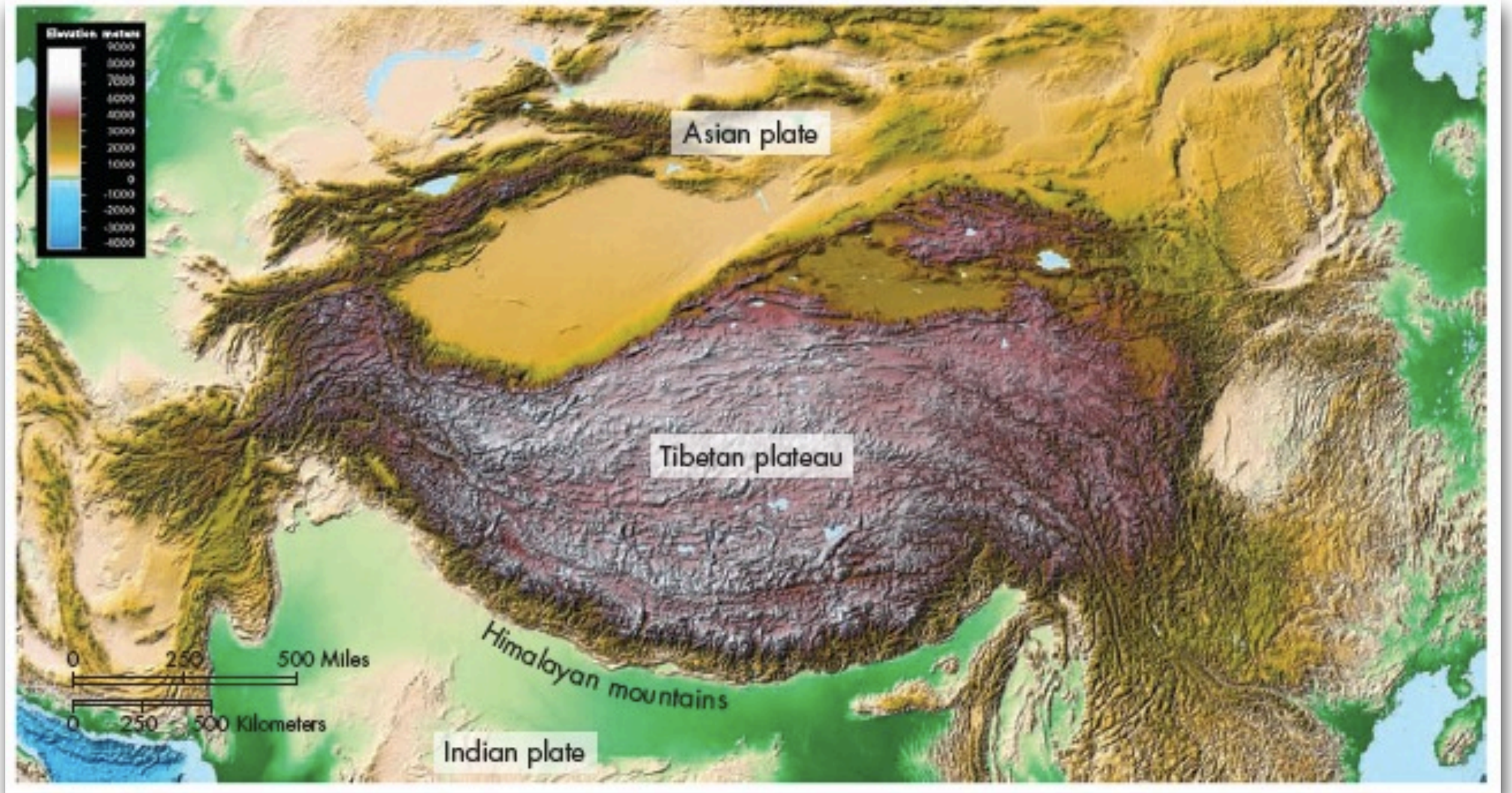


Passive Continental Margins

Anatomy and Growth of Continents

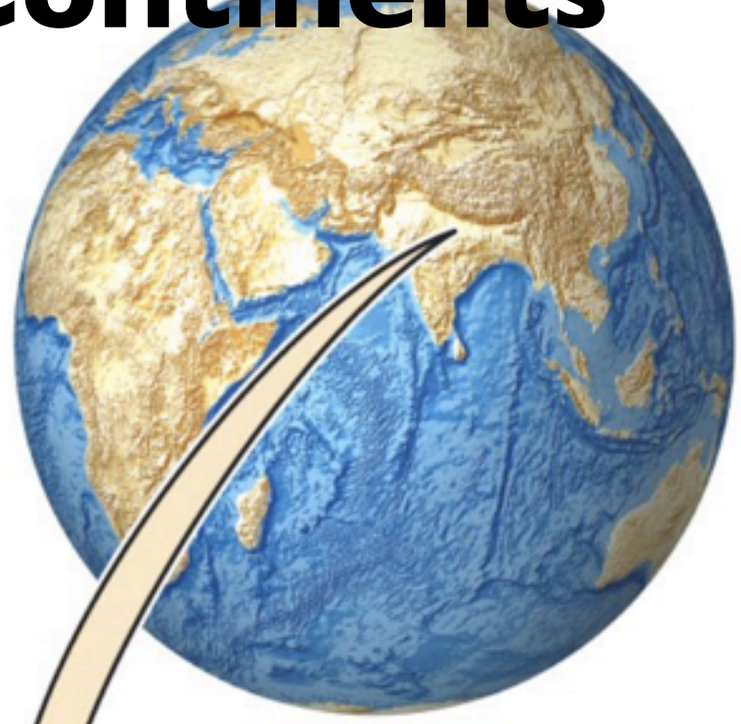
Anatomy and Growth of Continents

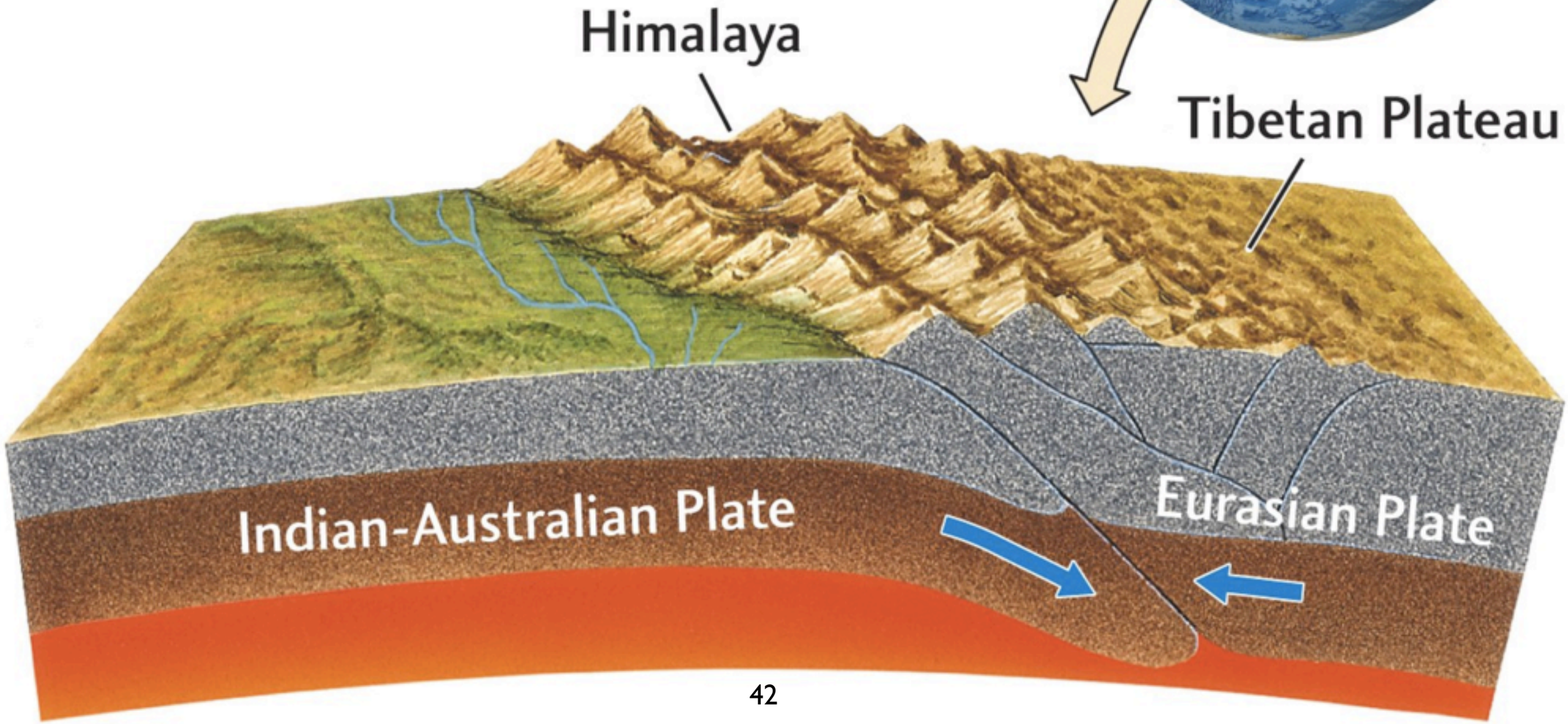
Continent-continent collision



Anatomy and Growth of Continents

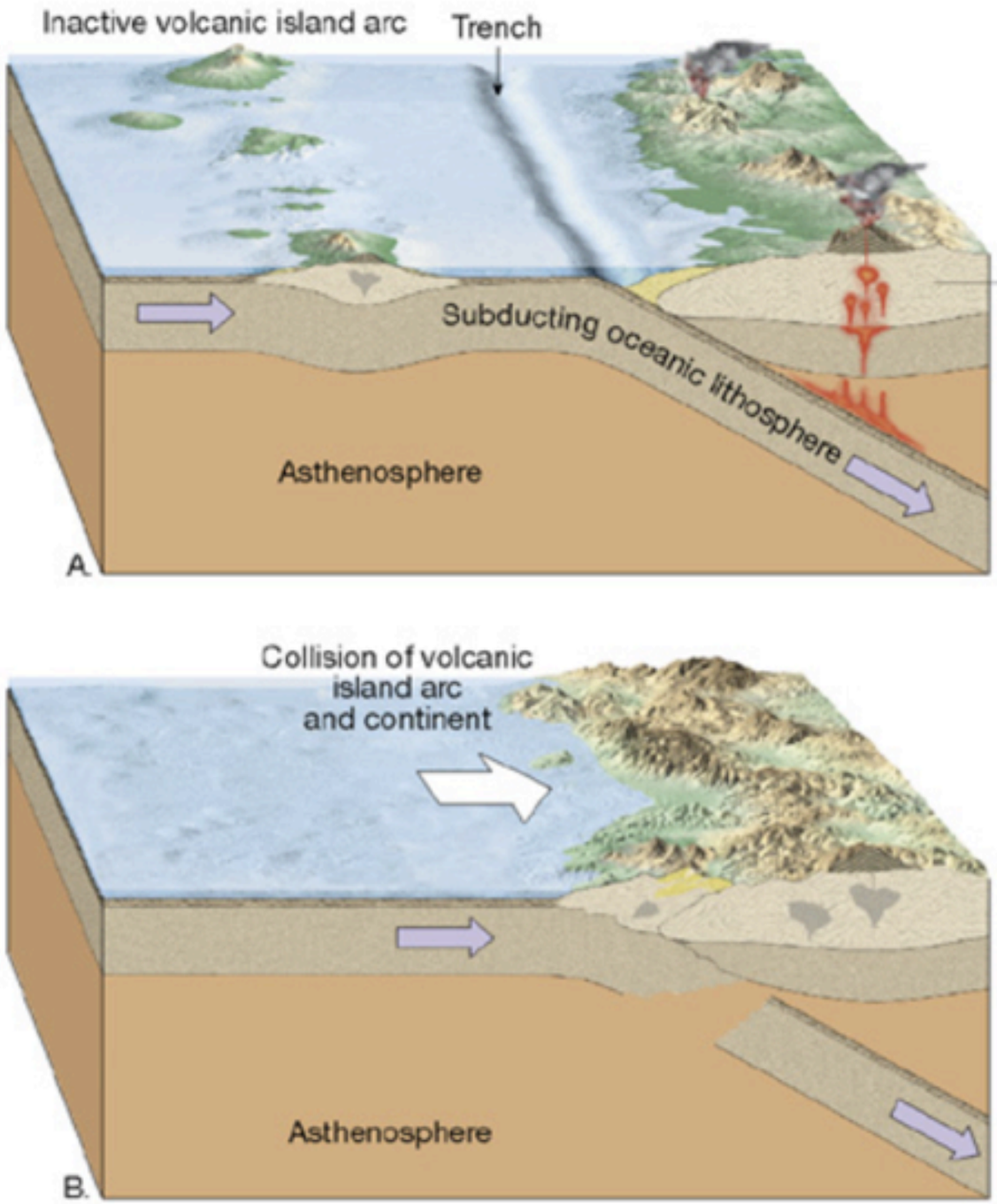
Continent-continent collision
Crustal Thickening

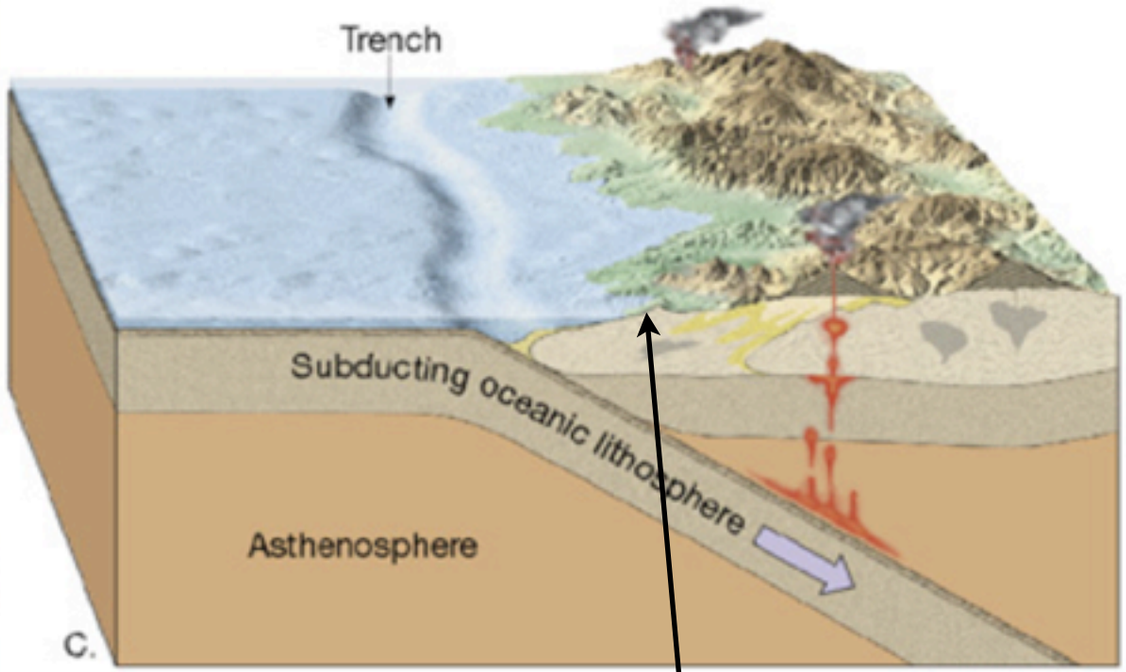




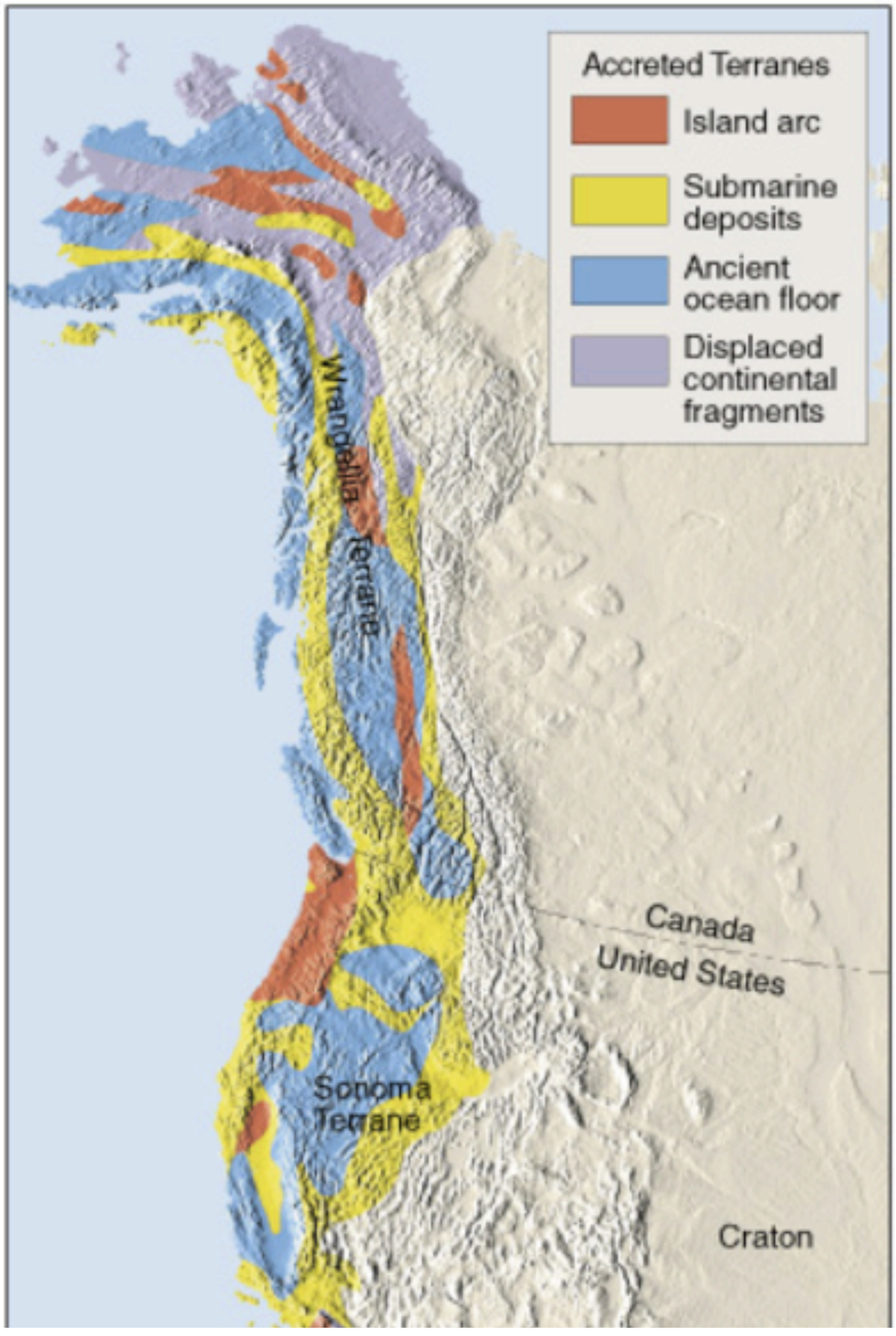
Anatomy and Growth of Continents
Continent-Continent Collision

Accretion of an exotic terrane (ocean island Arc)





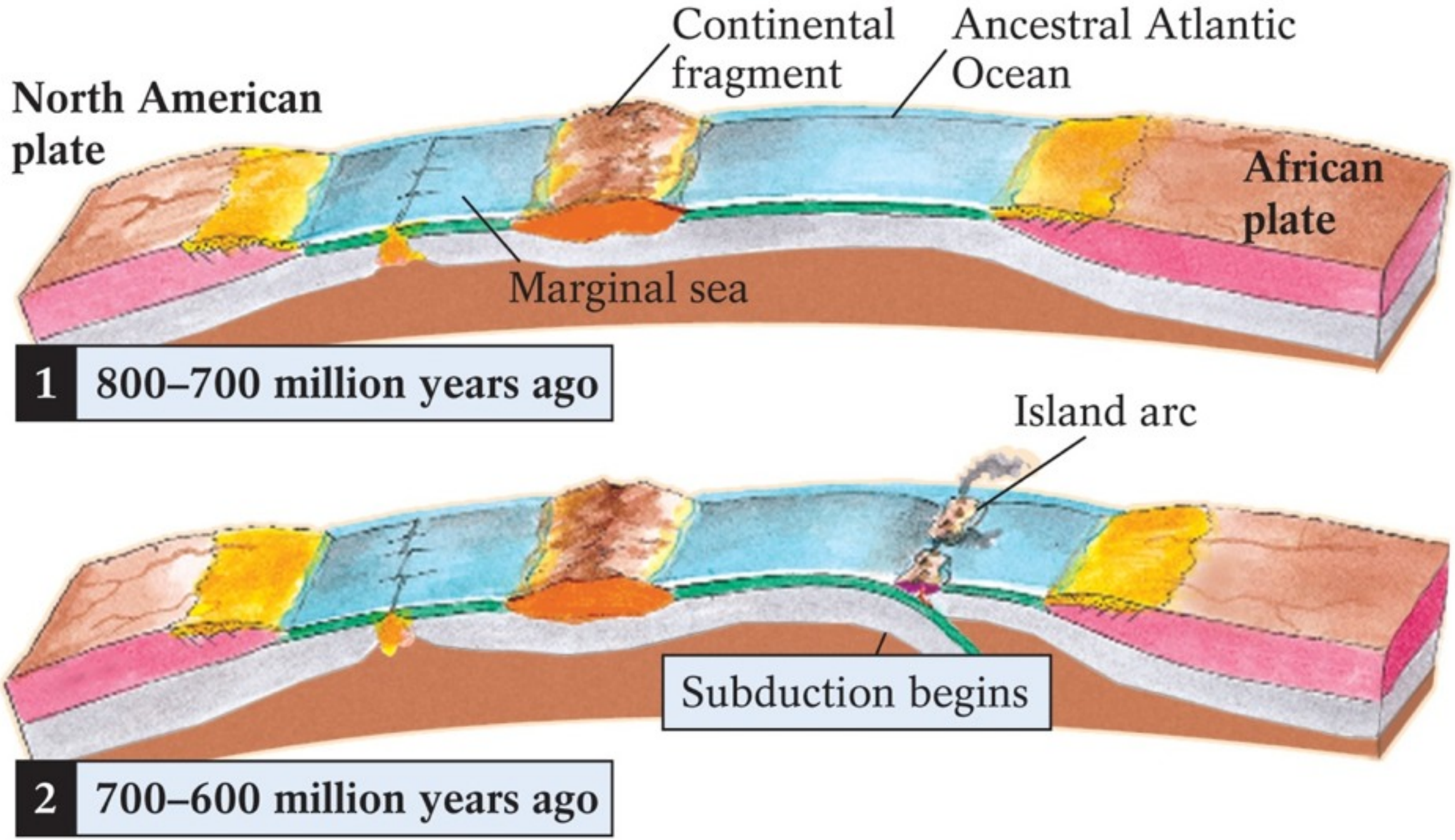
Active Continental Margin



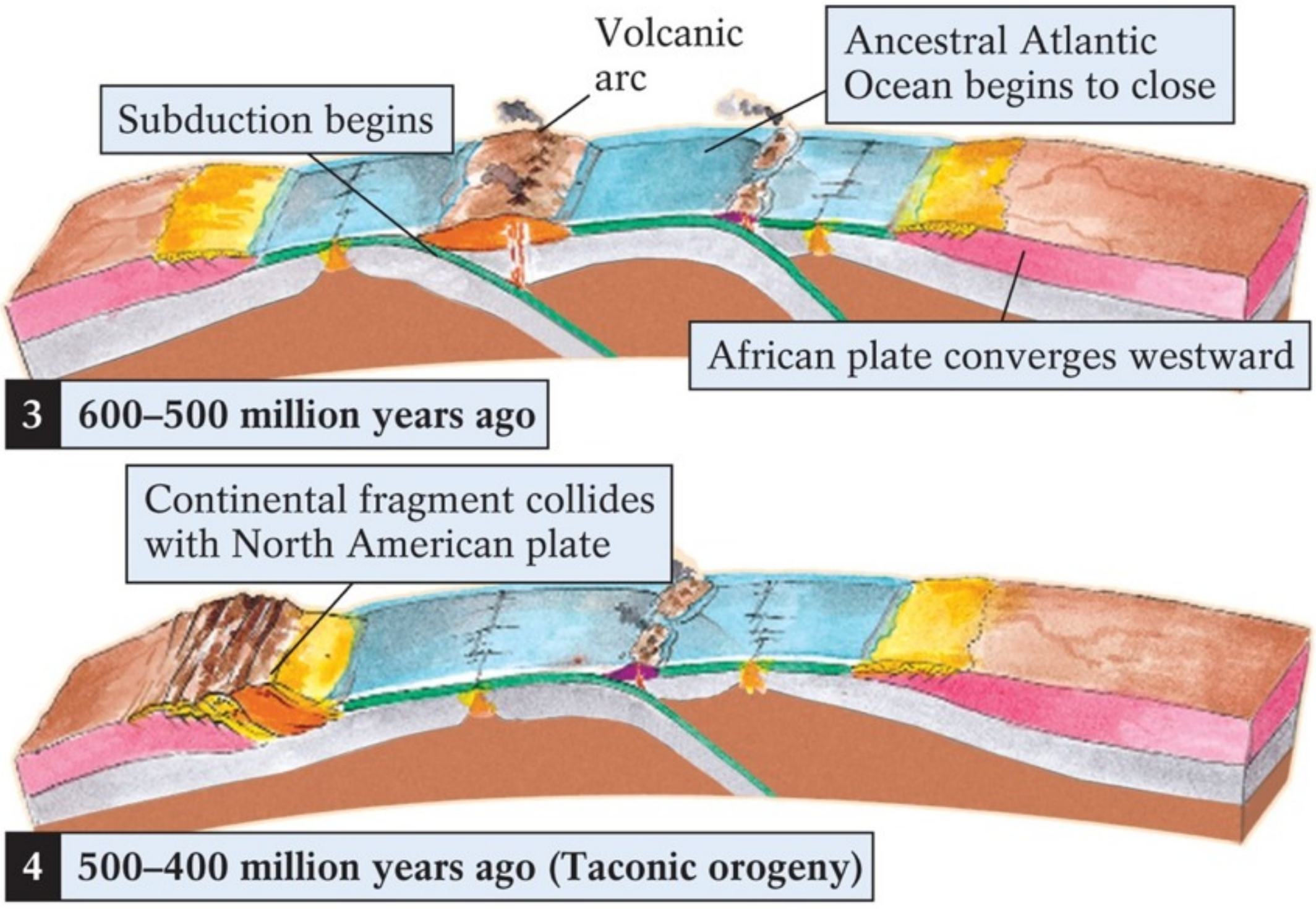
Anatomy and Growth of Continents

Accreted exotic terrains if the western US

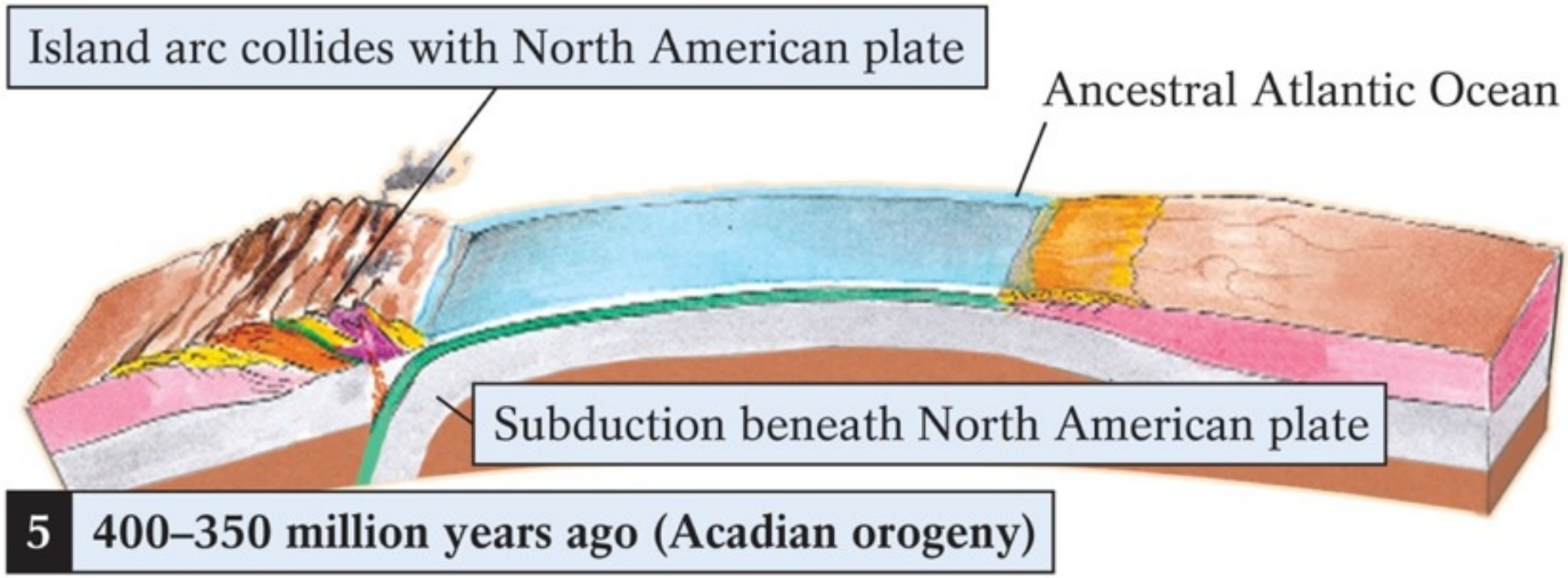
Assembling the Eastern US



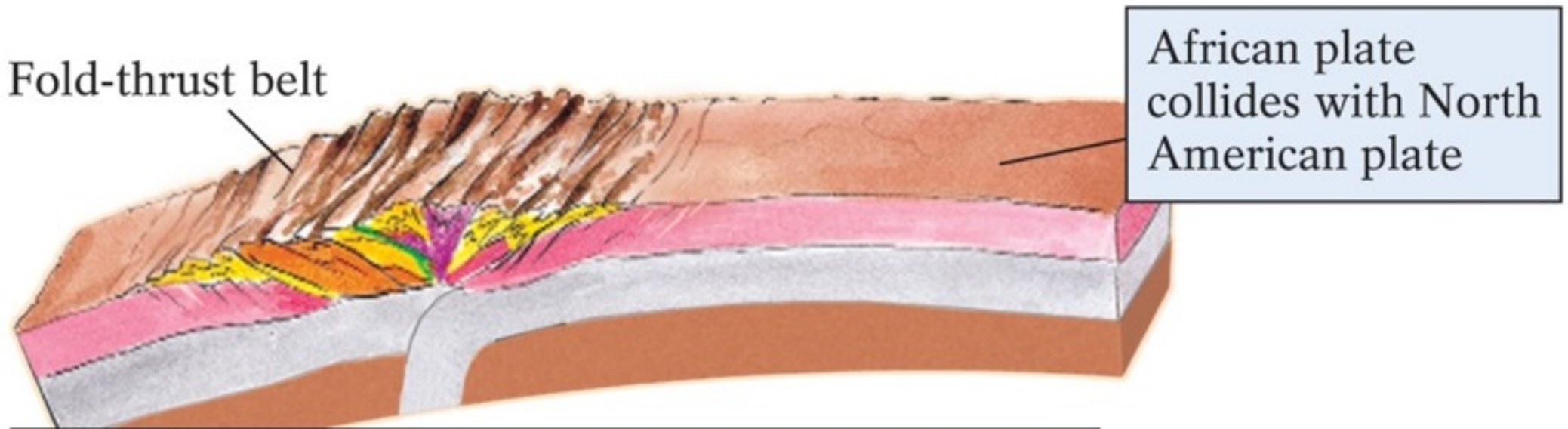
Assembling the Eastern US



Assembling the Eastern US

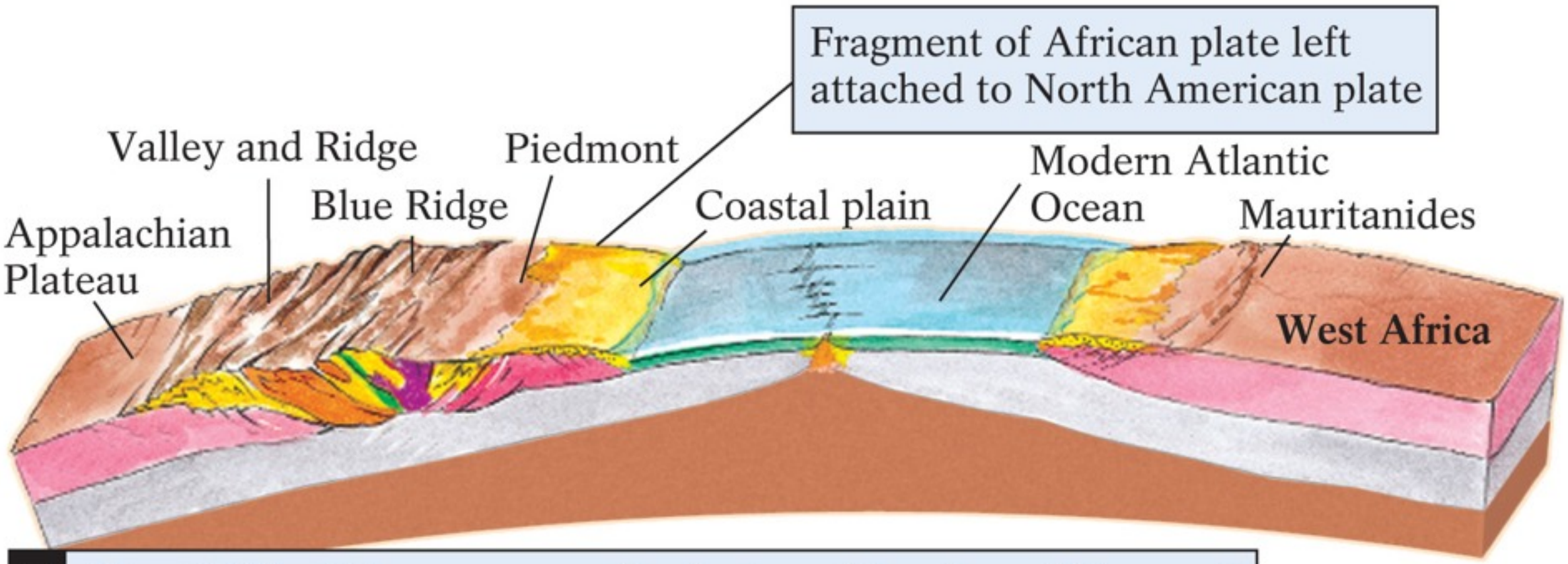


5 400–350 million years ago (Acadian orogeny)



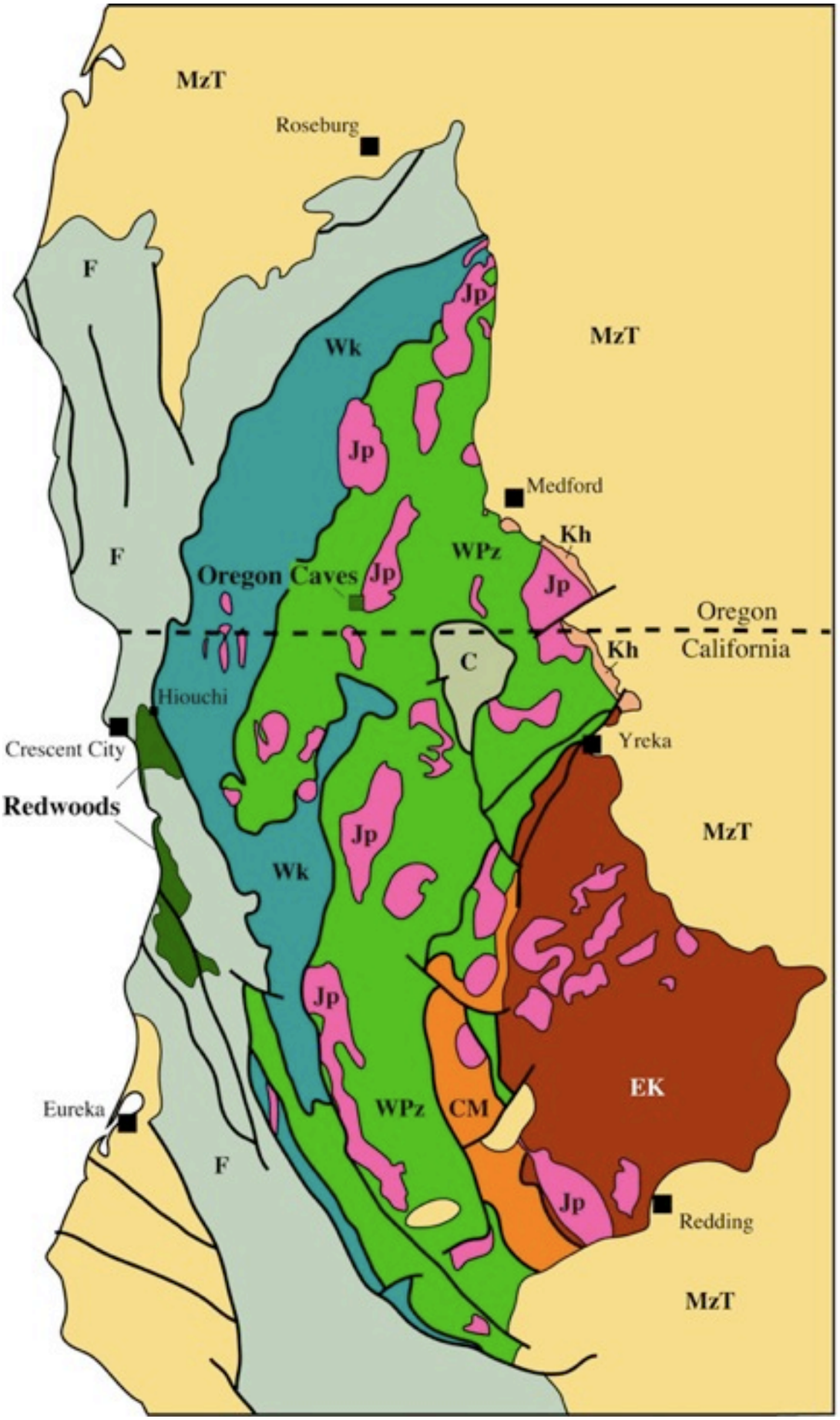
6 350–270 million years ago (Allegheny orogeny)

Assembling the Eastern US



7 About 200 million years ago (beginning of breakup of Pangaea)

Accreted terranes Eastern US



Terrane map of the Klamath Mountains, Oregon and California.

compiled by Marli Bryant Miller, University of Oregon

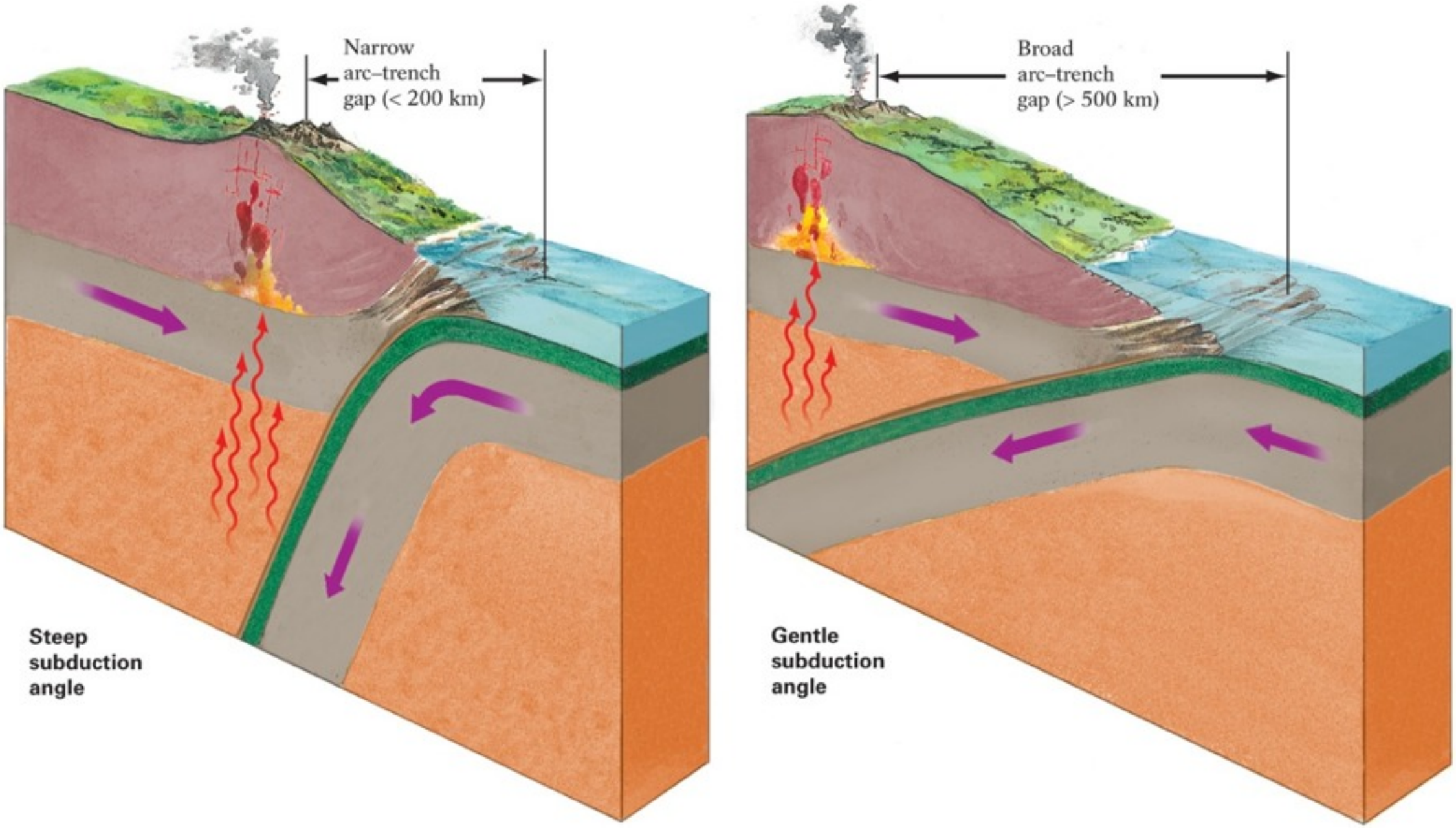
MzT	Mesozoic and Tertiary sedimentary rock, postdates accretion of Klamath terranes.
Kh	Cretaceous Hornbrook Formation.
F	Mesozoic rock of Coast Ranges; mostly Franciscan Fm.
C	Condrey Mountain Schist, Mesozoic.
Wk	Western Klamath Terrane, mostly Jurassic.
WPz	Western Paleozoic and Triassic Terrane.
CM	Central Metamorphic Terrane (Devonian).
EK	Eastern Klamath Terrane (Early Paleozoic to Jurassic).
Jp	Jurassic Plutons.

N

0 km 50

Accreted terranes northwestern US

What is driving subduction?



What process drives Plate Tectonics?

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In your Group: Write a short sentence that describes convection. Think about the lava lamp and don't forget to include words like: density (less and more), buoyant (less and more), rising, falling, etc.

What process drives Plate Tectonics?

In your Group: Write a short sentence that describes convection. Think about the lava lamp and don't forget to include words like: density (less and more), buoyant (less and more), rising, falling, etc.

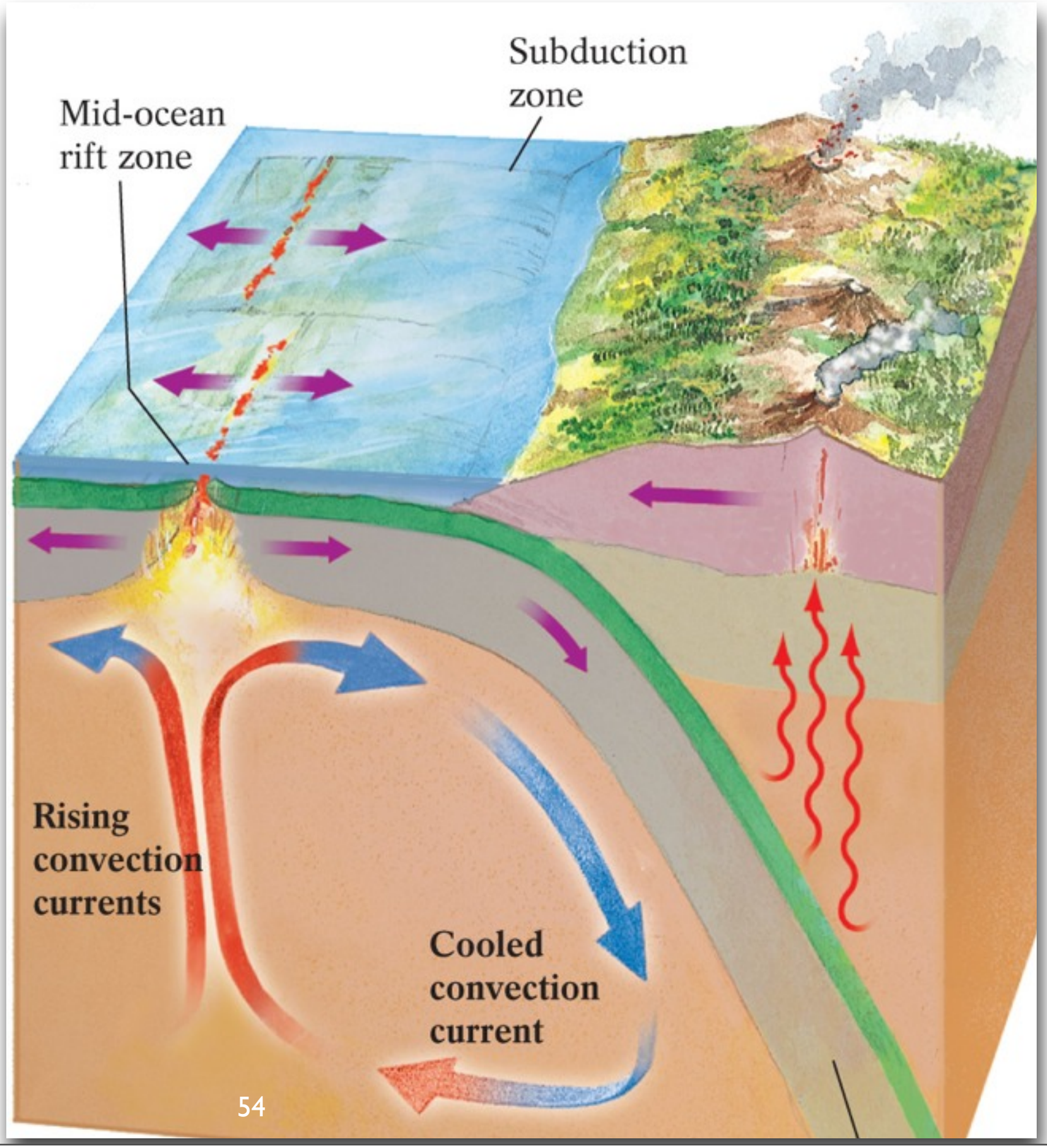
Write one to two short sentence that relates convection to plate tectonics.

What process drives Plate Tectonics?

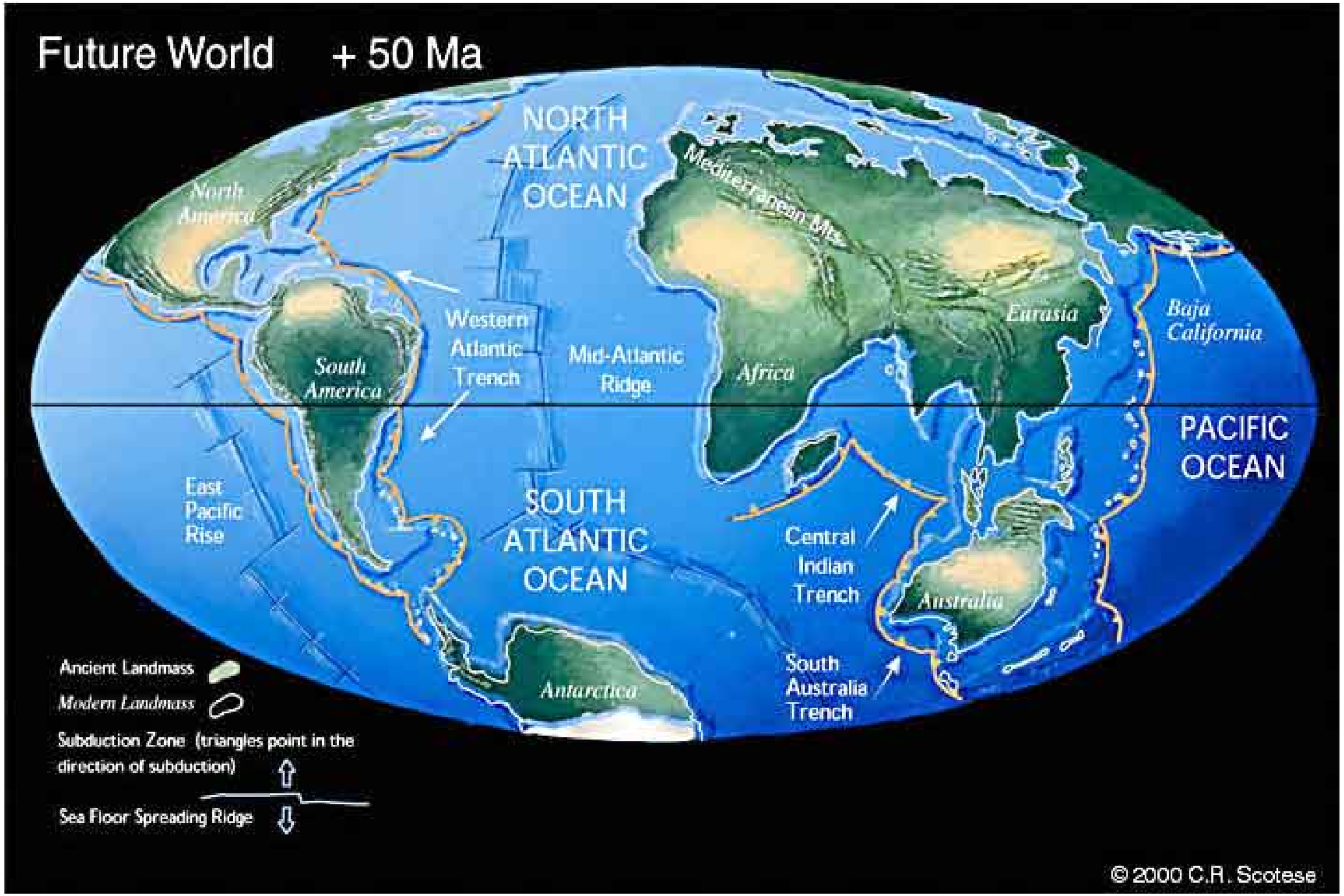
What process drives Plate Tectonics?

A convection cell is a cyclical process driven by density differences due to temperature variation; where hot, less dense material rises, then cools, densifies, and sinks. Similarly, plate tectonics is driven by hot buoyant rocks that rise at the divergent plate boundaries, which cool at shallow depths in the Earths, densify, and sink at subduction zones due to an increase in density.

Convection


Subduction zone
Mid-ocean rift zone
Rising convection currents
Cooled convection current

Future Tectonics



Next Quiz

1) Vocabulary Chapters 9
2) Review of Chapter 13