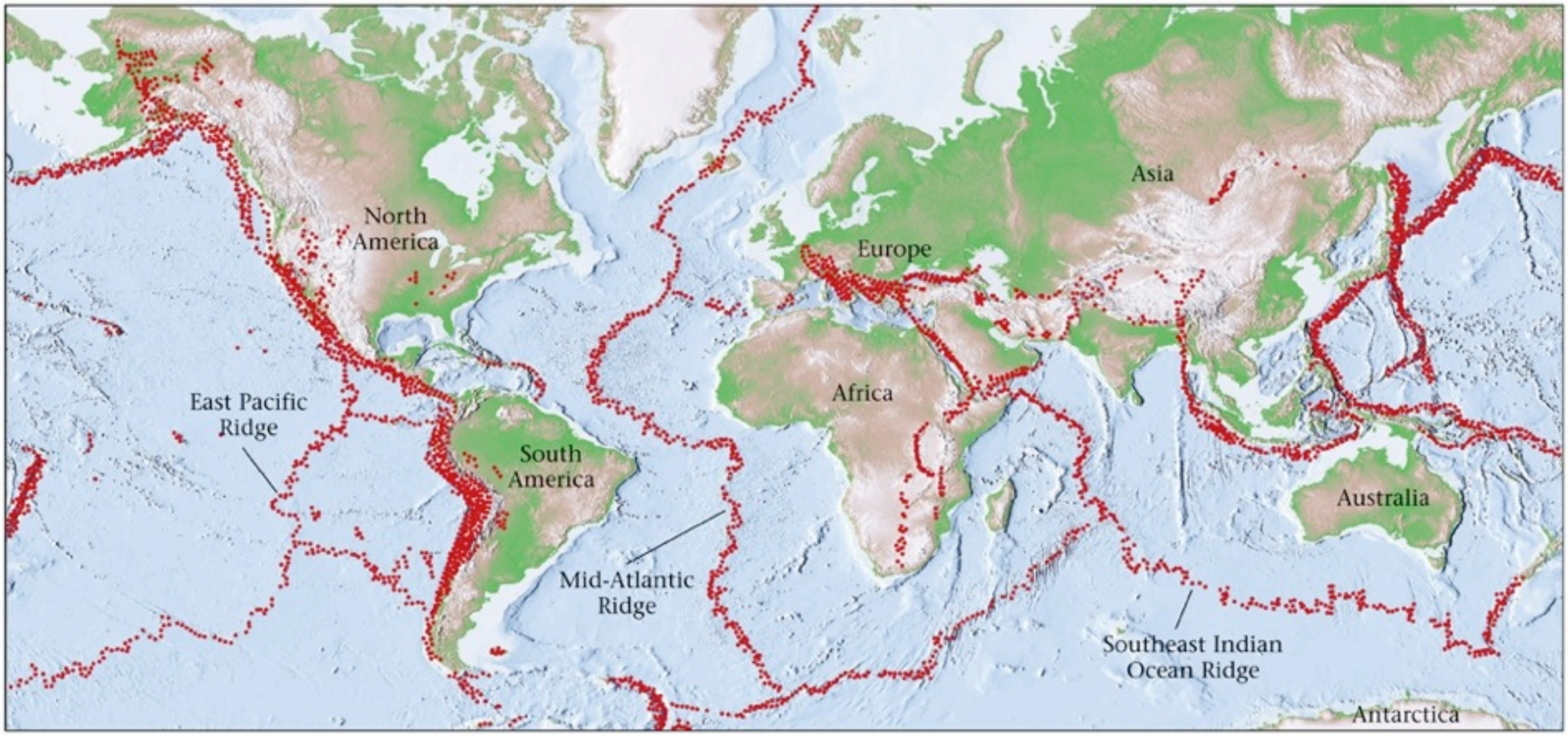
Today's Quiz

1) Vocabulary Chapters 13
2) Review of Chapter 1b and 12

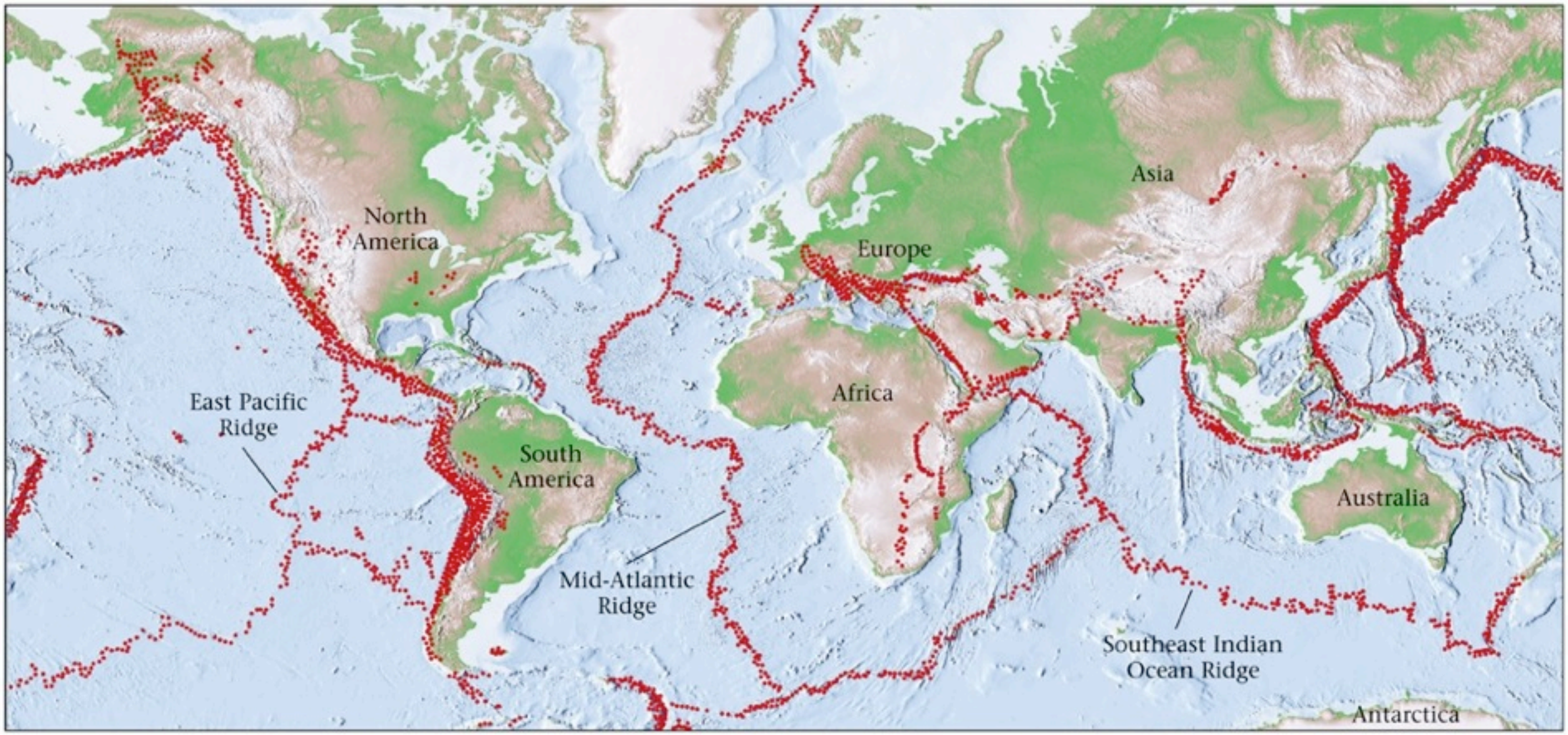

The Hobo-Dyer Equal Area Projection
This new map belongs to the family of Cylindrical Equal Area projections in which the latitude and longitude lines form a rectangular grid. Other projections in this family include the Lambert, Gall, Behrmann, Edwards, and Peters projections. In the present case the "cylinder" is assumed to wrap round the globe and cut through it at 37½ north and south. In order to preserve the equal area property the shapes of the landmasses become progressively flattened towards the poles, but shapes between 45 north and south are well preserved.
SOUTHERN OCEAN
A N T A R C T I C A
SOUTHERN OCEAN
PACIFIC OCEAN
INDIAN OCEAN
ATLANTIC OCEAN
ATLANTIC OCEAN
PACIFIC OCEAN
ARCTIC OCEAN
AUSTRALIA
NEW ZEALAND
INDONESIA
BRAZIL
U.S.A.
C A N A D A
C H I N A
INDIA
RUSSIA
MONGOLIA
KAZAKSTAN
SUDAN
LIBYA
ALGERIA
NIGER
MALI
CHAD
ETHIOPIA
SAUDI ARABIA
EGYPT
IRAN
TURKEY
BOLIVIA
COLOMBIA
KIRIBATI

Hobo-Dyer Map Projection

Worldwide Seismicity Map



Worldwide Seismicity Map



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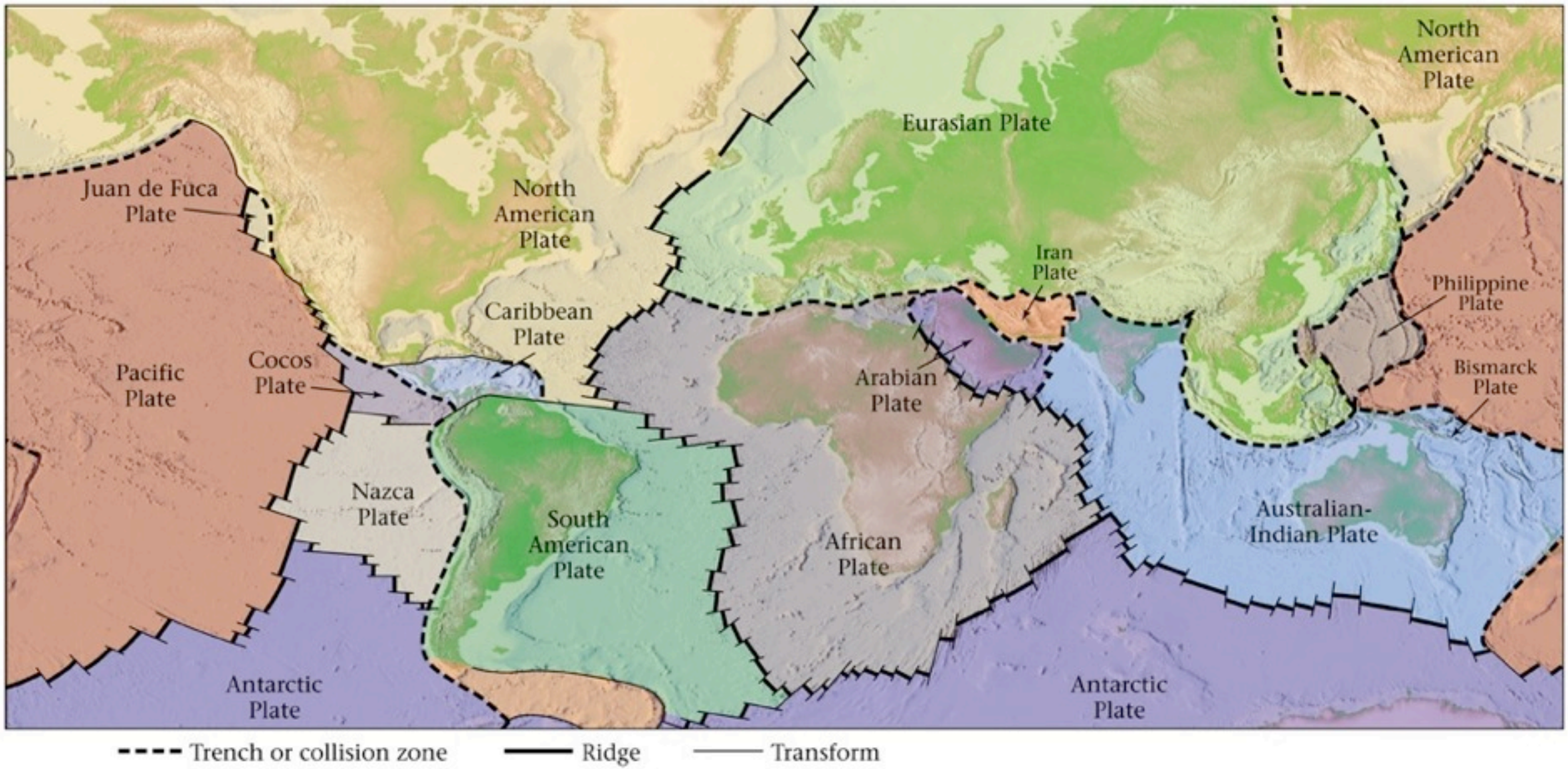
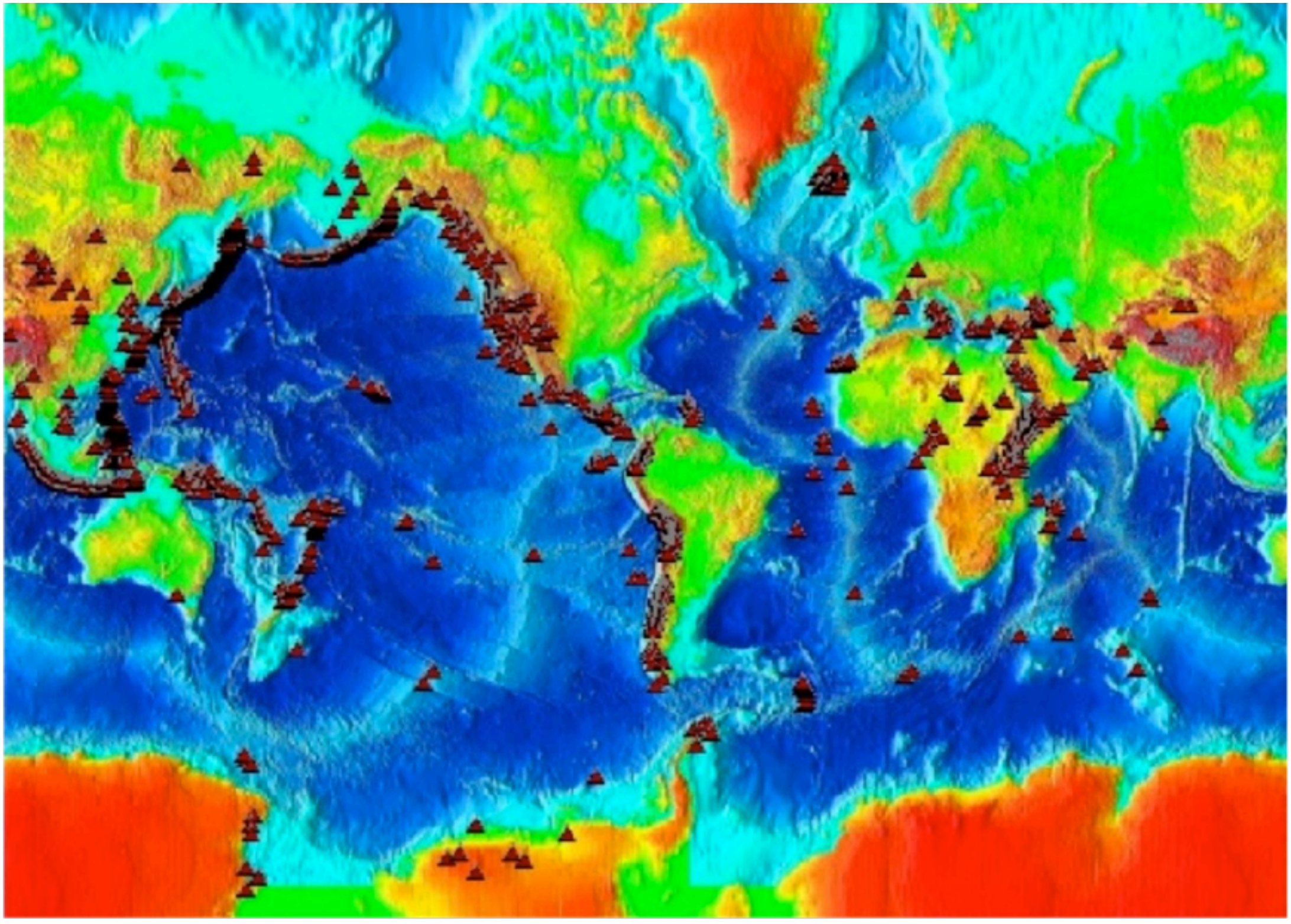


Worldwide Volcano Map



Major Tectonic Plates of the World

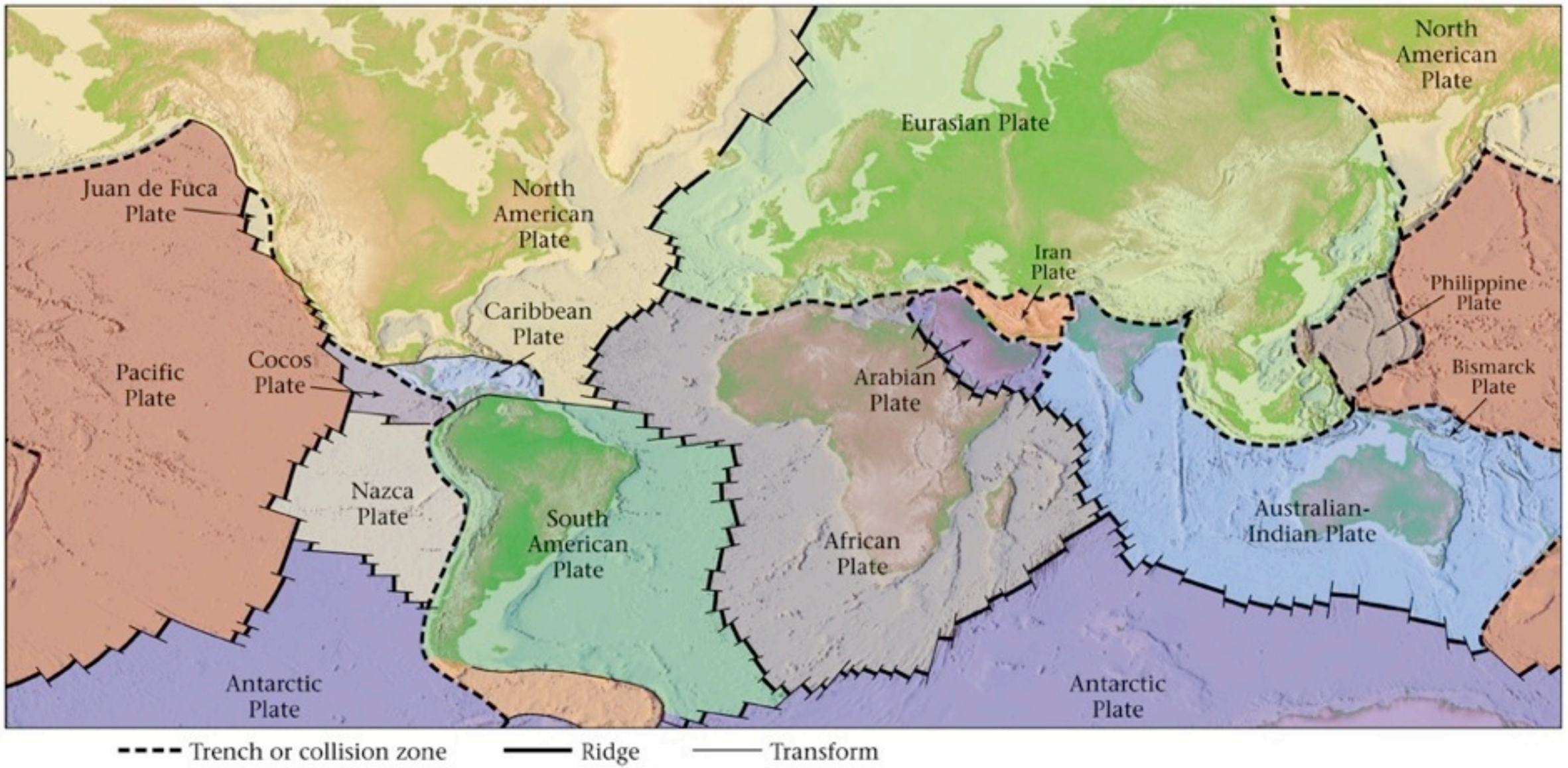


Plate-Tectonic Basics

1. Earth's lithosphere, which consists of the crust and the rigid uppermost mantle, is broken into a dozen or so major plates. Most plates are composed of both continental and oceanic lithosphere

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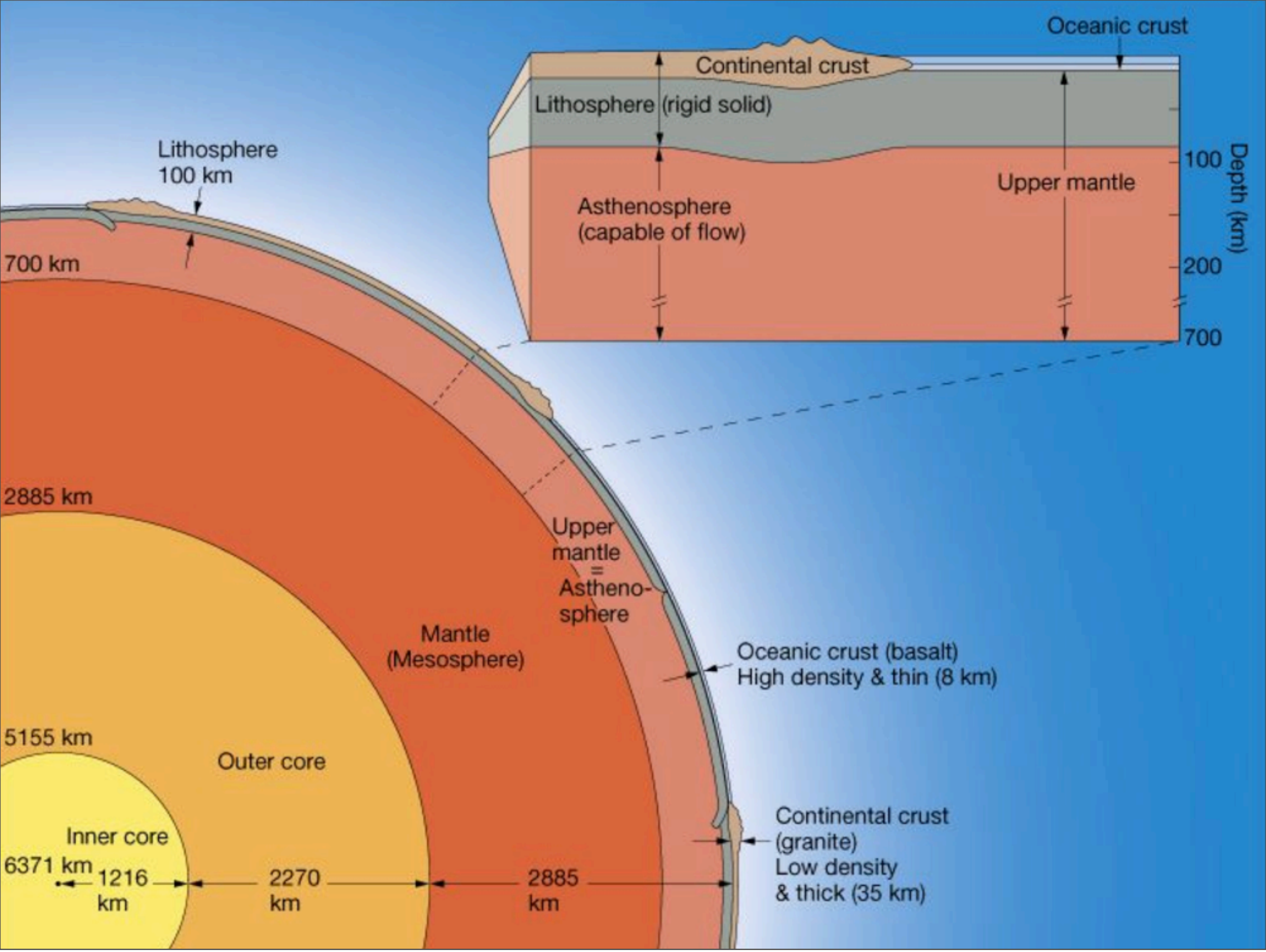
2. Oceanic lithosphere is *thinner* and more *dense* than continental lithospheric plates.


Oceanic crust
Continental crust
Lithosphere (rigid solid)
Lithosphere
100 km
Upper mantle
Asthenosphere
(capable of flow)
100
200
700
Depth (km)
700 km
2885 km
Upper
mantle
=
Astheno-
sphere
Mantle
(Mesosphere)
Oceanic crust (basalt)
High density & thin (8 km)
5155 km
Outer core
Continental crust
(granite)
Low density
& thick (35 km)
Inner core
6371 km
1216
km
2270
km
2885
km

More Plate-tectonic Basics

4. Convergent plate boundaries can involve subduction or collision.

More Plate-tectonic Basics

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5. Most earthquakes, volcanic activity, and mountain building take place at plate boundaries.

More Plate-tectonic Basics

3. The plates are in constant motion relative to one another by divergence, convergence, or transform motion (relative motion).

4. Convergent plate boundaries can involve subduction or collision.

5. Most earthquakes, volcanic activity, and mountain building take place at plate boundaries.

UNIVERSITY of HOUSTON

Berkeley

Typical oceanic crust thickness

Minimum continental crust thickness

San Francisco

San Francisco

Daly City

Pacifica

Moss Beach

Half Moon Bay

San Mateo

Redwood City

San Francisco Bay

Hayward

San L

Clear

80

980

880

24

13

580

238

380

280

101

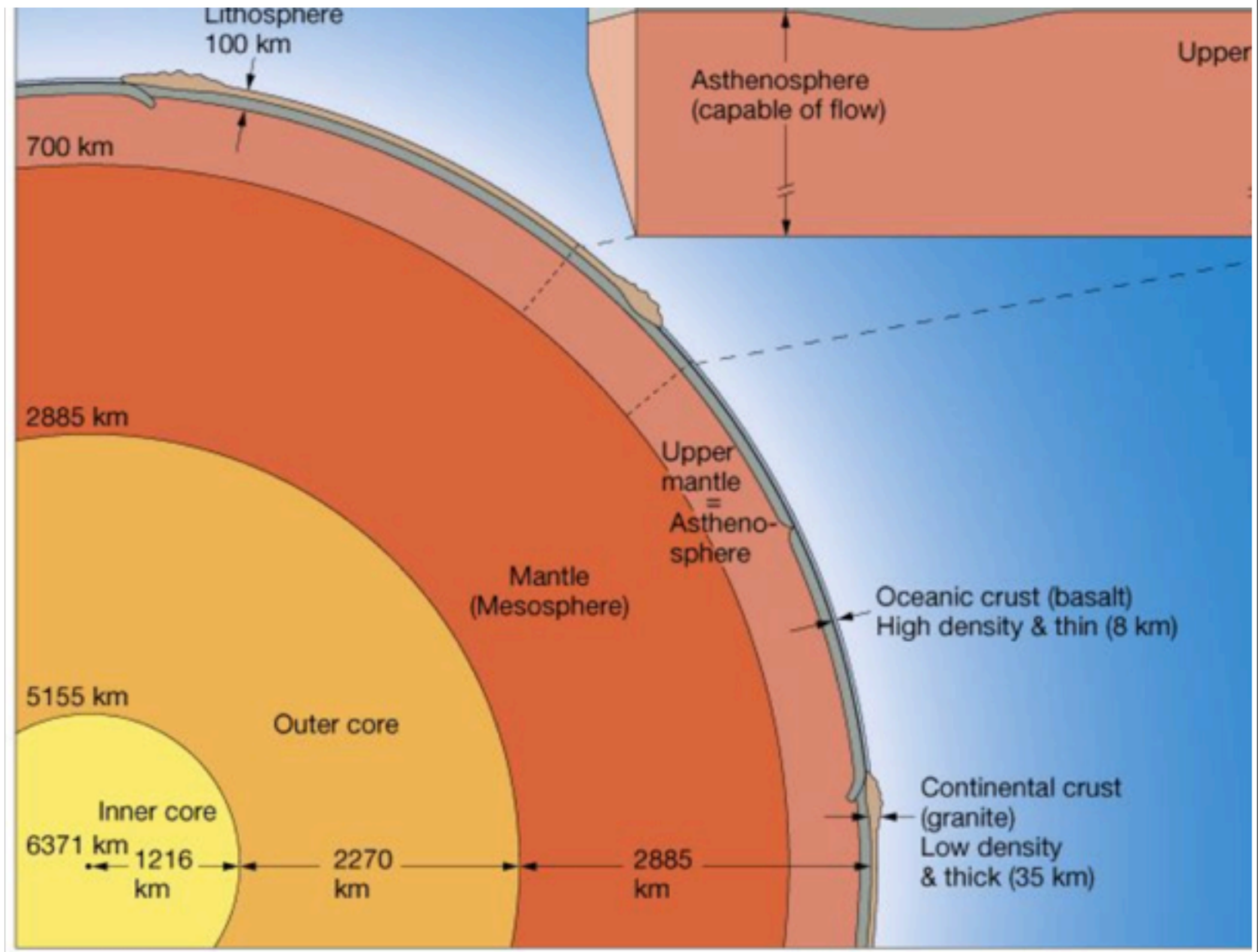
92

84

Thursday, August 29, 13

In which of Earth's Rheologic layers is the MOHO found?

A) Crust
B) Lithosphere
C) Mantle
D) Asthenosphere



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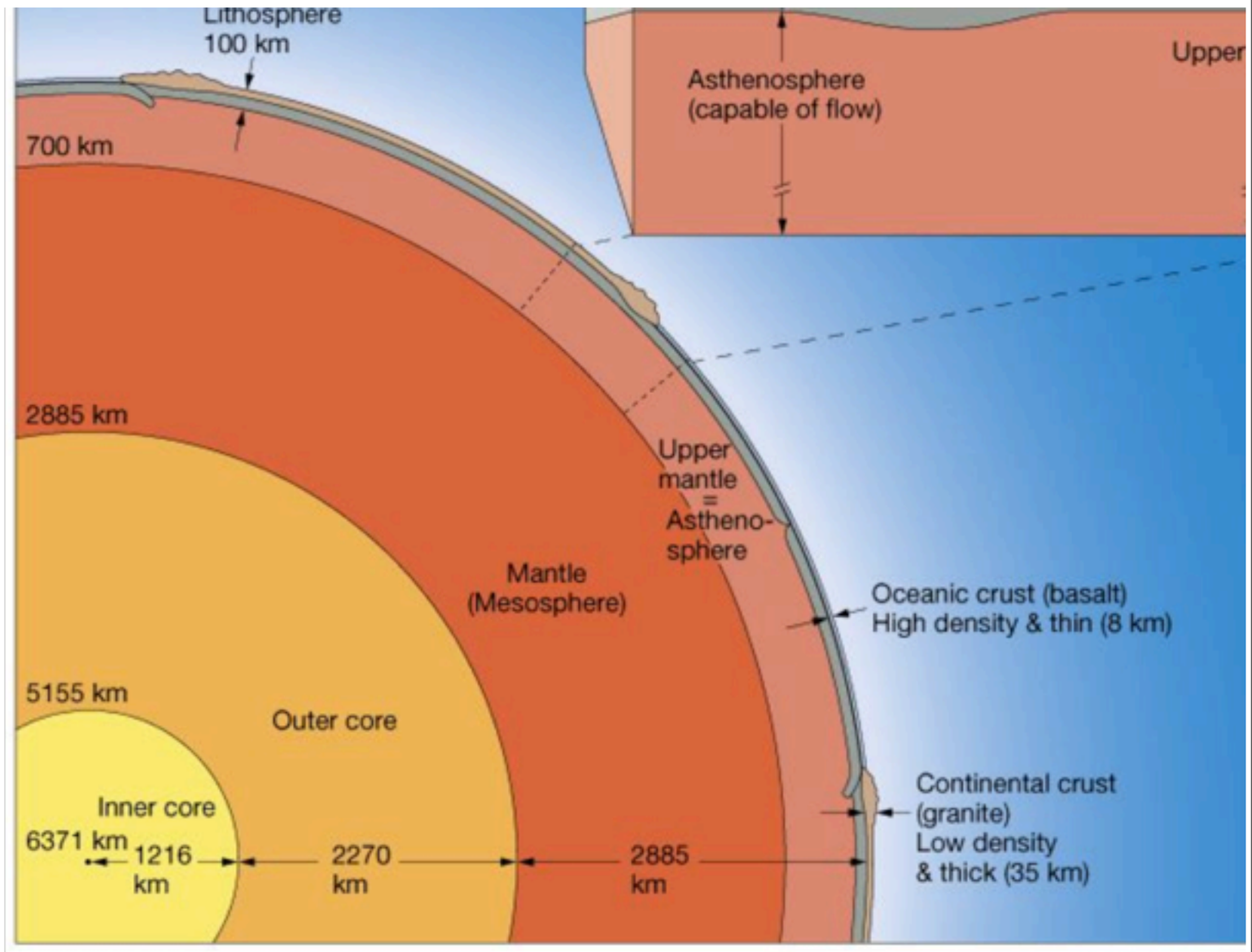
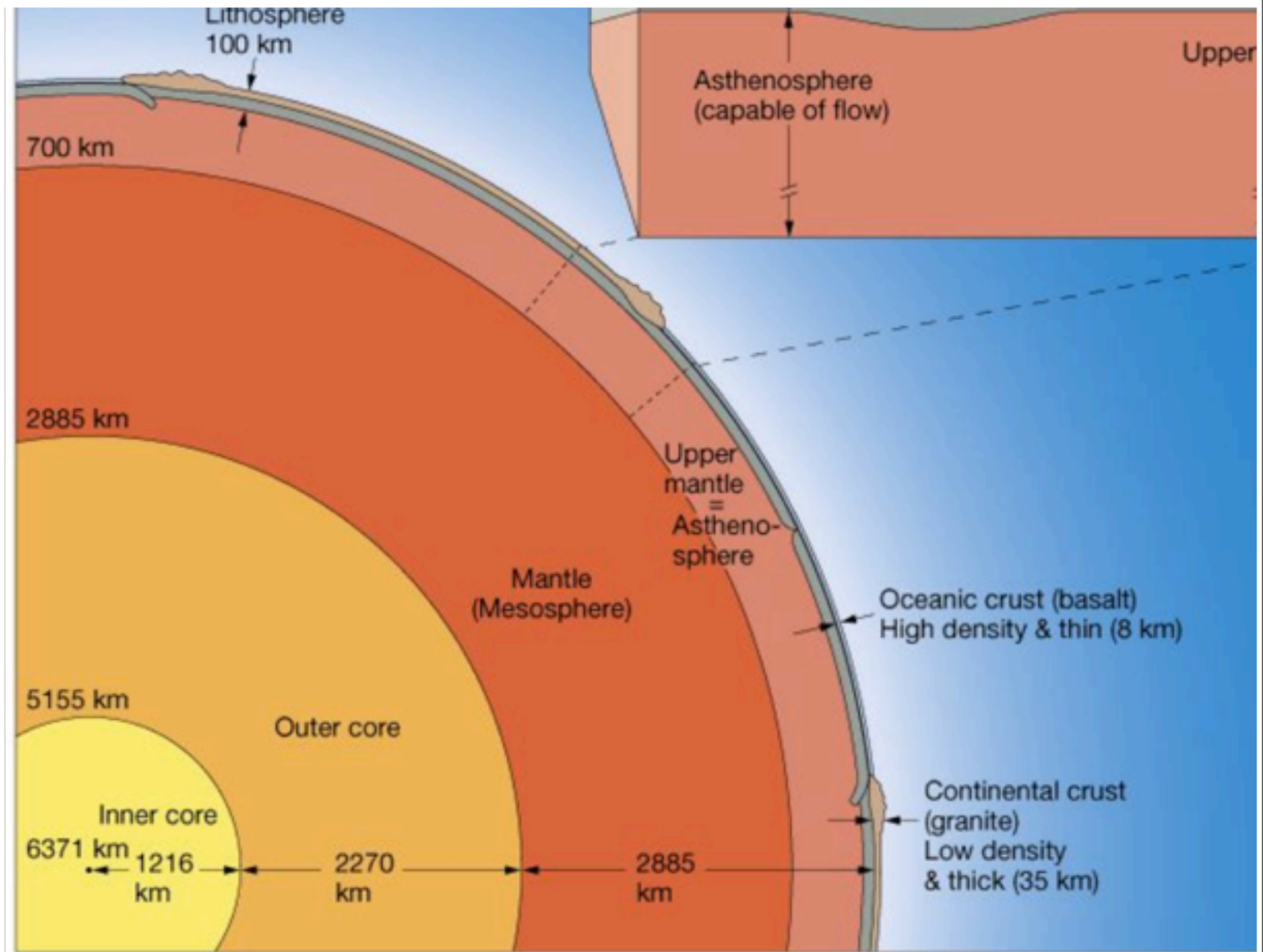


In which of Earth's rheologic layers is responsible for driving plate tectonics?

A) Crust
B) Lithosphere
C) Mantle
D) Asthenosphere
E) Outer Core



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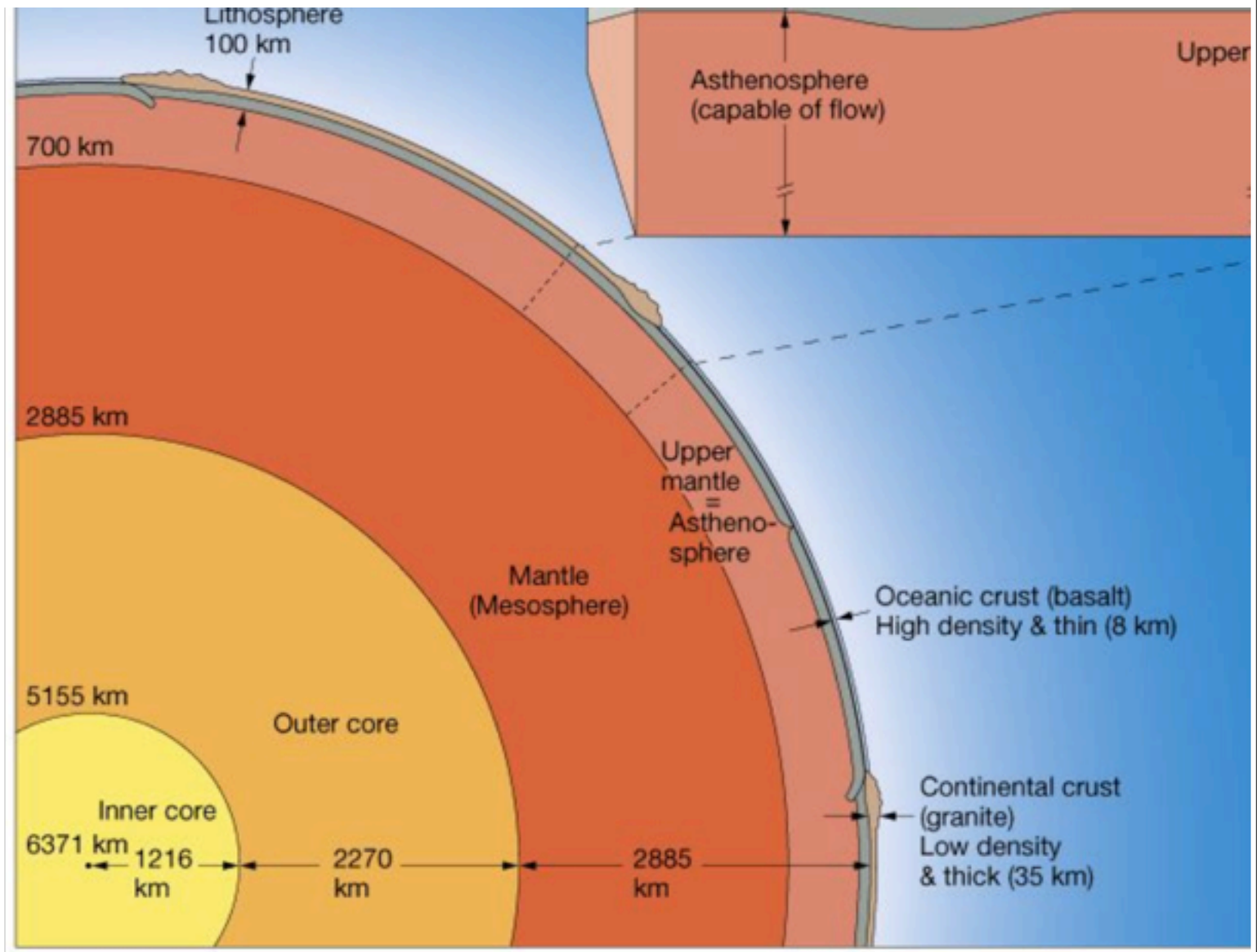
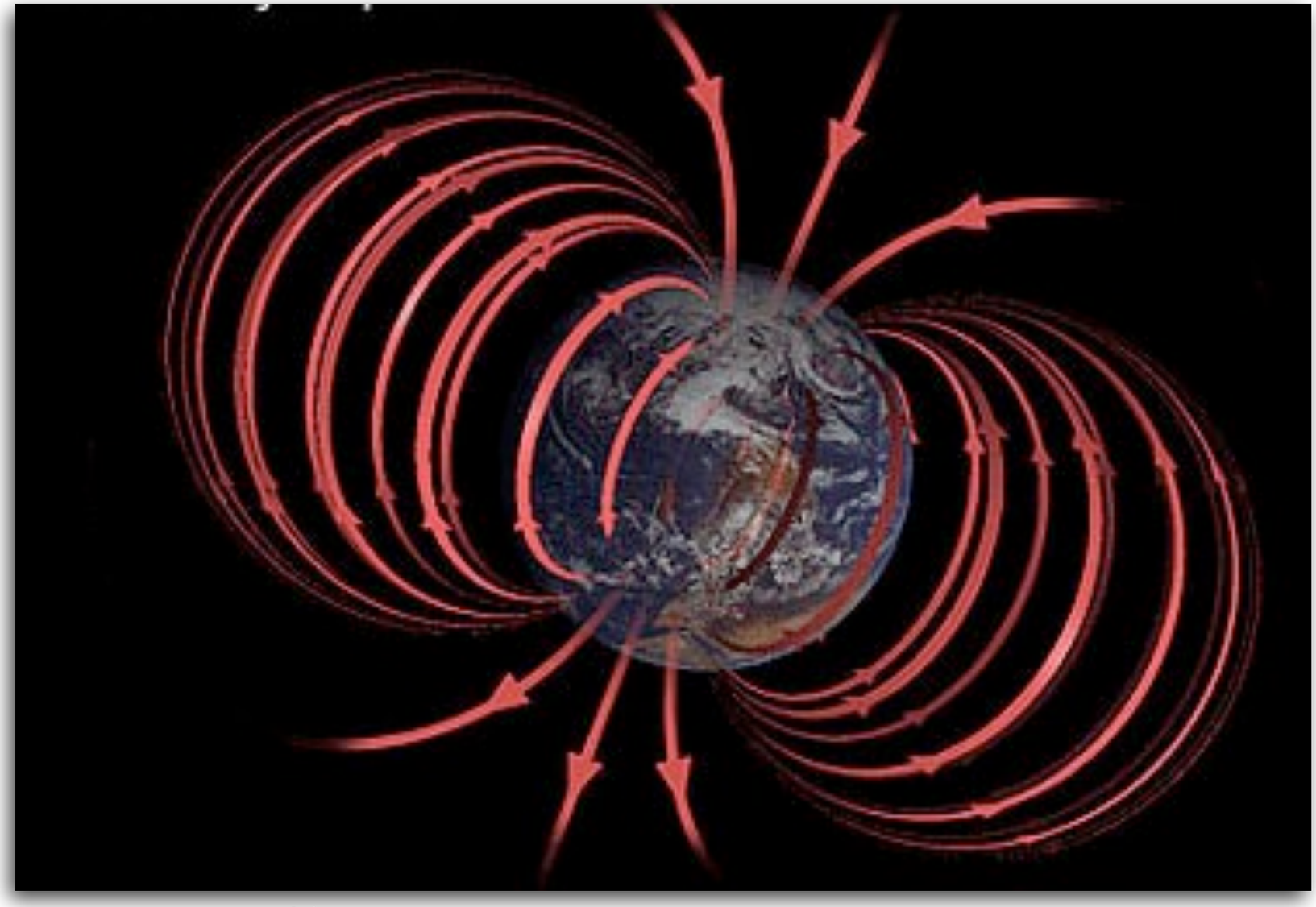


The Earth's Magnetic Field is an important Driving force involved in Plate Tectonics?

A)True
B) False



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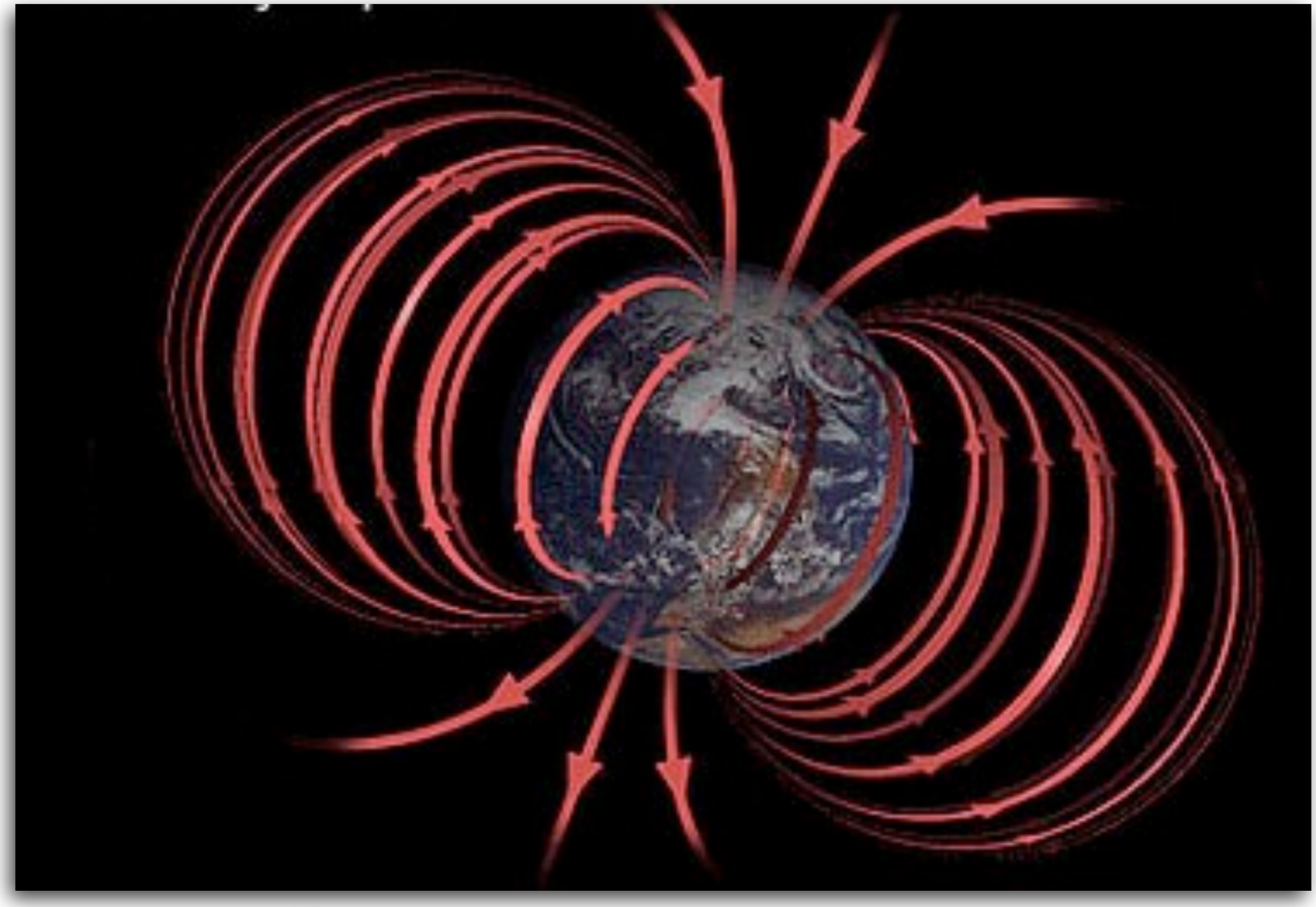
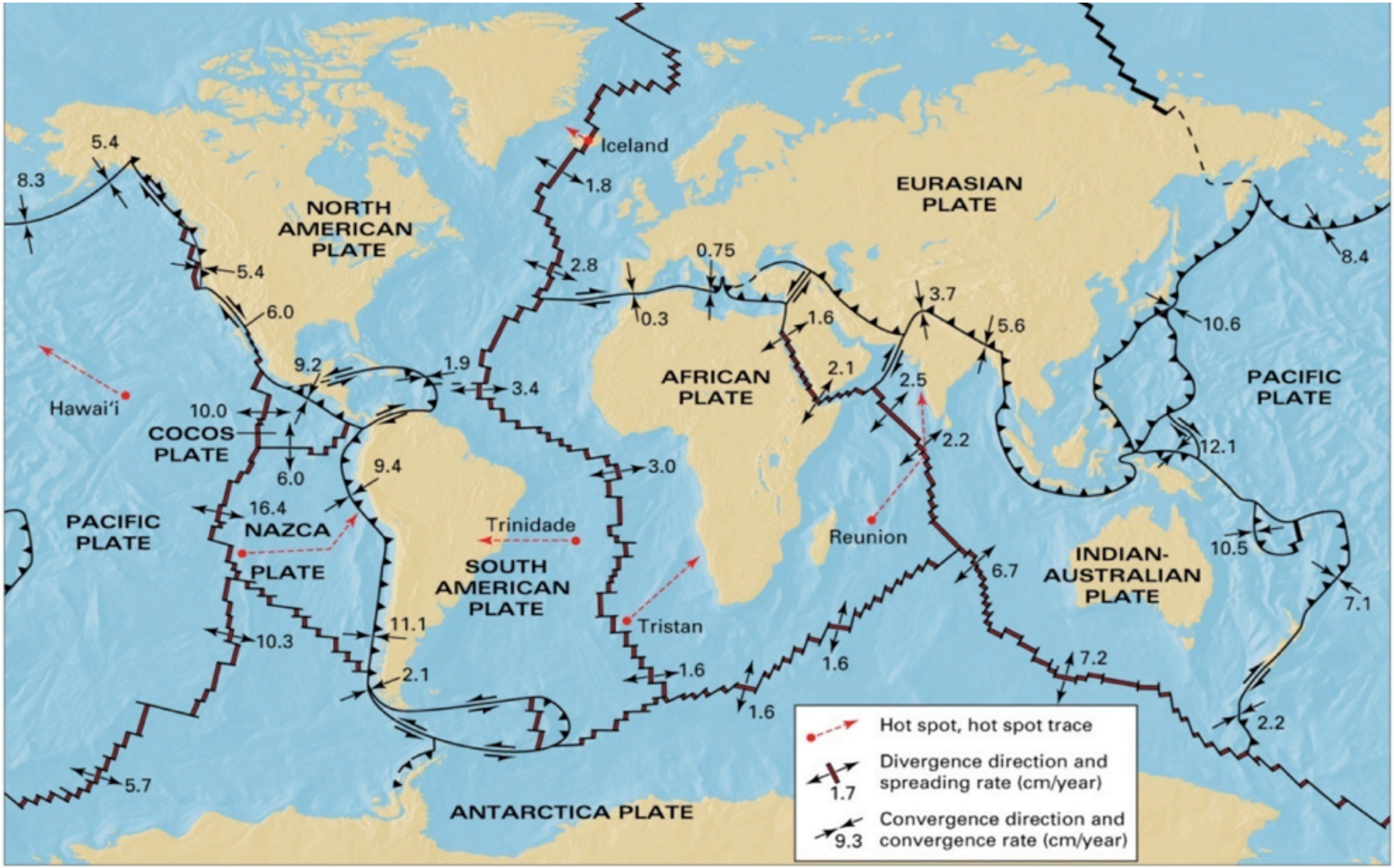
A)True

B) False



Relative Plate Motions

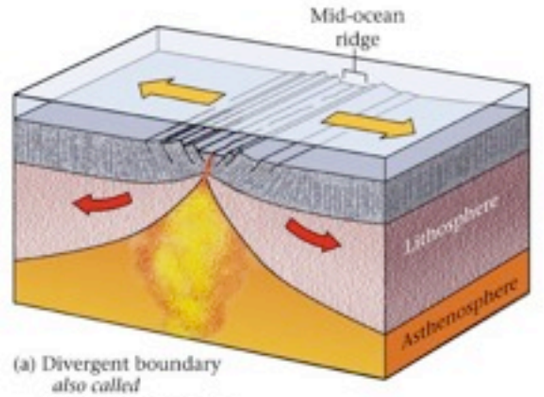


Types of Plate Boundaries

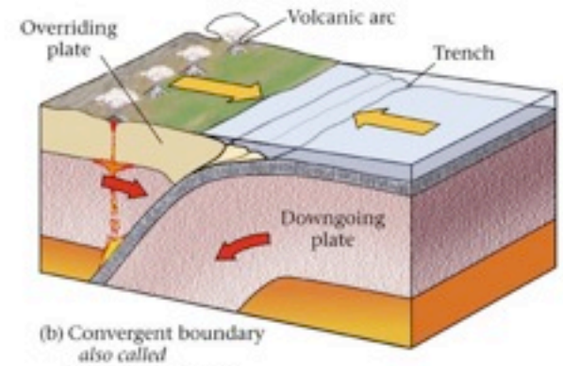
Divergent
- Mid-ocean ridges
- Continental rifts

Convergent
- Subduction zones
  --ocean-ocean
  --ocean-continent
  -Collisional (continent-continent)

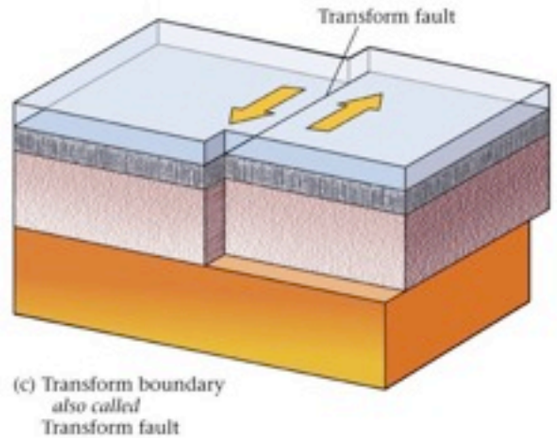
Transform
- Continental
- Oceanic



(a) Divergent boundary
also called
Spreading boundary
Mid-ocean ridge
Ridge



(b) Convergent boundary
also called
Convergent margin
Subduction zone
Consuming boundary
Trench



(c) Transform boundary
also called
Transform fault

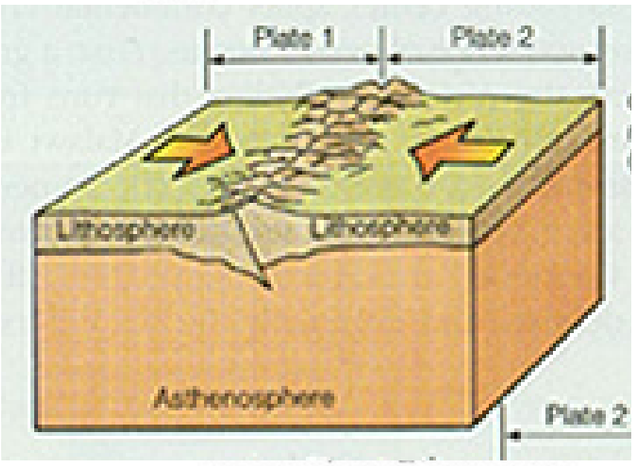
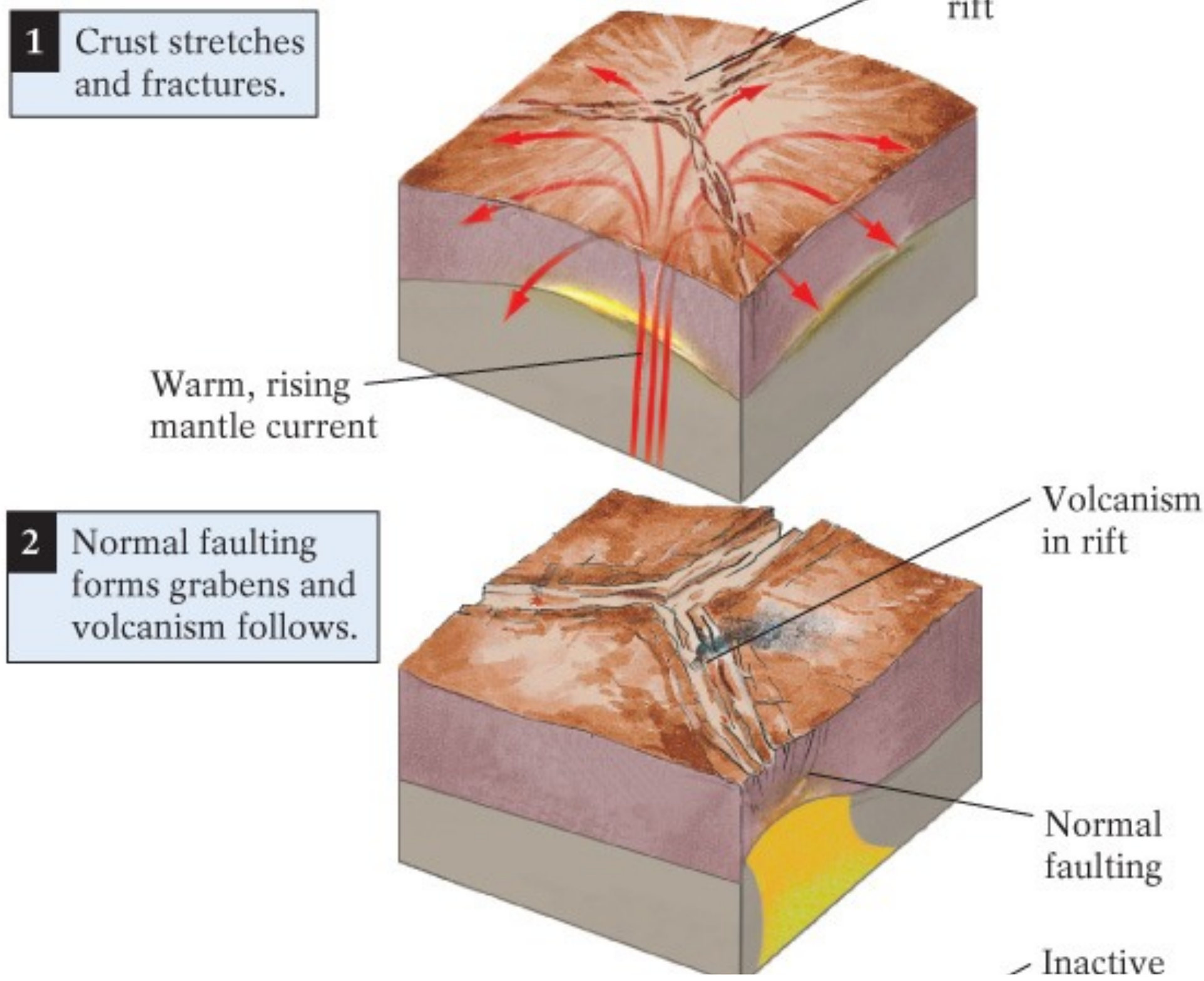


FIGURE 2.32

Anatomy of Divergent Boundaries

On land or beneath the ocean
(Divergent = Extension)

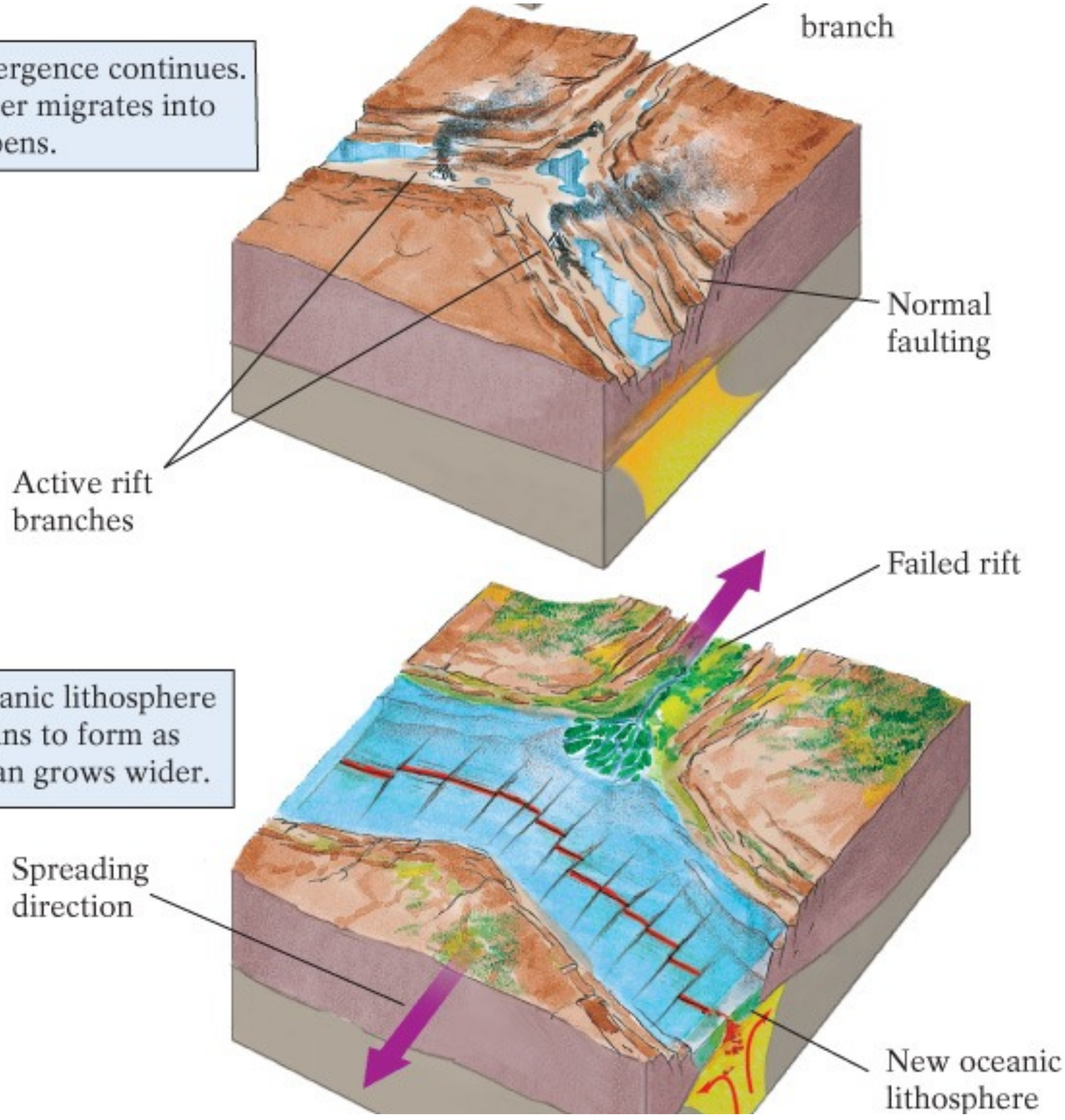
Continental Rift
Birth of a plate Boundary



Divergent Cake Tectonics

Divergent Cake Tectonics

Continental Rift to Mid-ocean Ridge



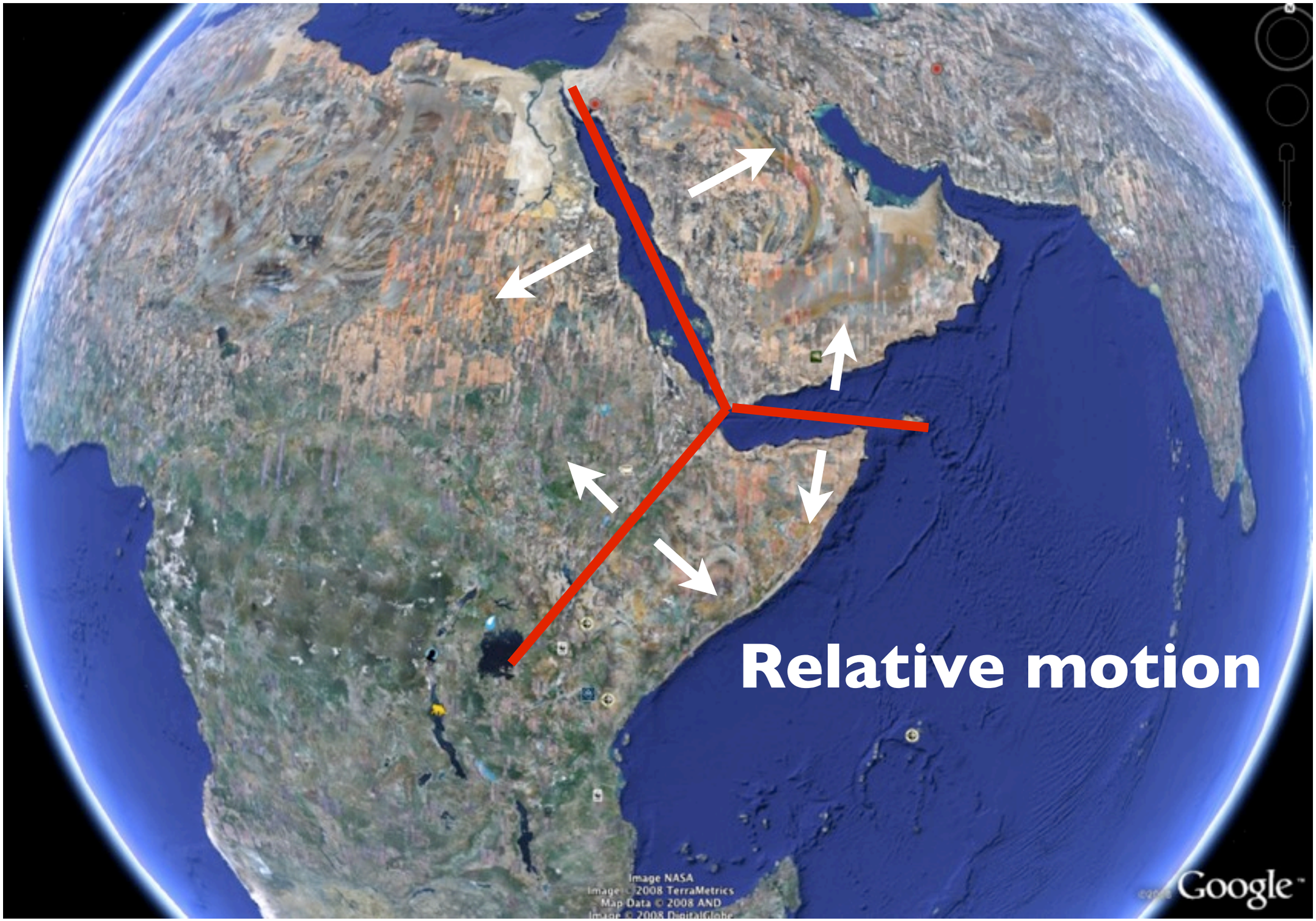
Three Rifting Arms

Three Rifting Arms

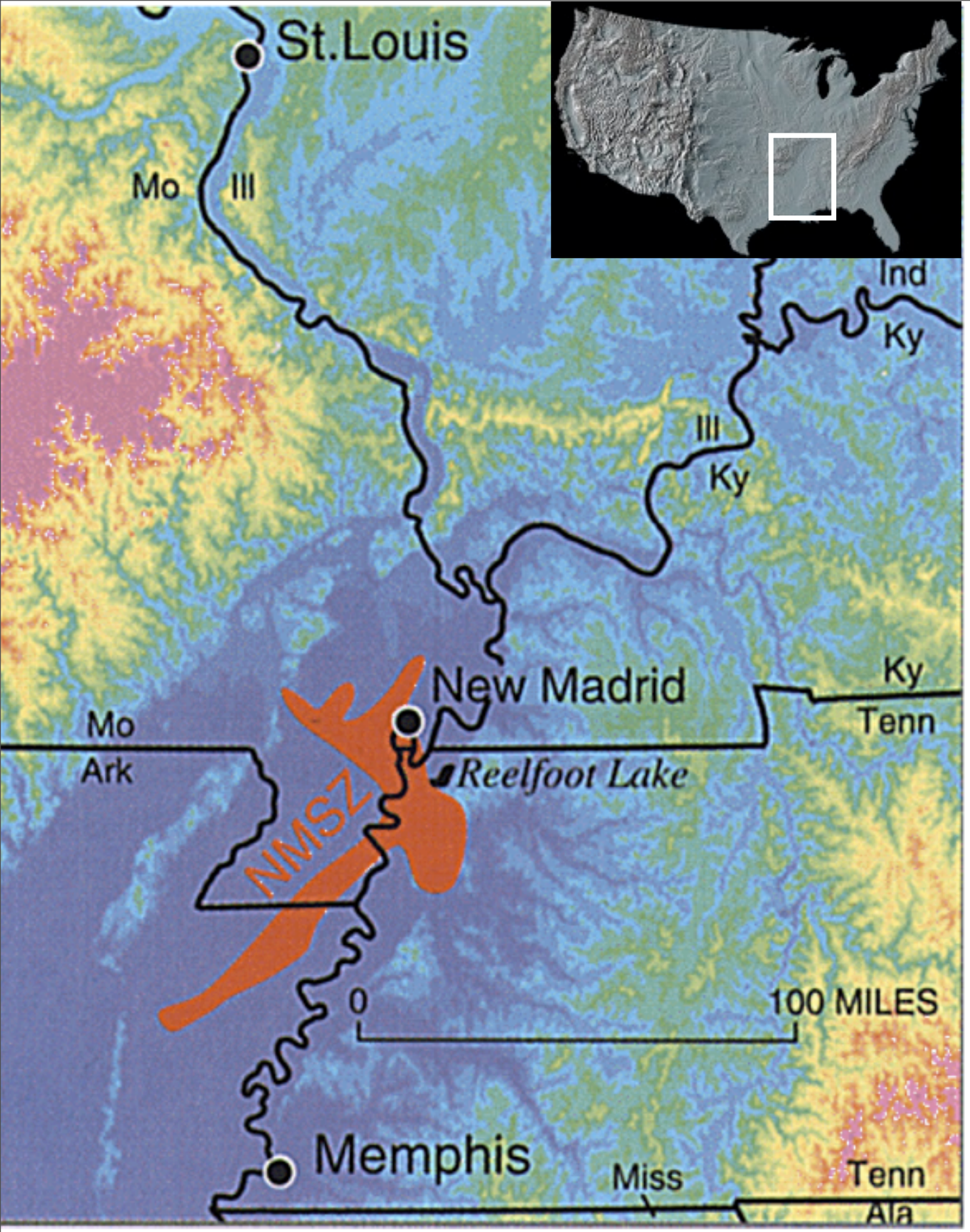
Three Rifting Arms

Three Rifting Arms

Three Rifting Arms



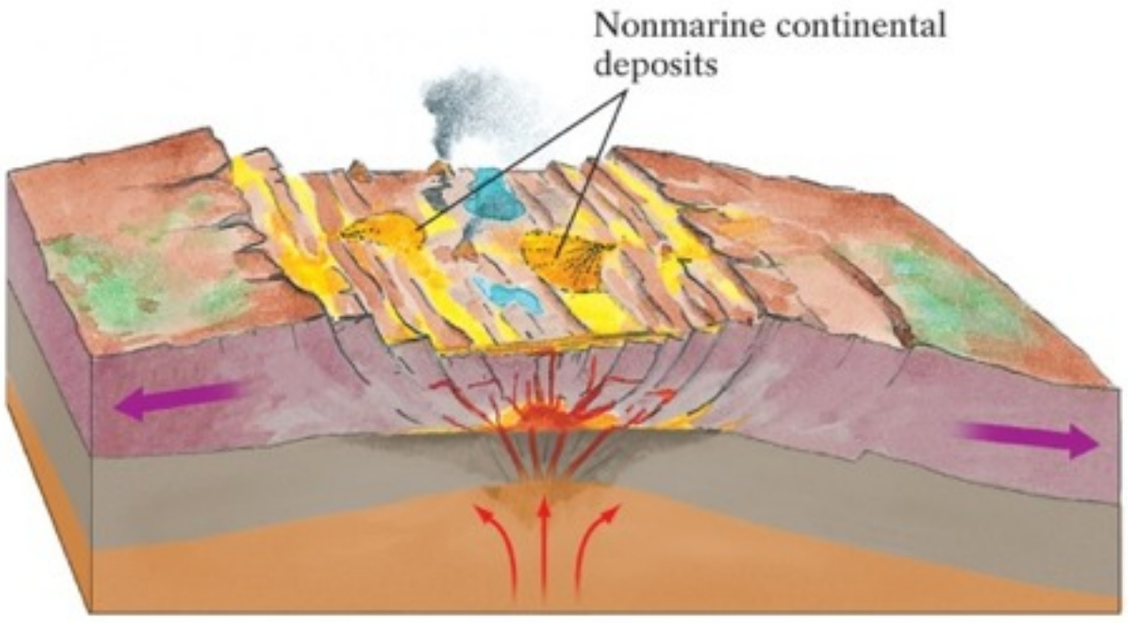
Failed Continental Rift



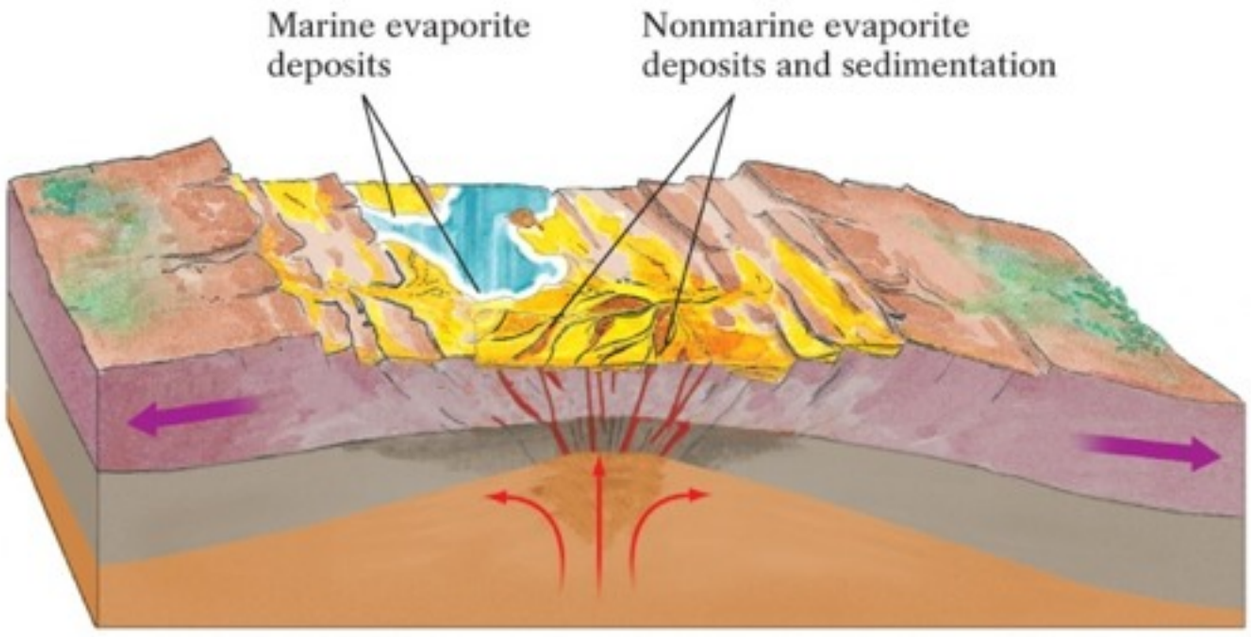
New Madrid Seismic Zone

This intra-plate seismic area is a zone of crustal weakness called an ***aulacogen*** that formed about 750 million years ago during the break-up of the supercontinent ***Rodinia***

Continental Rift to Mid-ocean Ridge

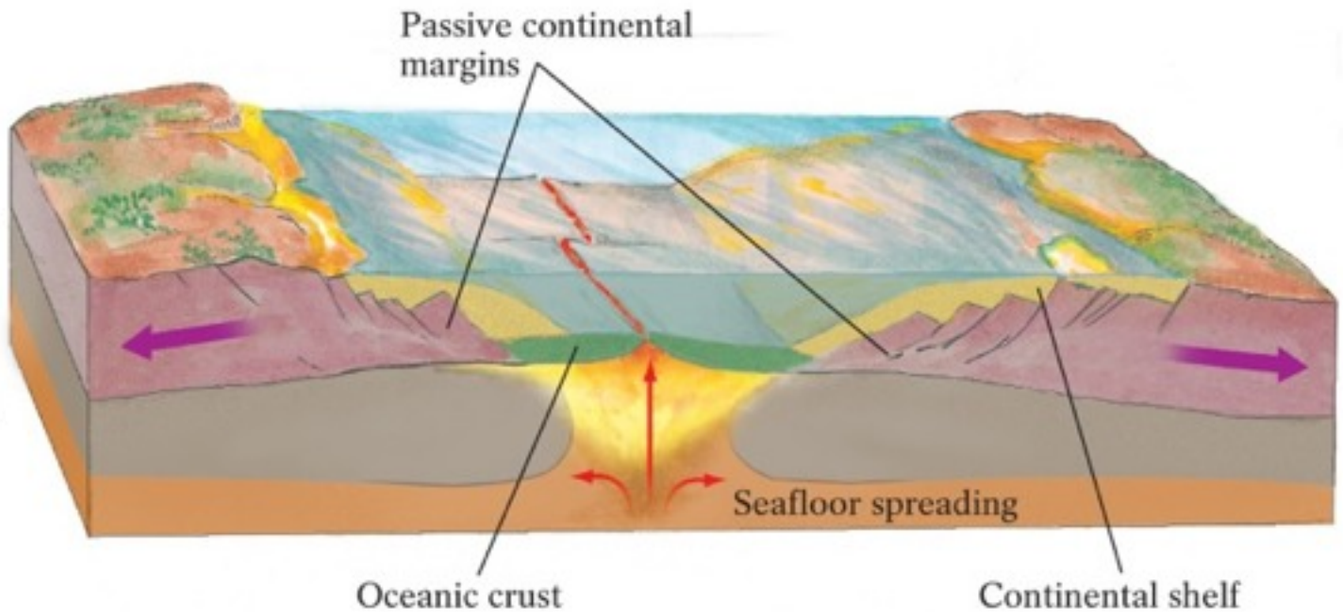


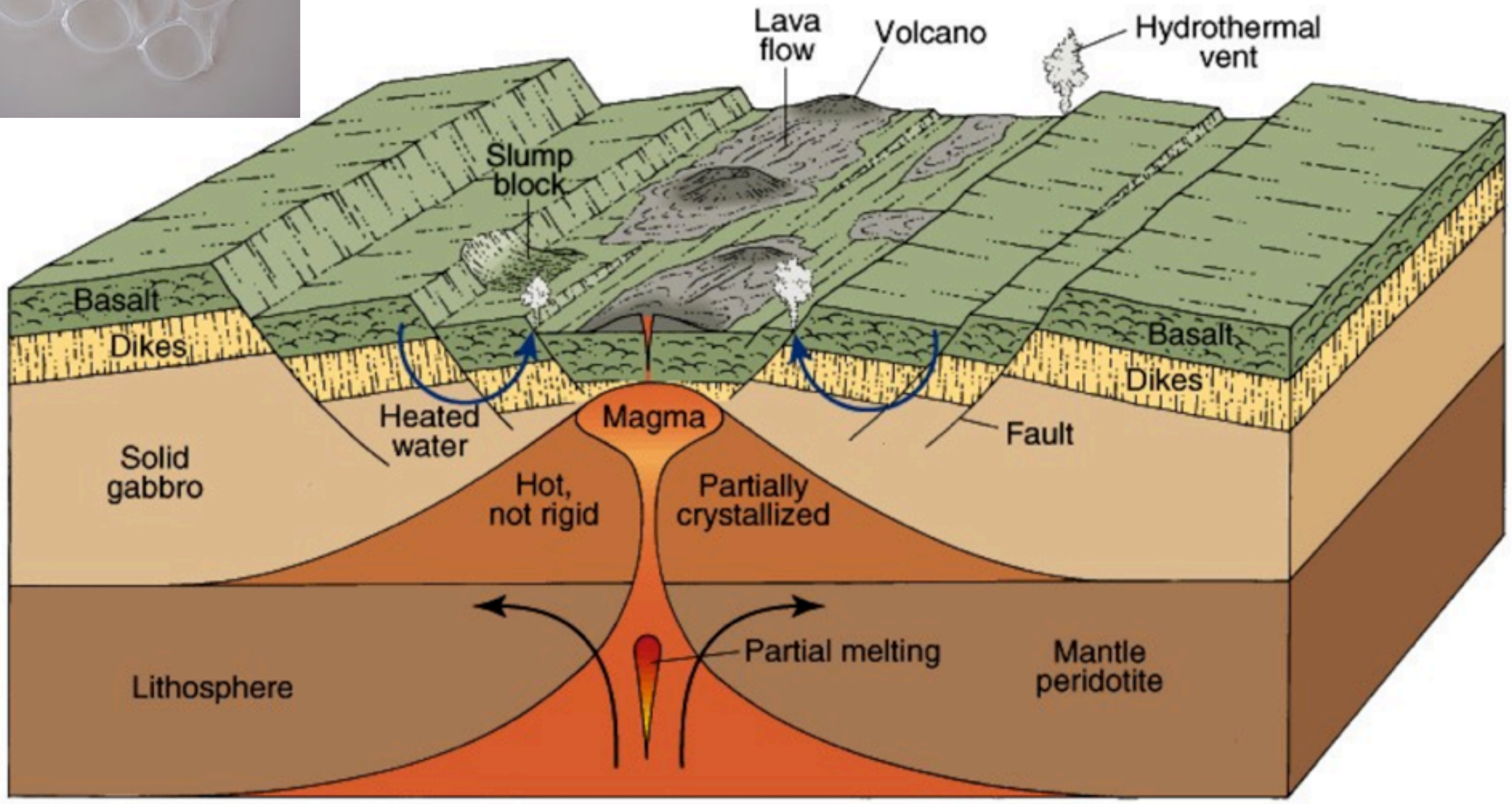
1 Erosion of steep rift-valley walls causes rapid sedimentation



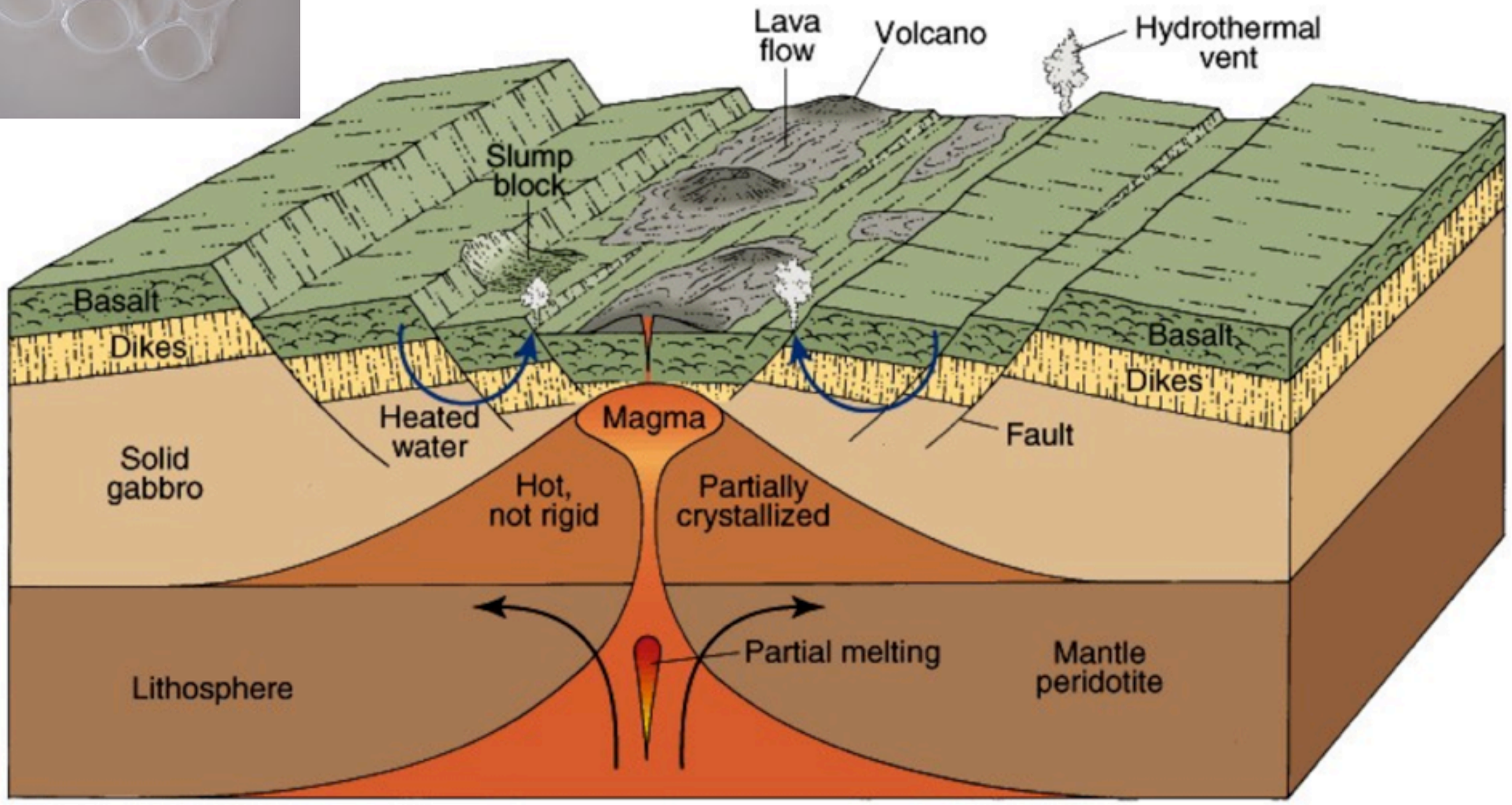
2 Rift valley widens; water alternately fills basin and evaporates with changing sea levels

3 Further widening of rift valley prevents evaporation; continued sedimentation produces continental shelf at passive continental margin

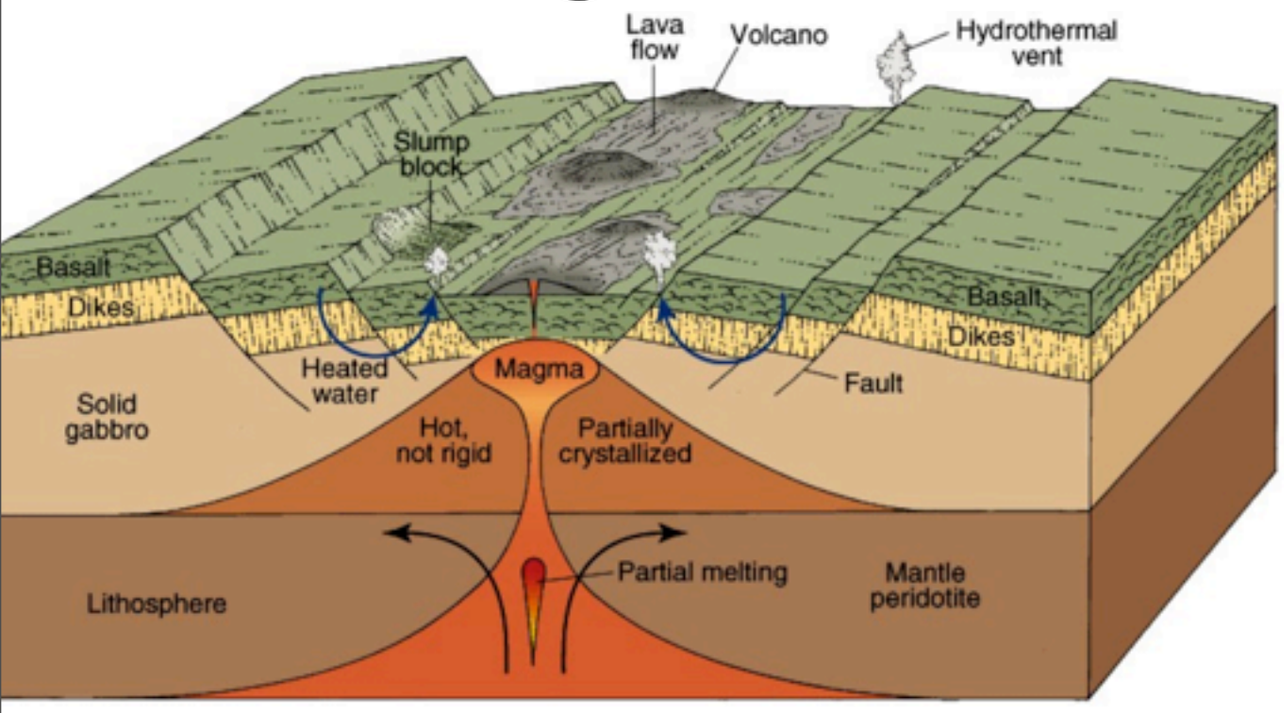



Lava flow
Volcano
Hydrothermal vent
Slump block
Basalt
Dikes
Heated water
Magma
Basalt
Dikes
Fault
Solid gabbro
Hot, not rigid
Partially crystallized
Partial melting
Lithosphere
Mantle peridotite

Thinning of the Lithosphere at Divergent Boundary



Thinning of the Lithosphere and melting Divergent Boundary



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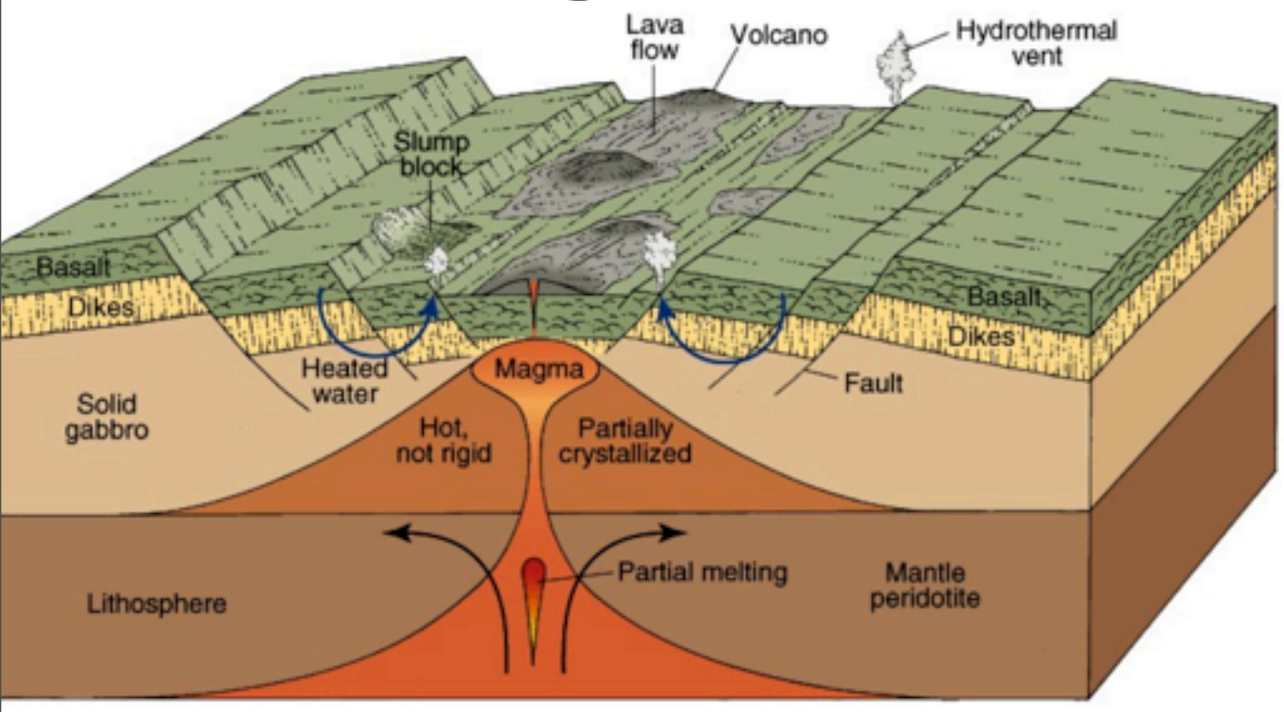

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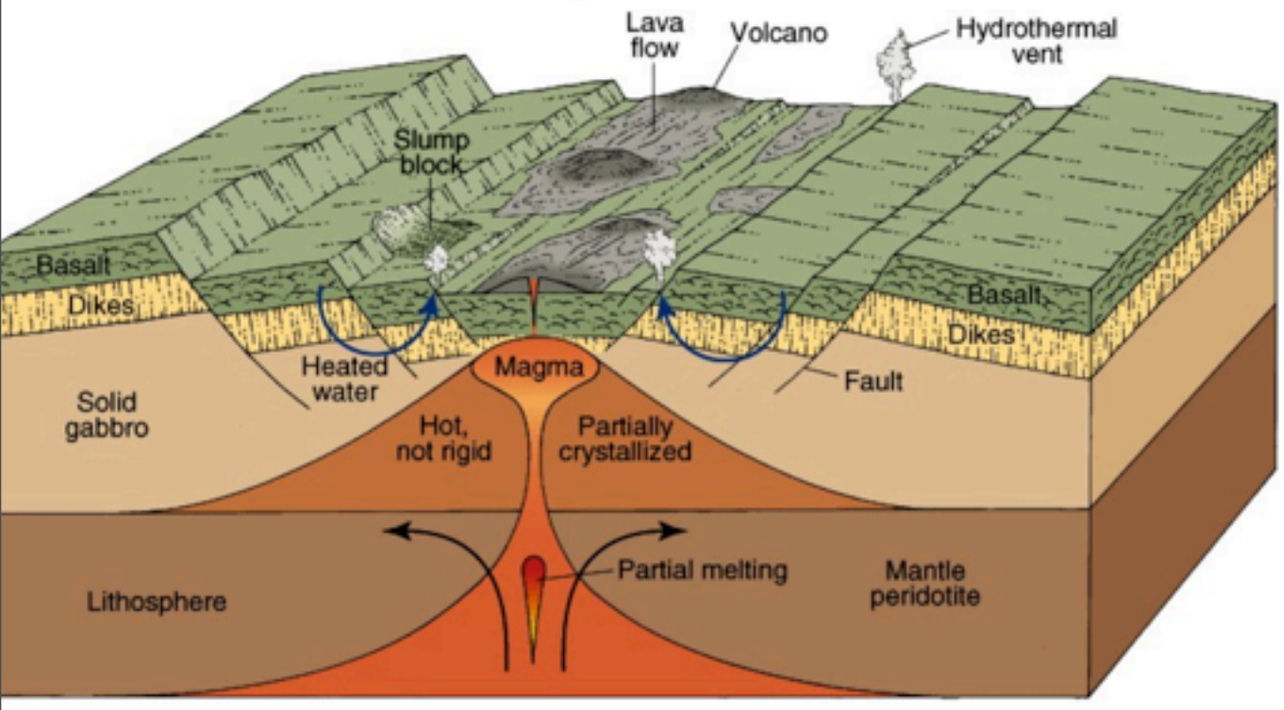

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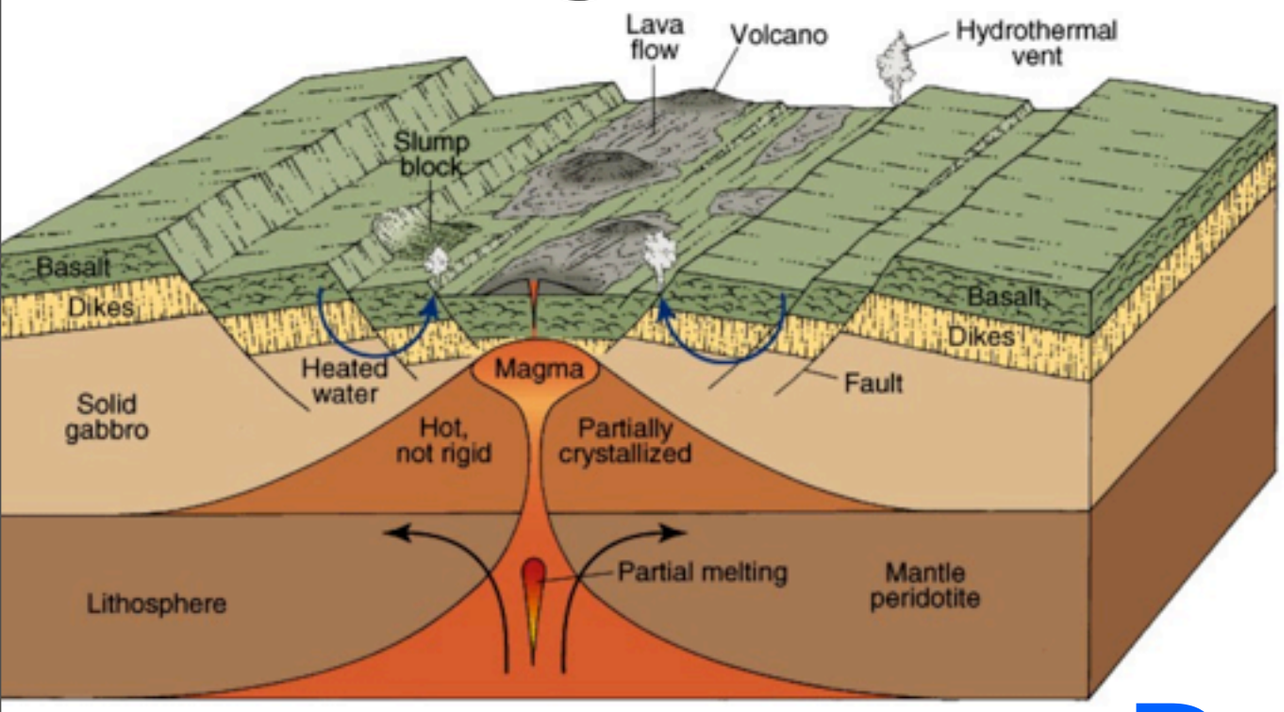
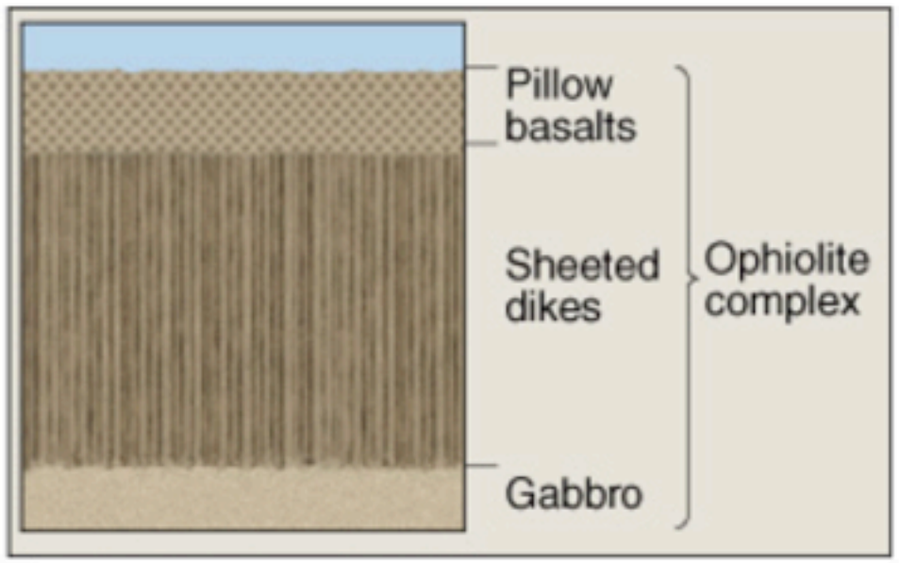


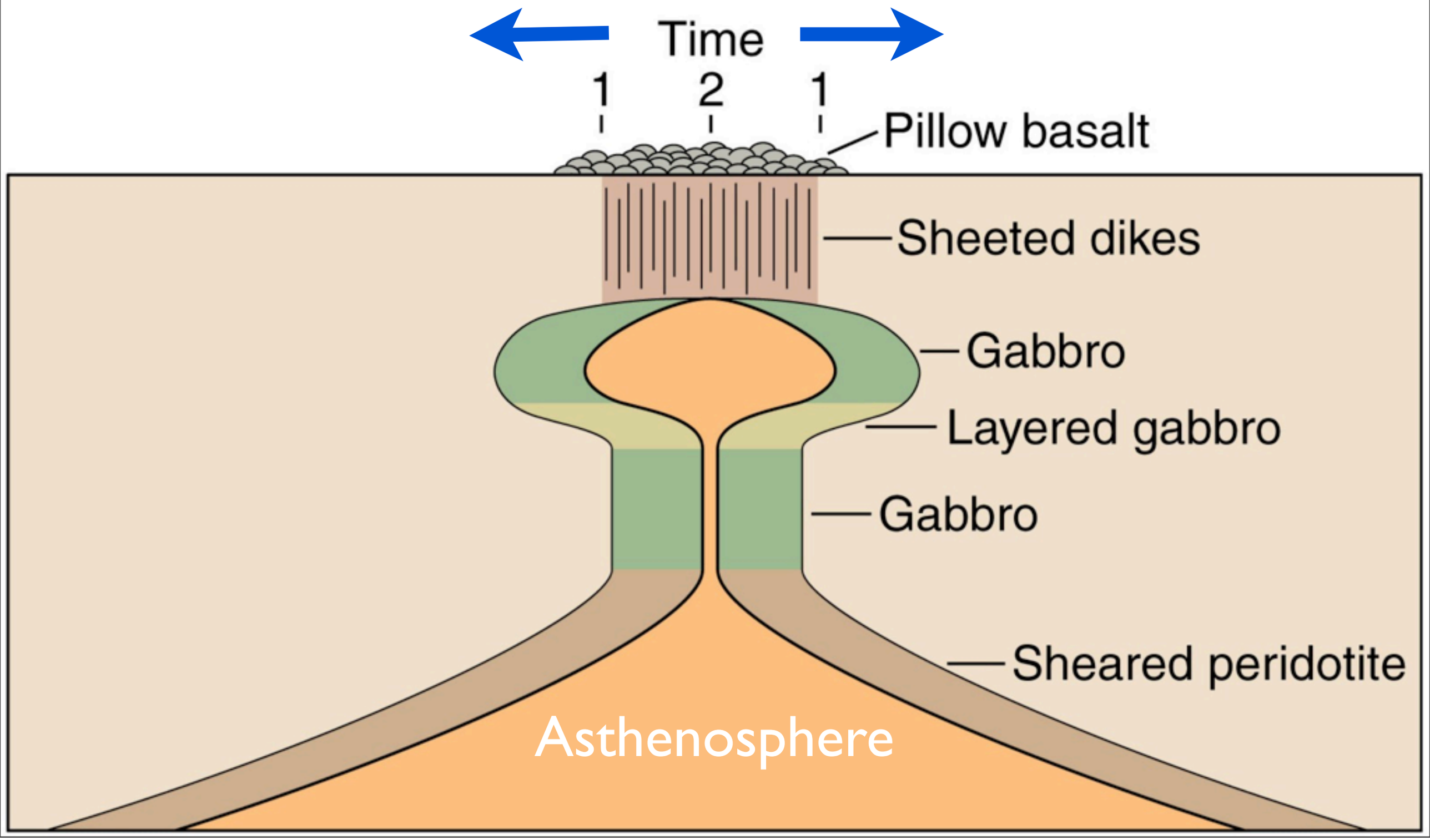
Decompression Melting

Formation of Oceanic Crust at Divergent Boundaries



A.

Formation of Oceanic Lithosphere at Divergent Boundaries



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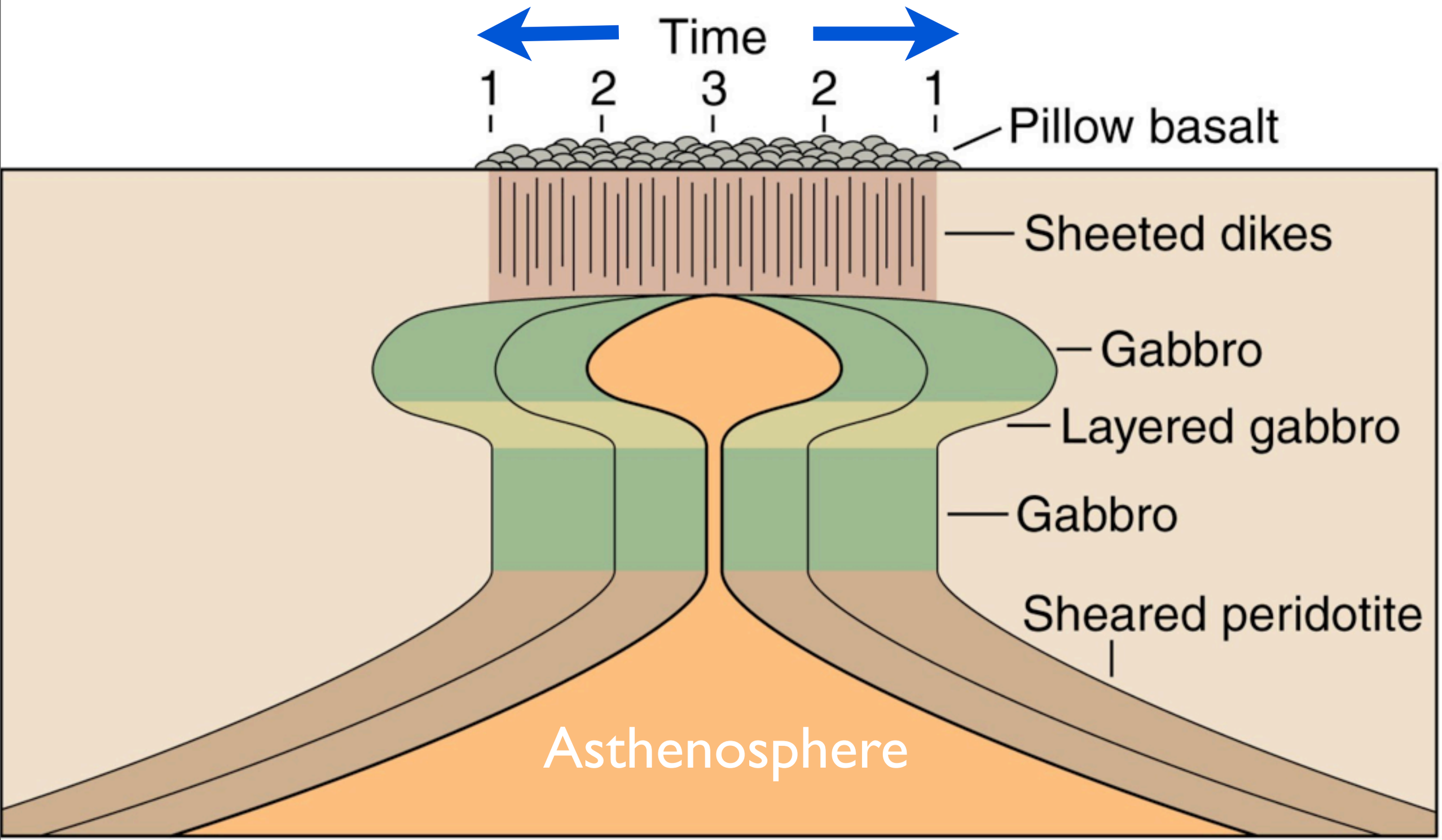

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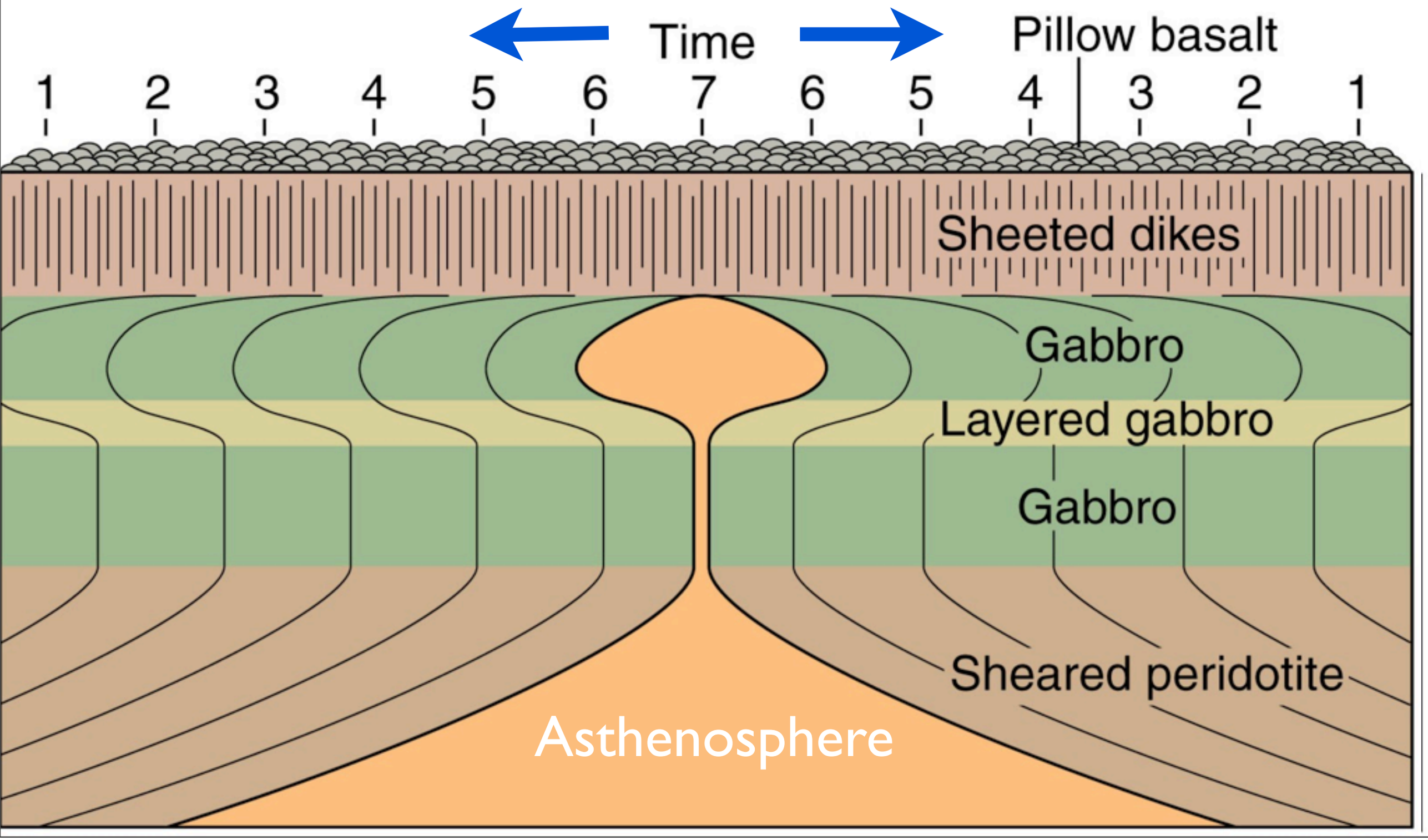
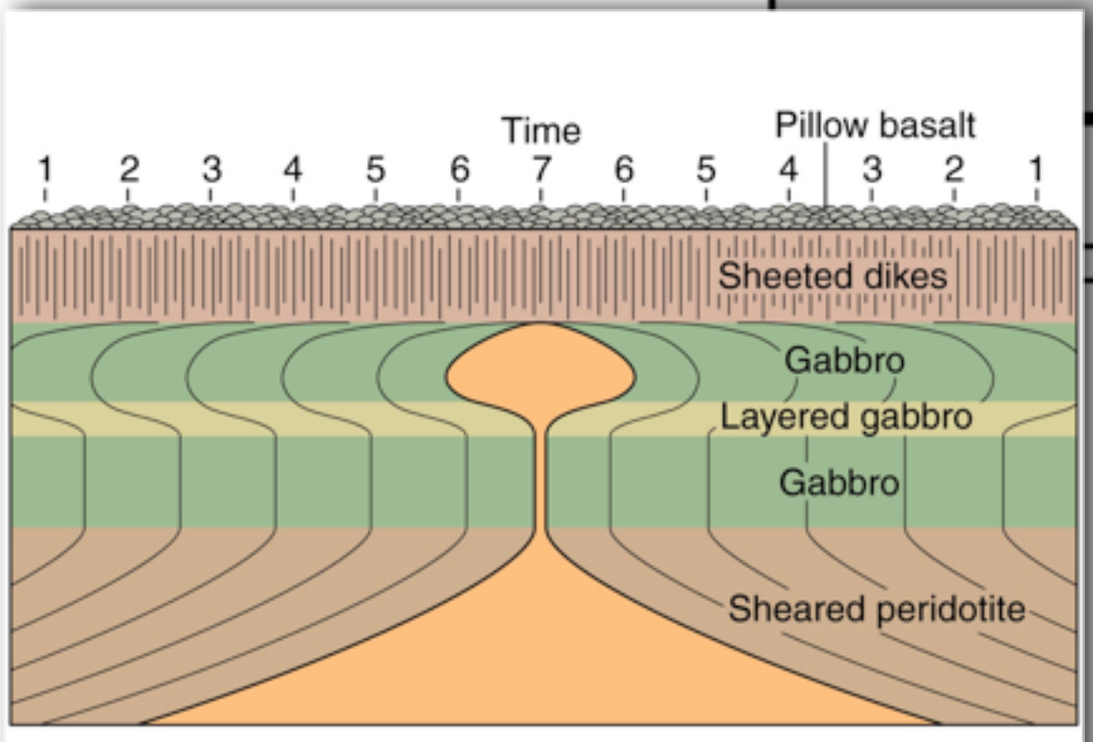


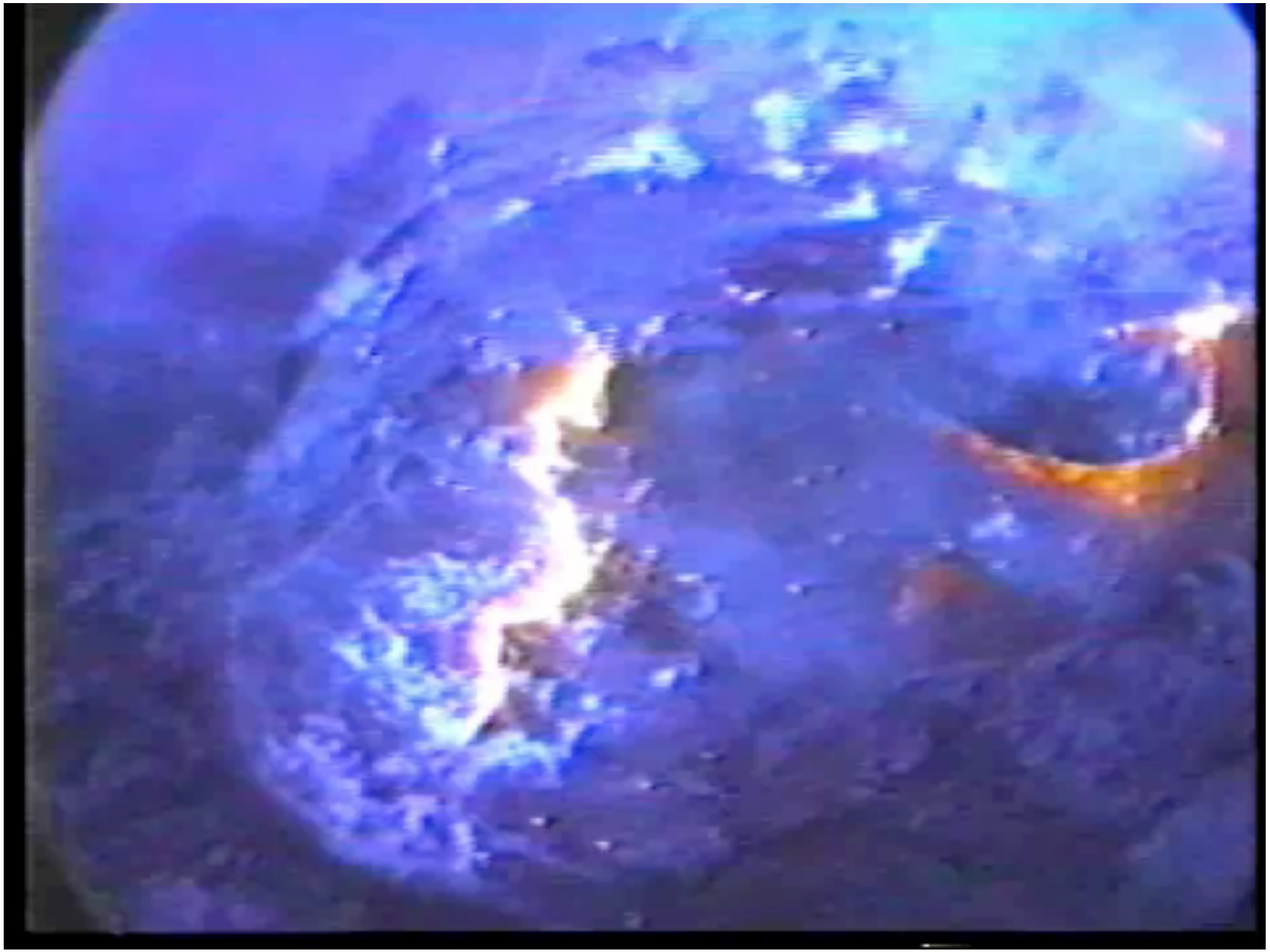
OPHIOLITE STRATIGRAPHY

	Sea bottom
Oceanic sediment	
Pillow basalts	
Sheeted basaltic dikes	
Massive Gabbro	Moho
Depleted mantle rock (Sheared peridotite)	Base of lithosphere
	Beginning of asthenosphe

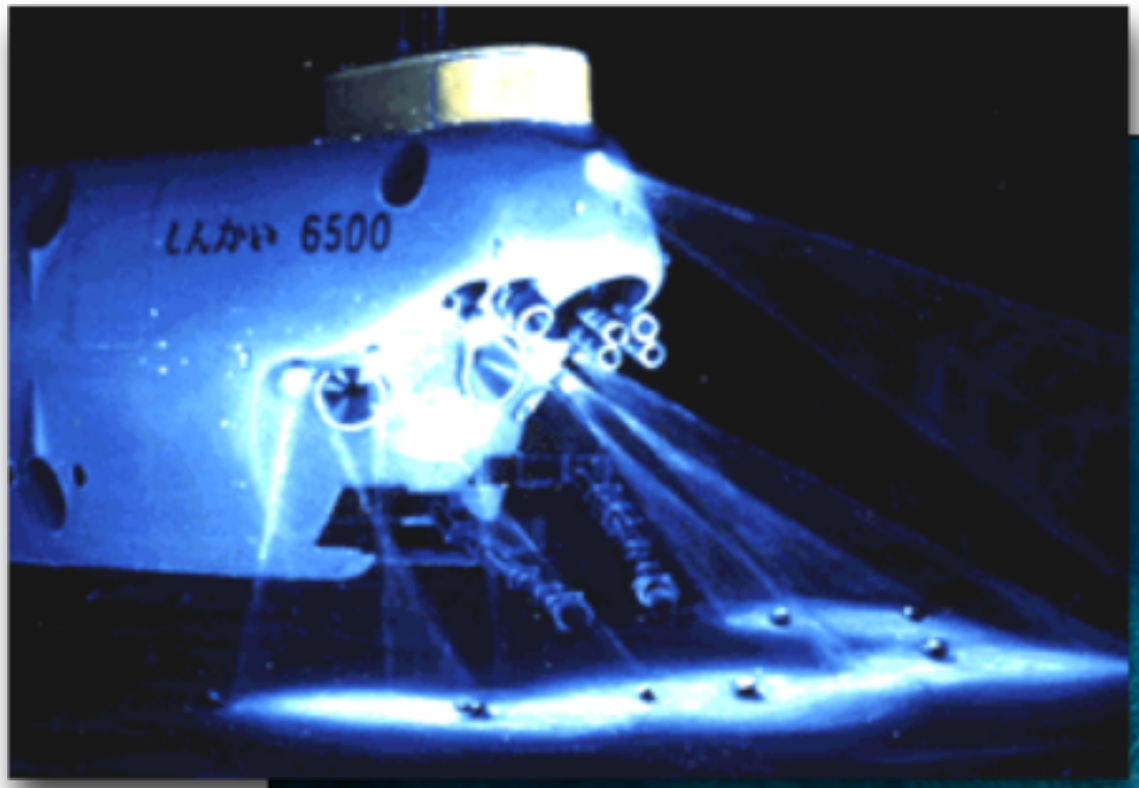


Pillow Basalt Video

Pillow Basalt Video



Pillow Basalt on the Sea Floor

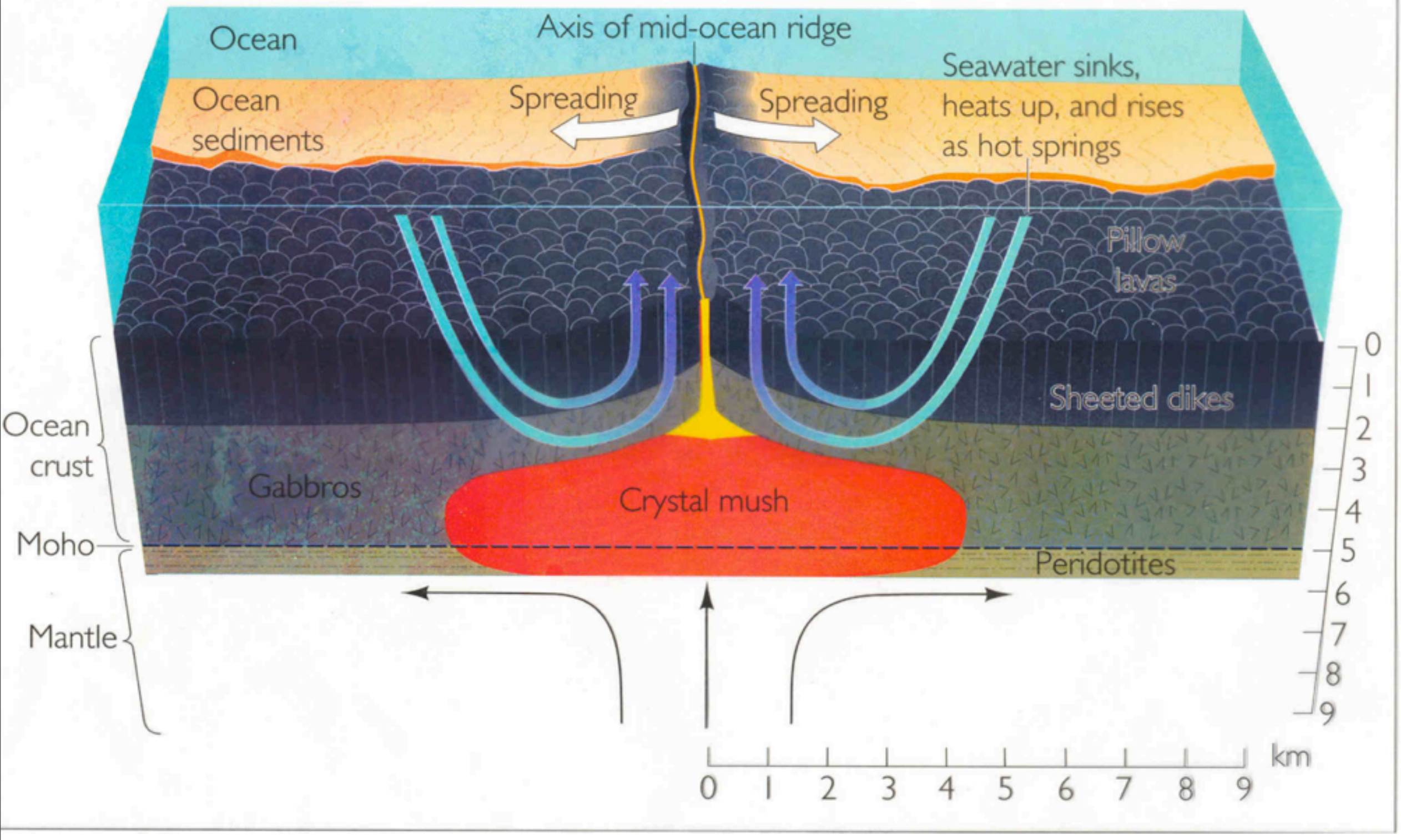


Pillow Basalt accreted to the curst of the North Bay 150 Ma

Pillow Basalt at Point Bonita, Marin Headlands

Pillow Basalt formerly on the Sea Floor

Hydrothermal Alteration of Oceanic Lithosphere at Mid-ocean Ridge



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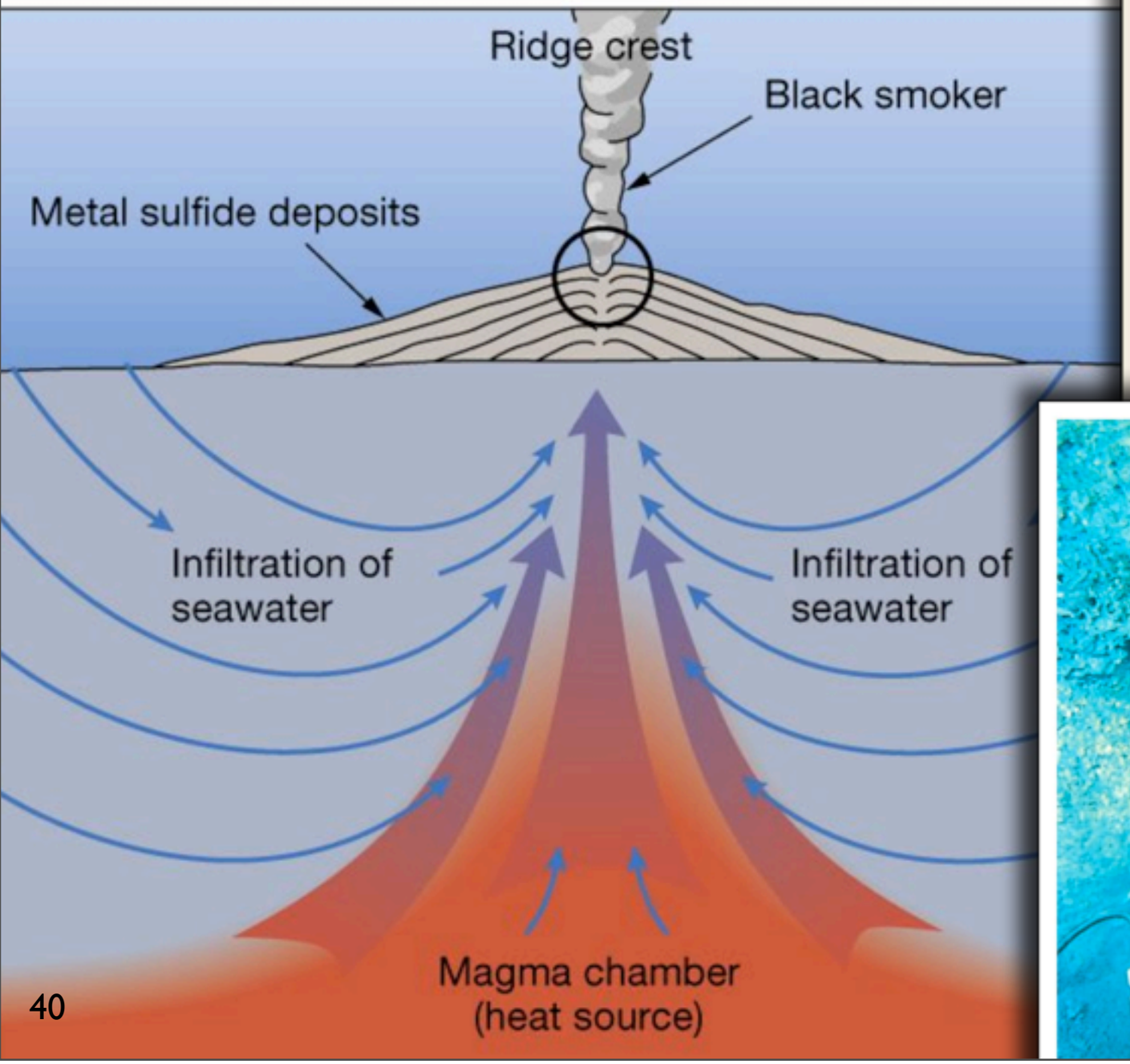

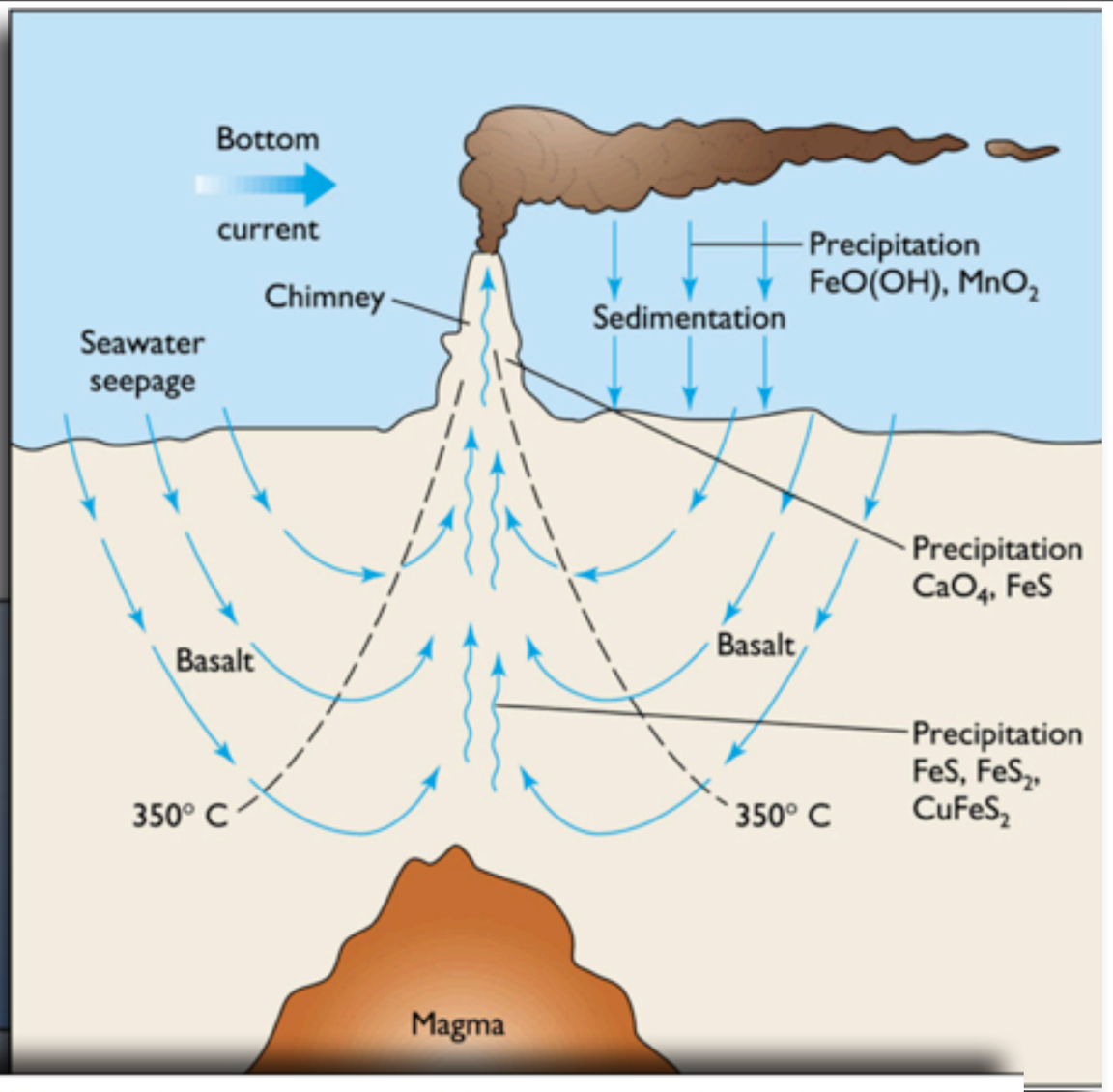

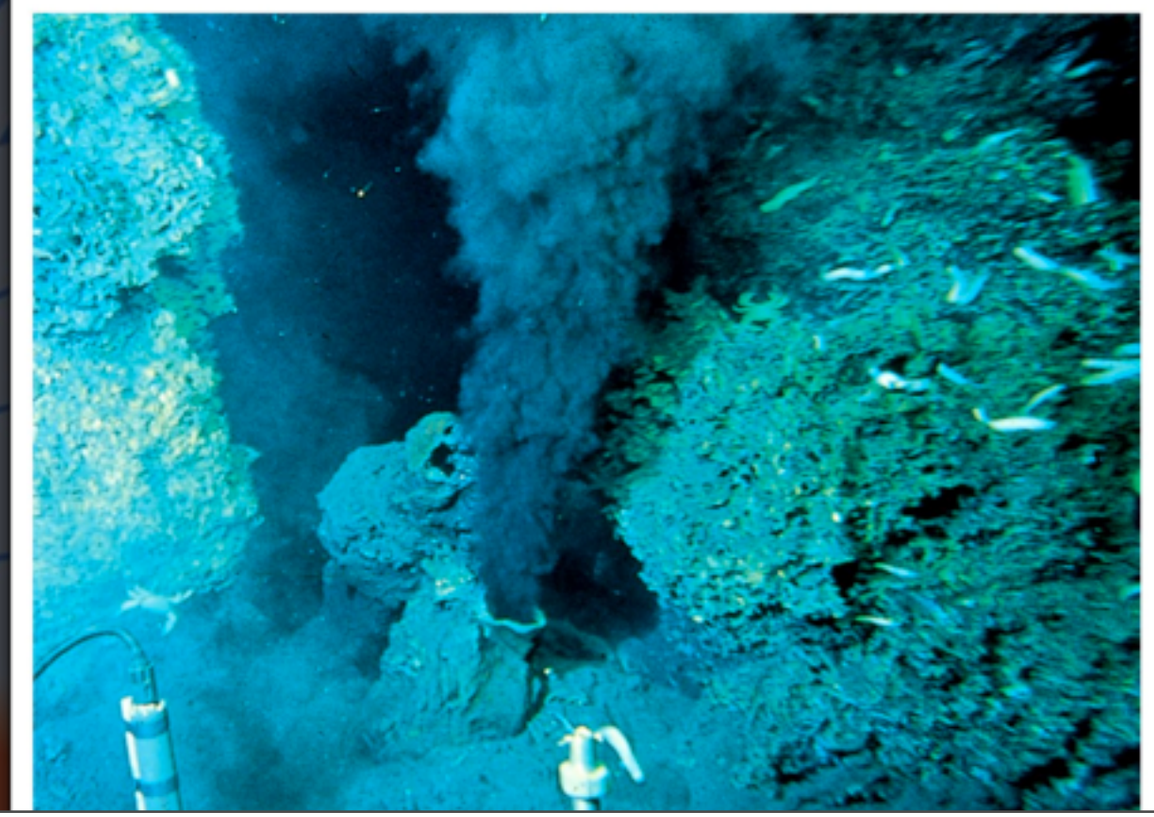

Hydrothermal Alteration of Oceanic Lithosphere at Mid-ocean Ridge

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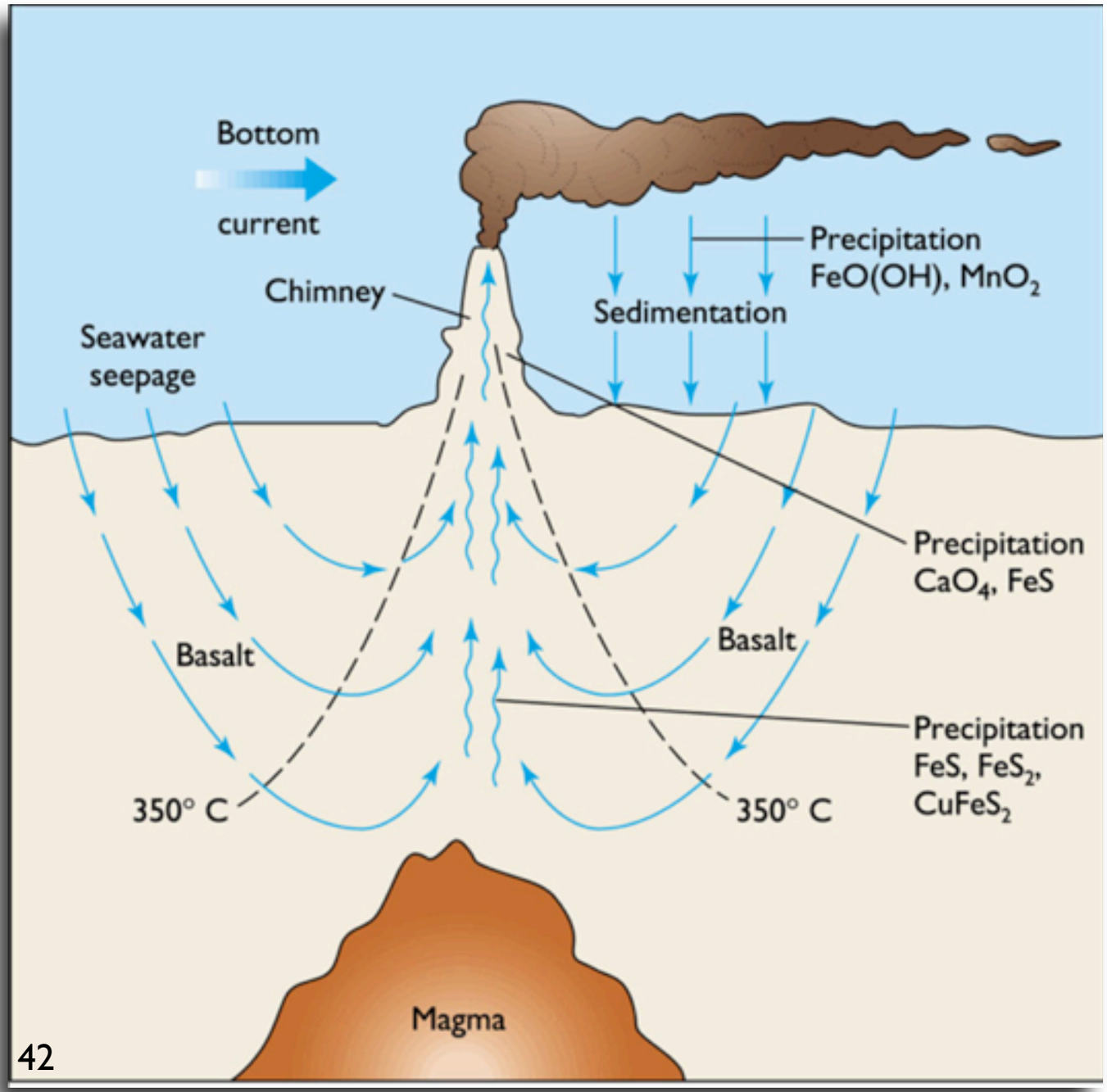
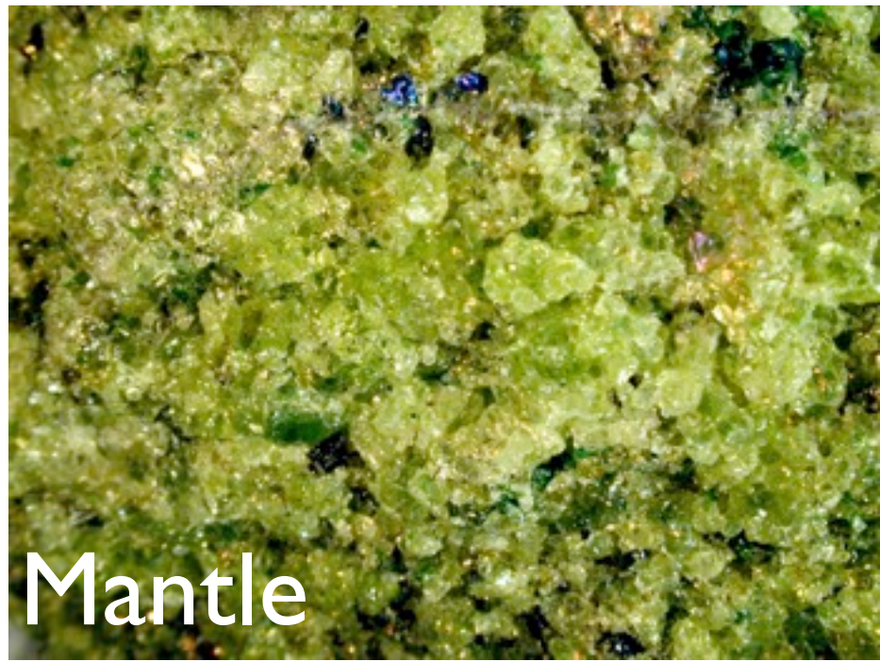


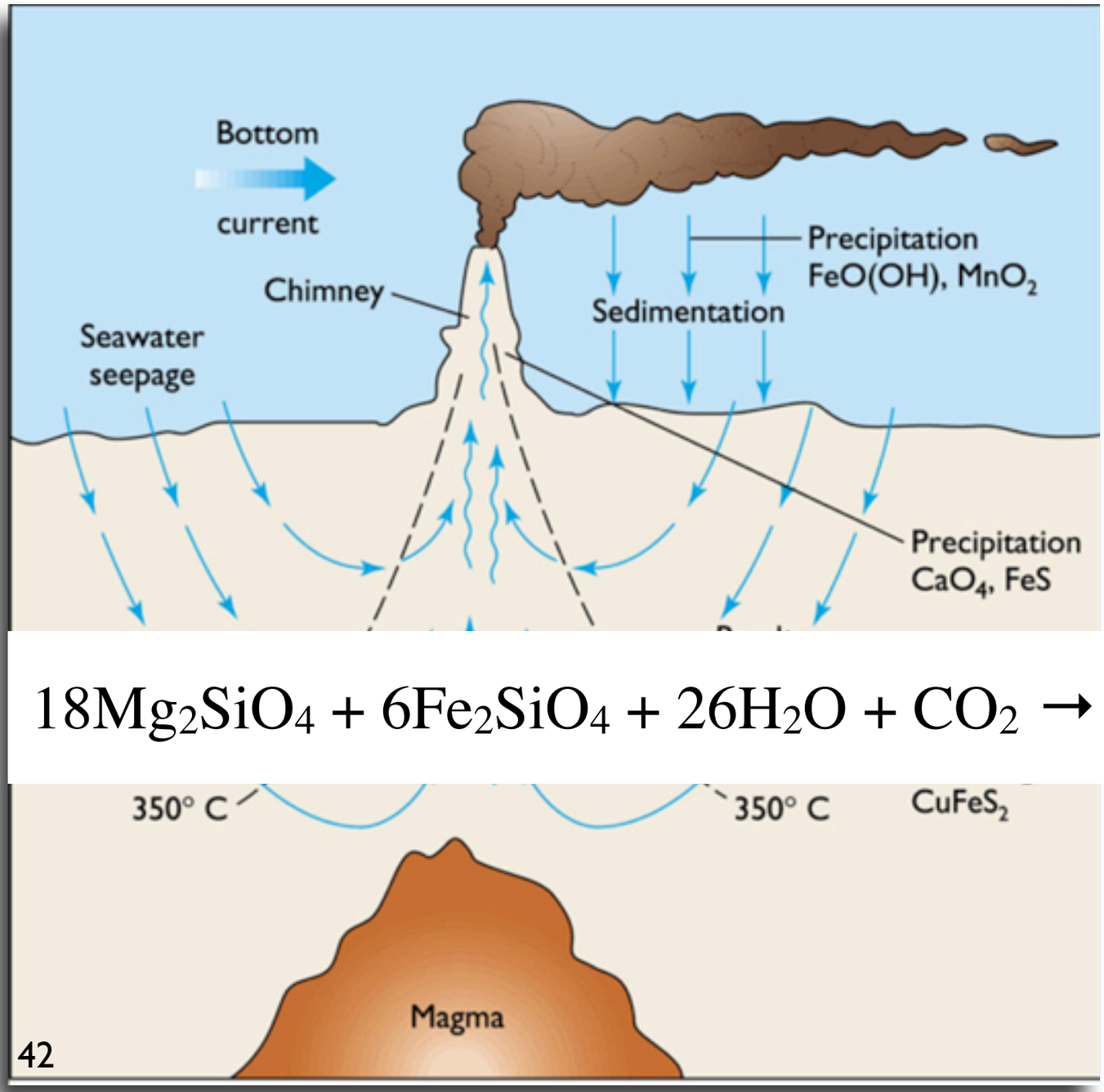


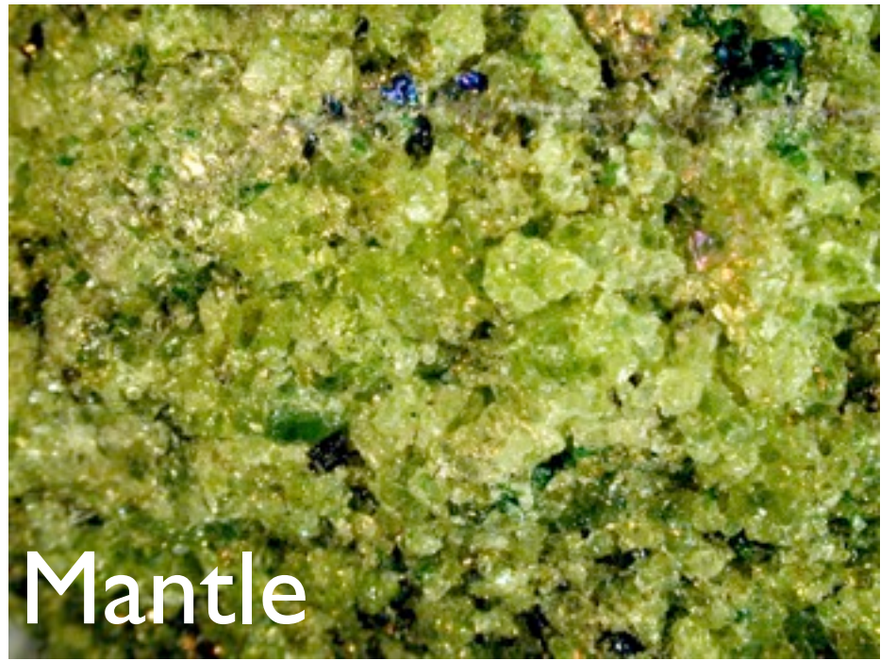
+

hot H20

=

Hydrothermal Alteration of Oceanic Lithosphere at Mid-ocean Ridge





+

hot H20

=

$$18Mg_2SiO_4 + 6Fe_2SiO_4 + 26H_2O + CO_2 \rightarrow 12Mg_3Si_2O_5(OH)_4 + 4Fe_3O_4 + CH_4$$

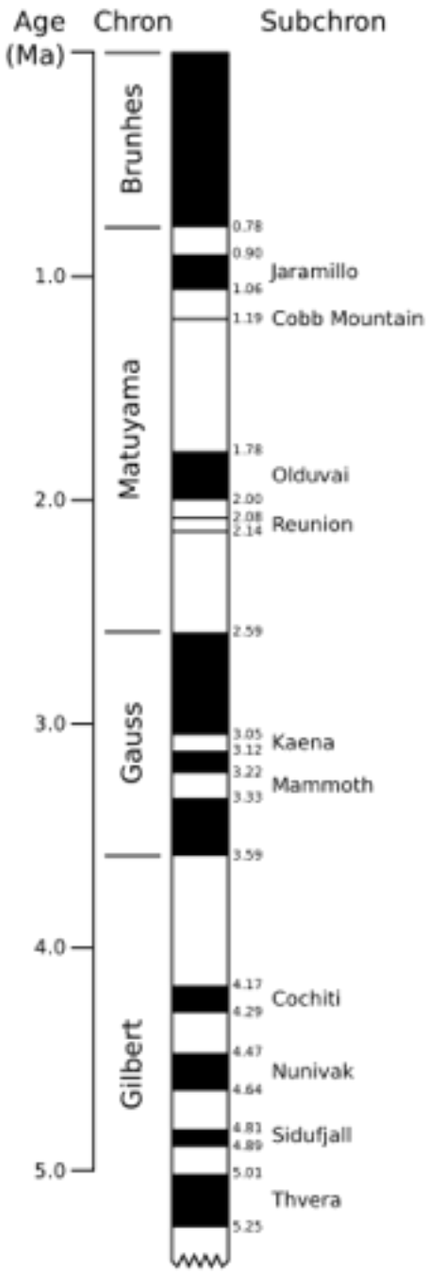
Minerals within rocks can hold a lot of water!

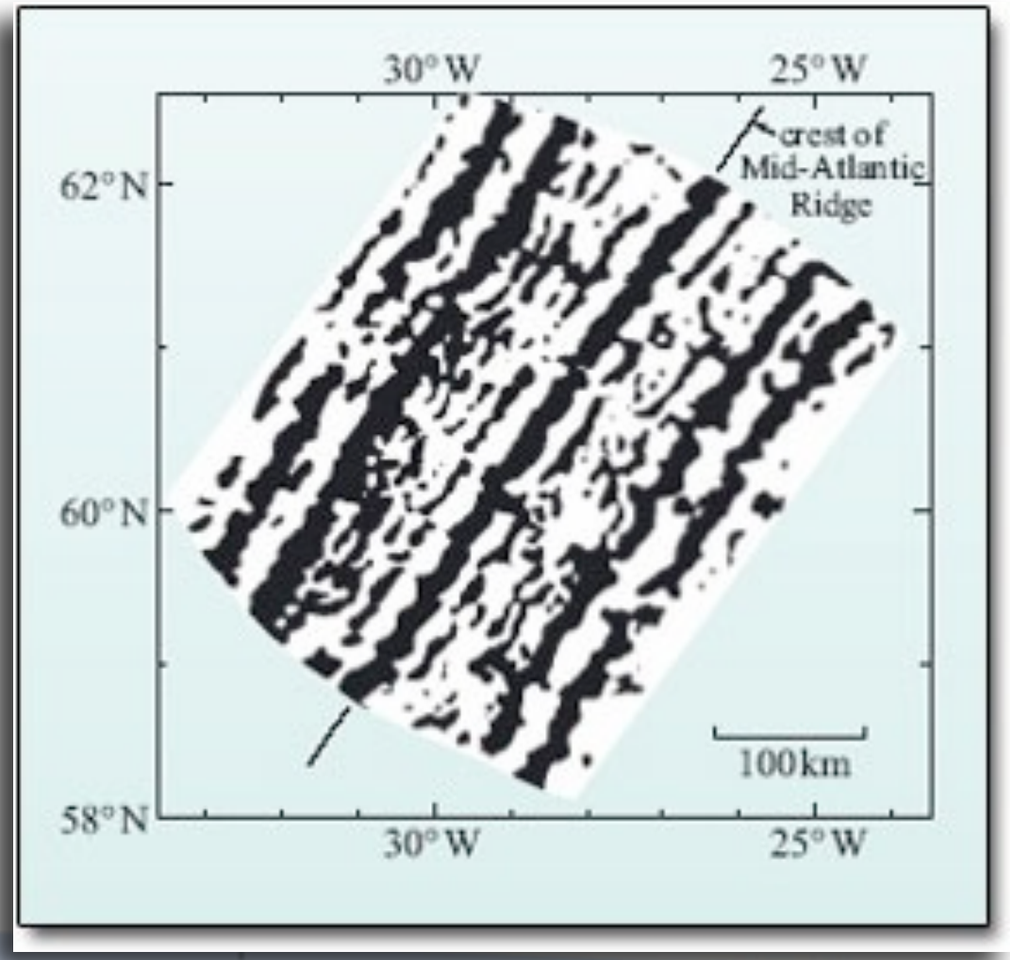
Serpentinite 12% water!

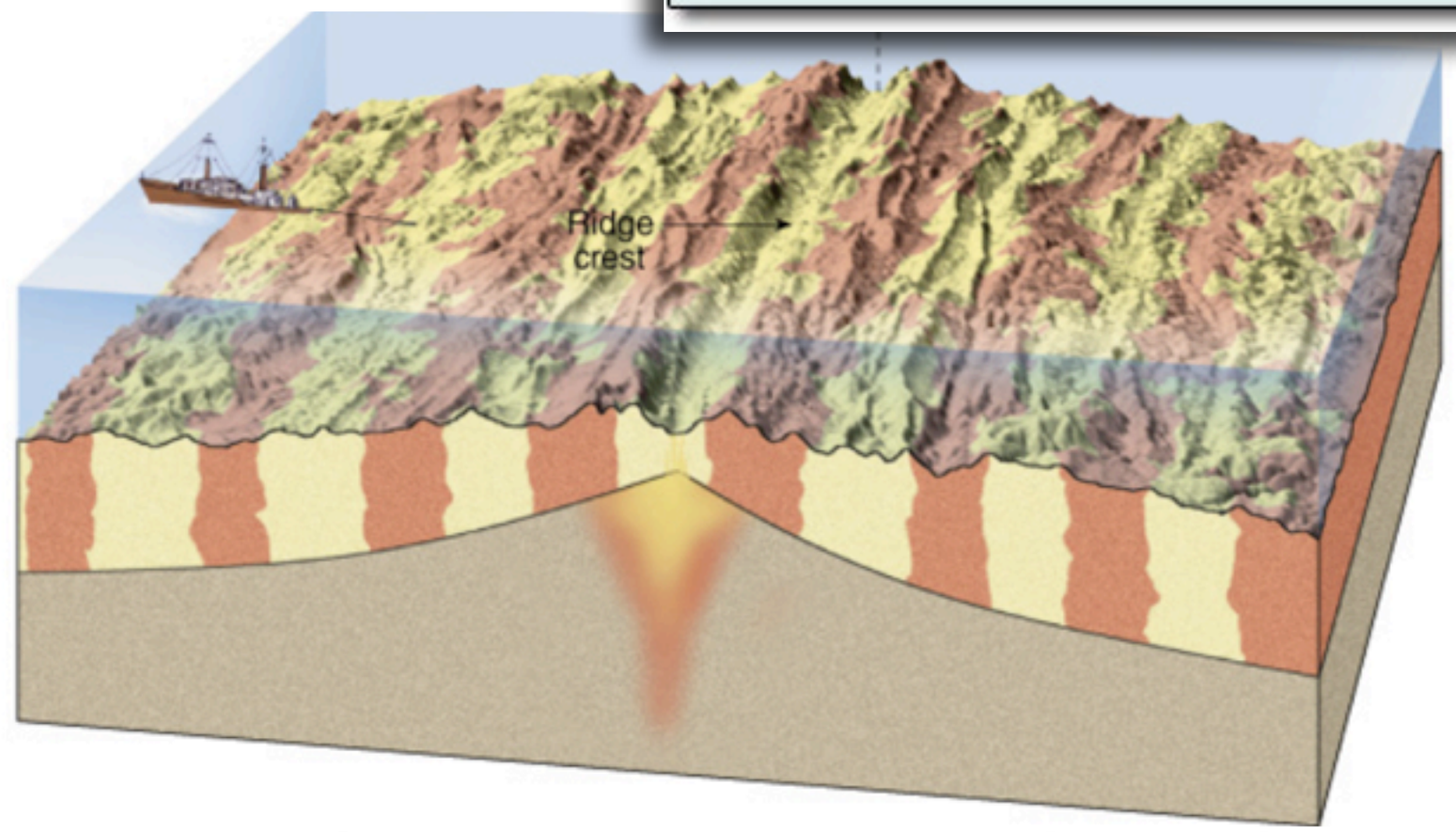
$Mg_3Si_2O_5(OH)_4$

Serpentinite at Baker Beach

Magnetic Anomaly Map of the Mid Atlantic Ridge







Symmetrical pattern centered on the ridge

Measuring <u>RELATIVE</u> Speed and Direction of Plate Motion

Distance between ridge crest and
7 m.y. rock is ~350 km.

$$Speed = \frac{350 km}{7 my} = 50 \frac{km}{my}$$

$$\frac{km}{my} \div 10 = \frac{cm}{yr}$$

Measuring <u>RELATIVE</u> Speed and Direction of Plate Motion

Distance between ridge crest and
7 m.y. rock is ~350 km.

$$Speed = \frac{\text{distance}}{\text{time}}$$

$$Speed = \frac{350km}{7my}$$

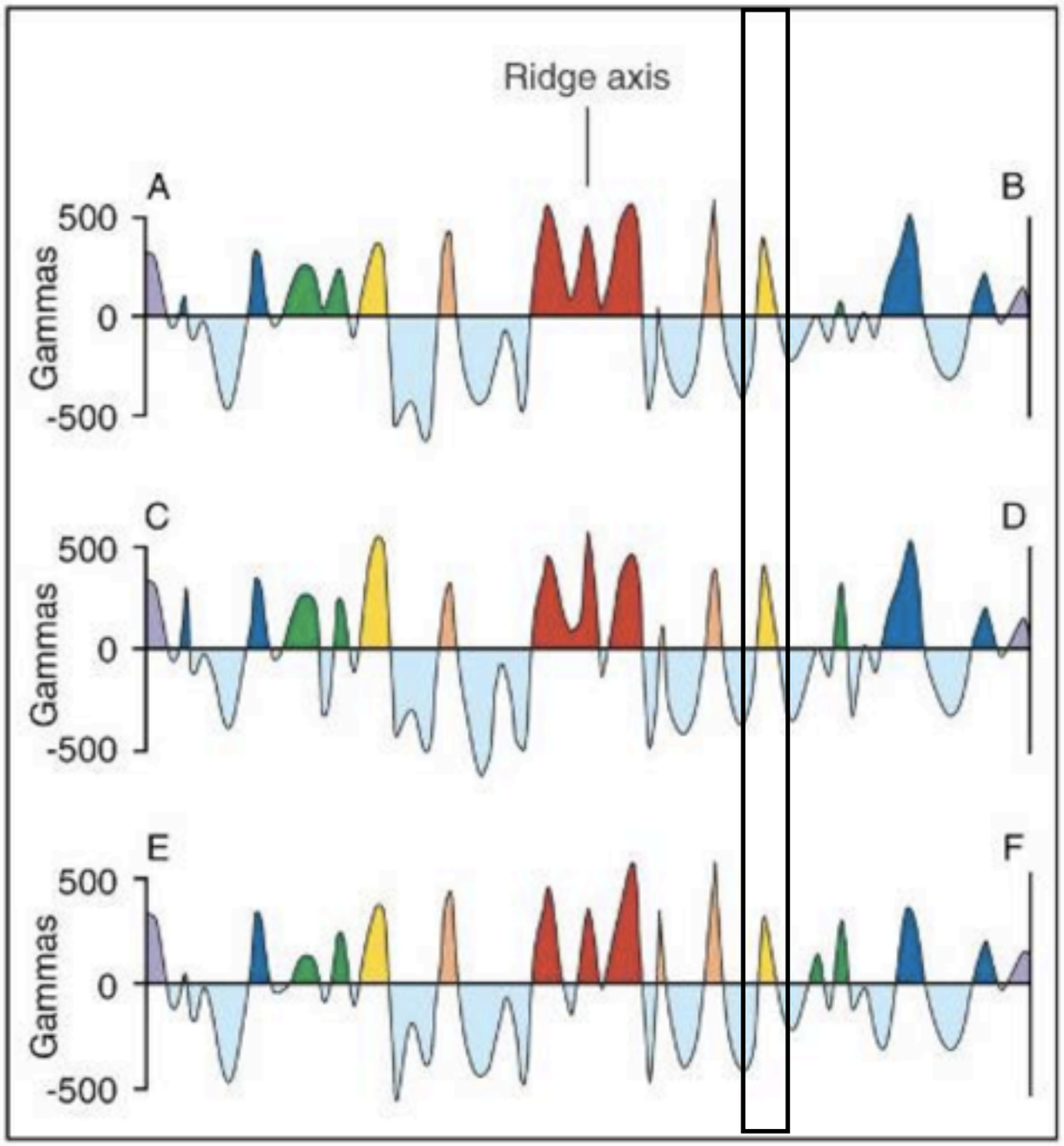
Measuring <u>RELATIVE</u> Speed and Direction of Plate Motion

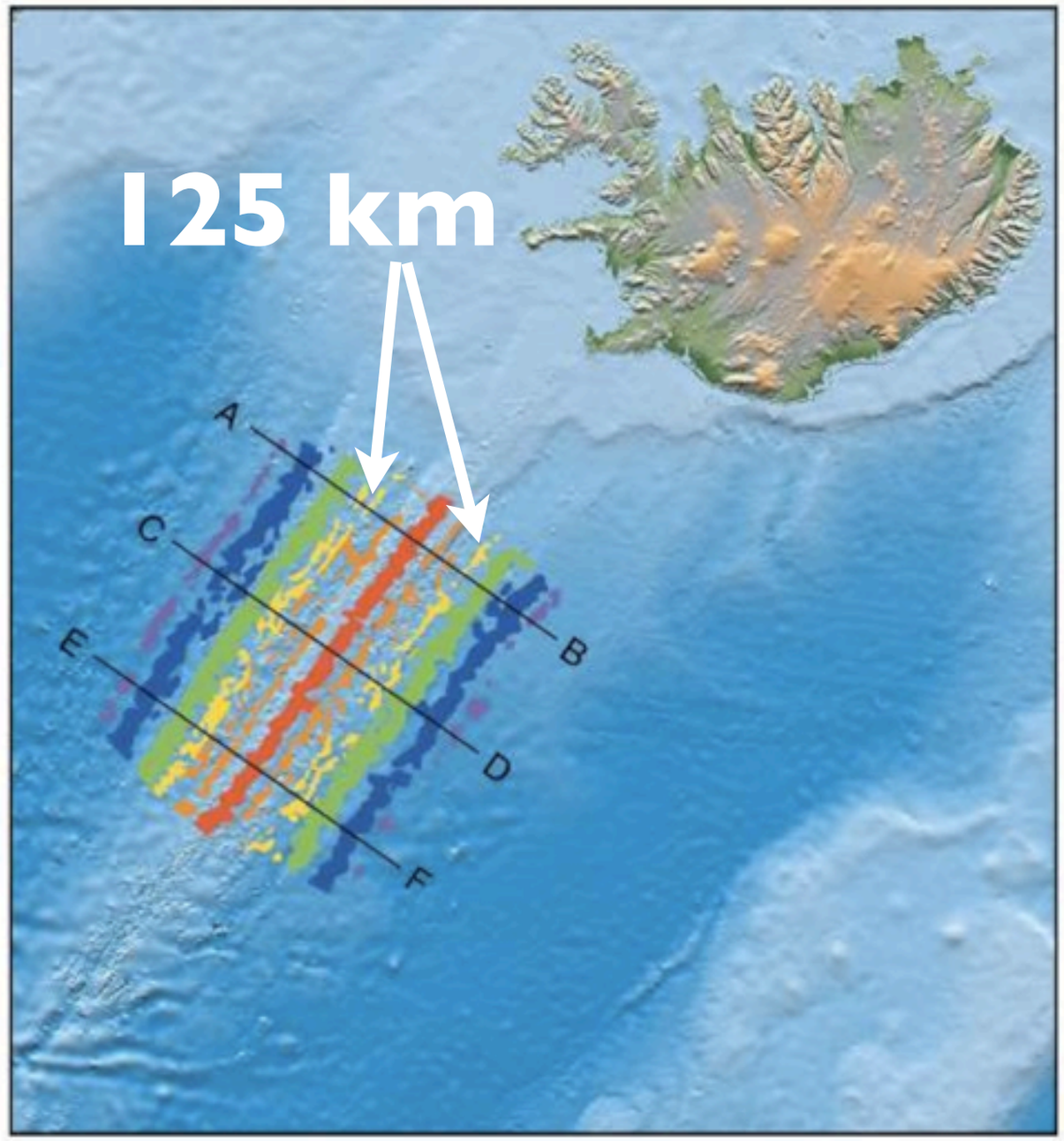
Distance between ridge crest and
7 m.y. rock is ~350 km.

$$50\frac{km}{my} \div 10 = \boxed{5.0\frac{cm}{yr}}$$

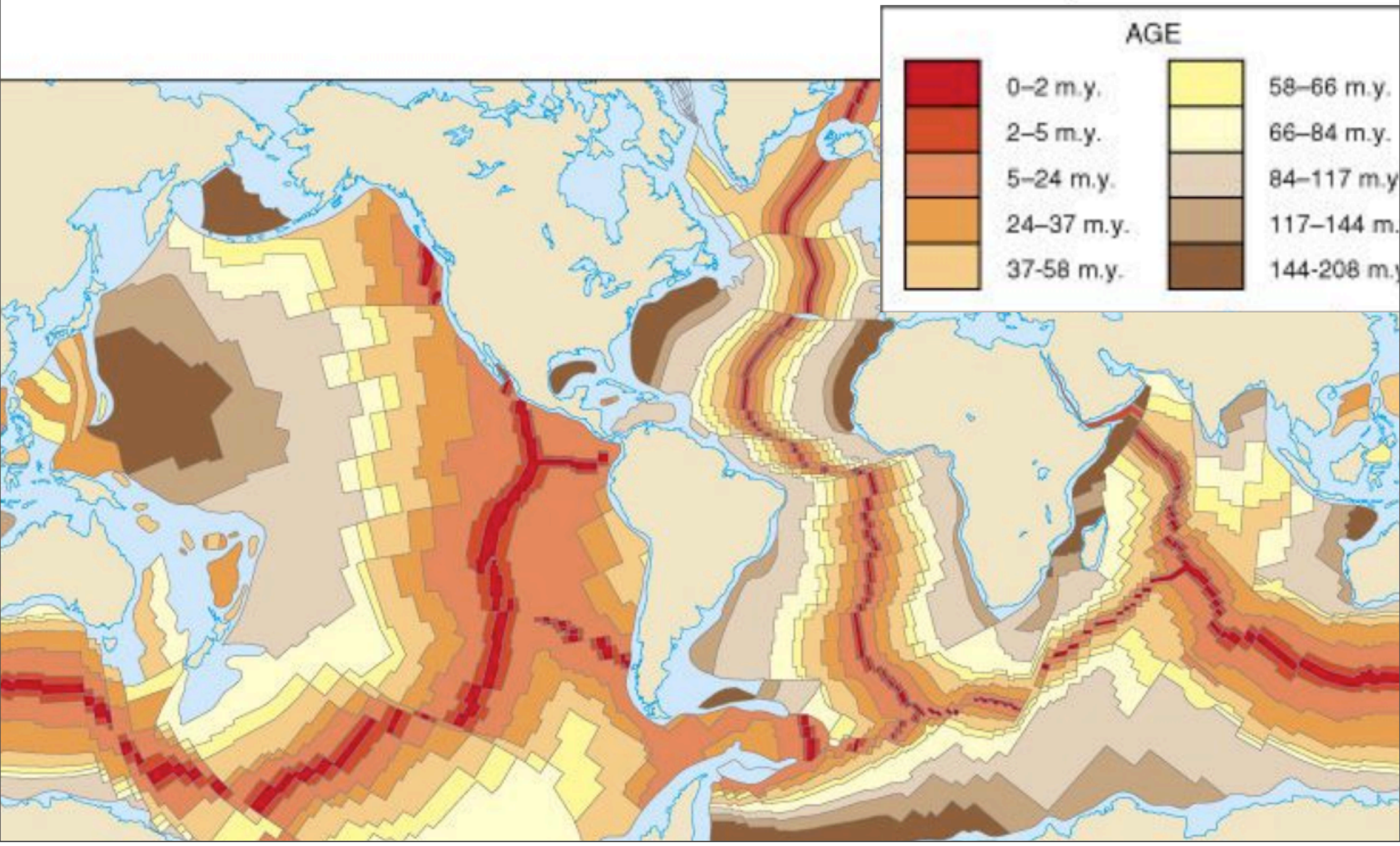
Measuring <u>RELATIVE</u> Speed (cm/yr)and Direction of the Mid Atlantic Ridge

5 Ma

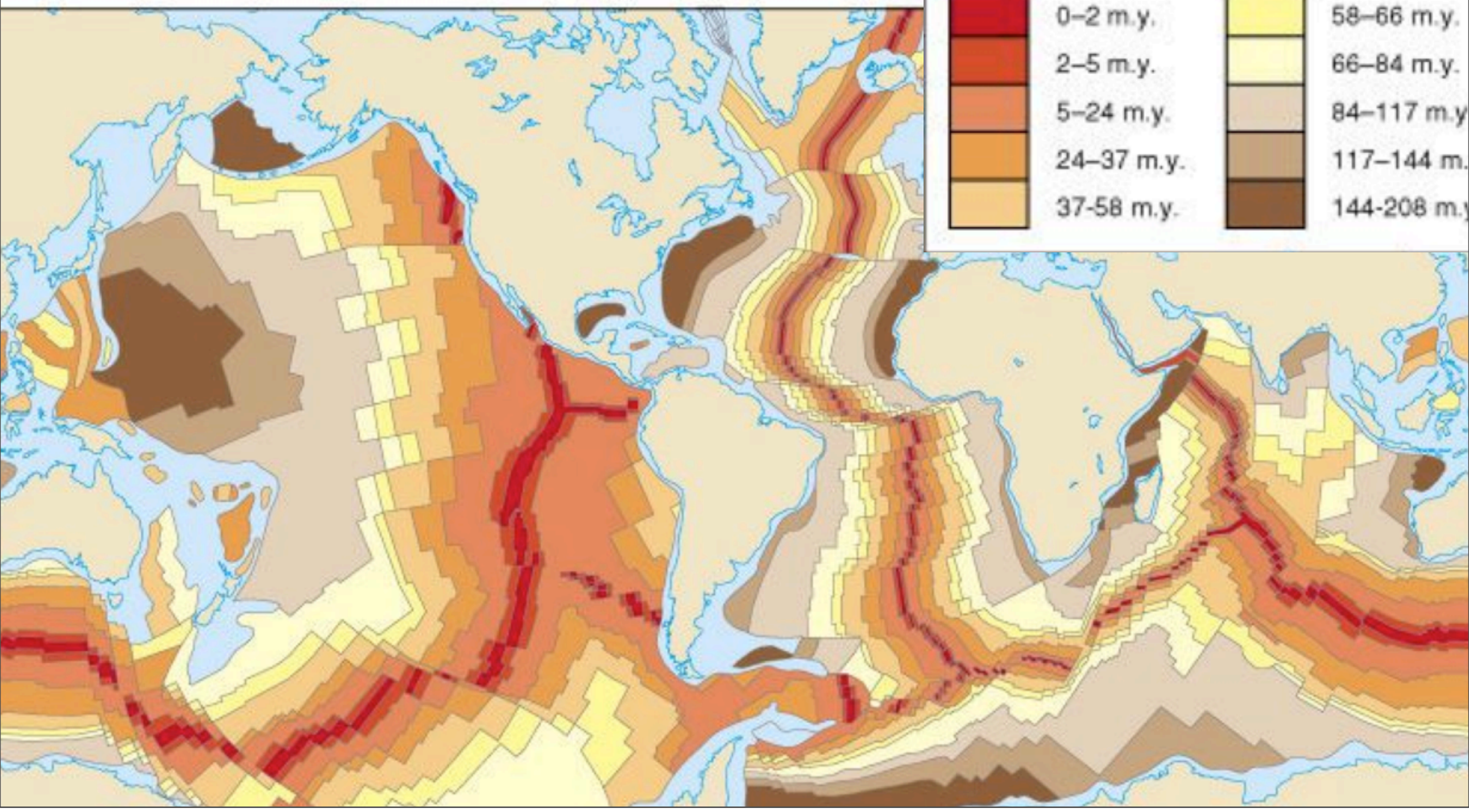




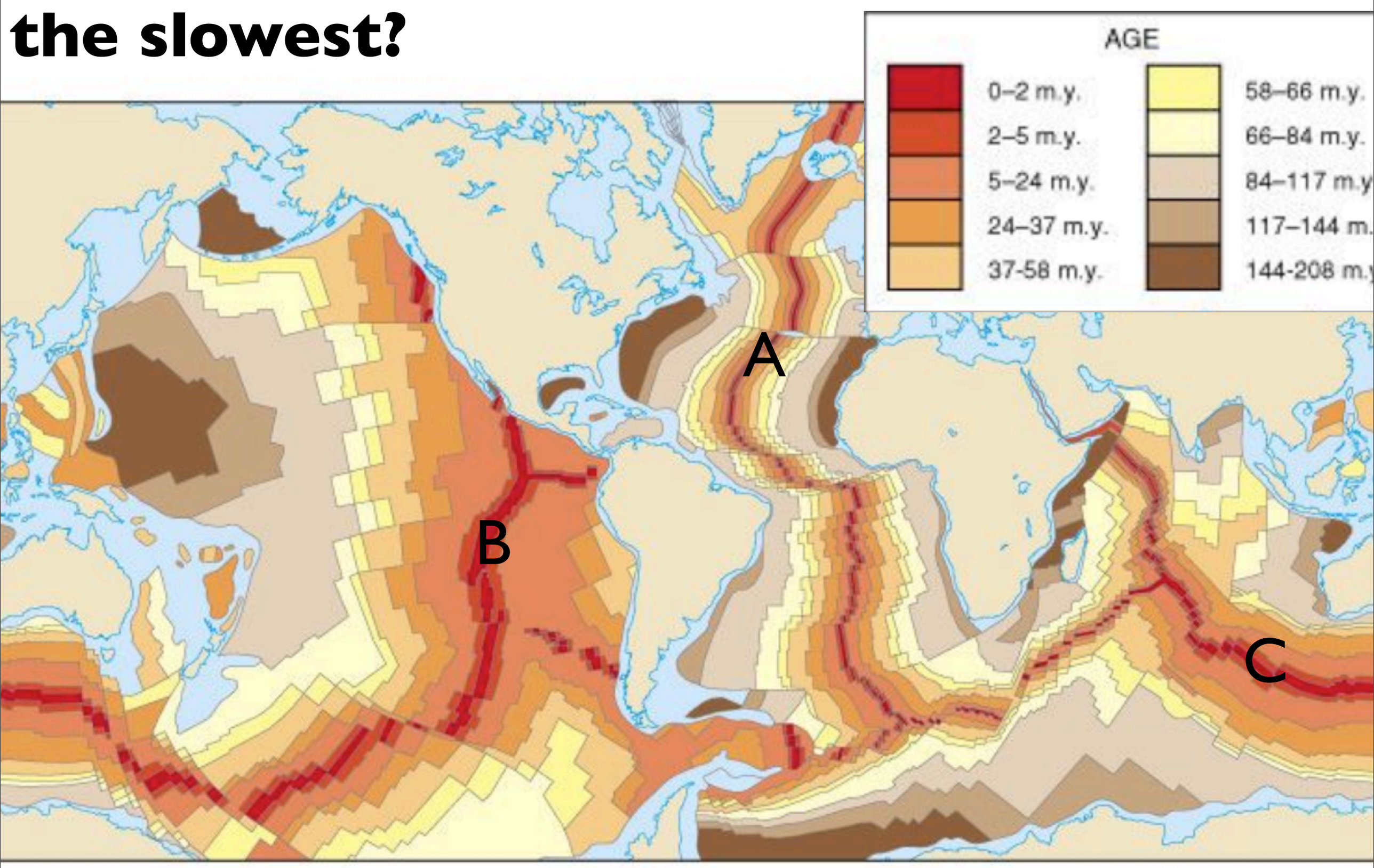
Age of the Sea Floor.
Where is it the youngest and how old is it?
Where is it the oldest and how old is it?



Age of the Sea Floor.
Do all the Ridges look the same? How are they different and what does that tell us?

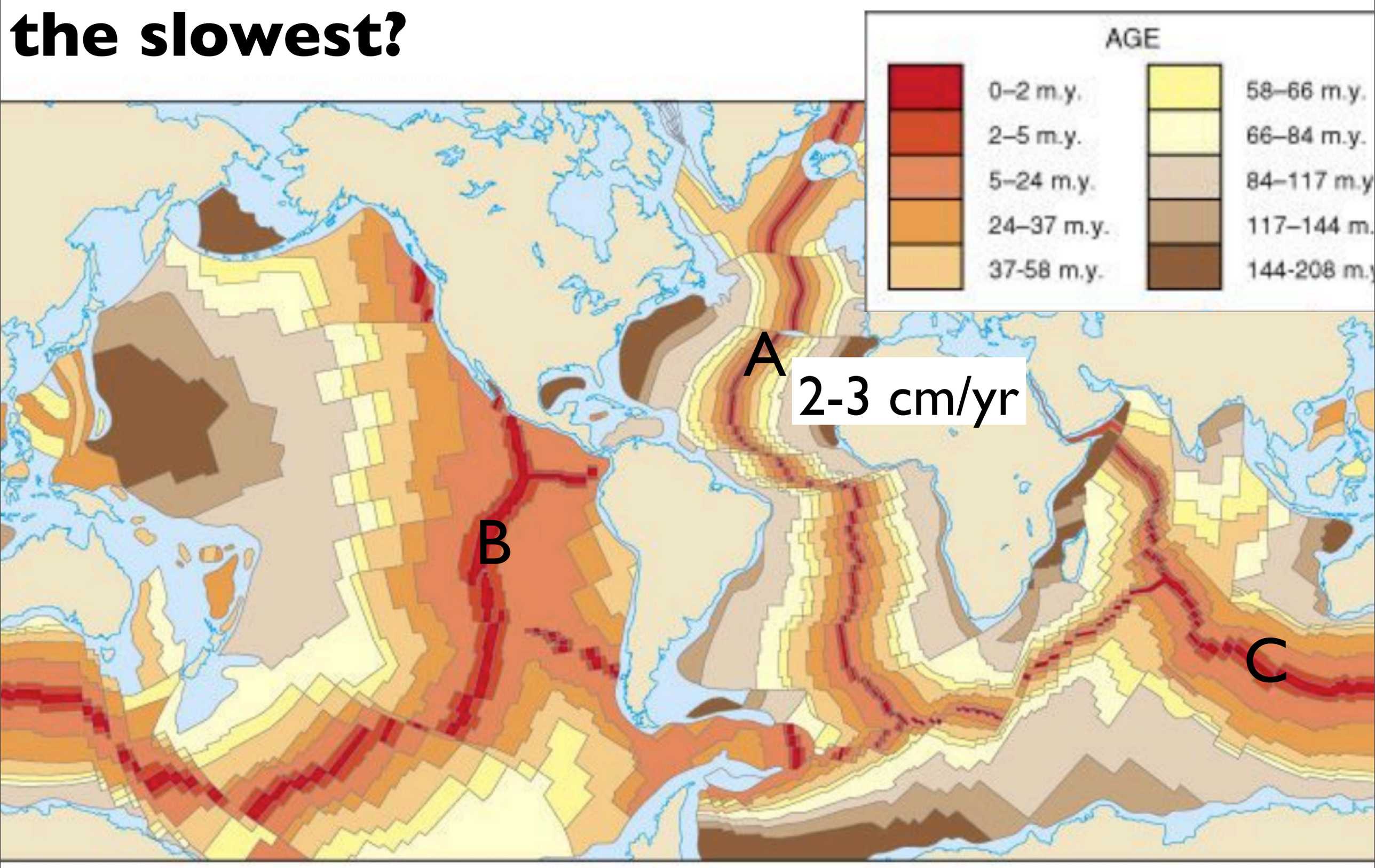


In which location is Sea-floor spreading the slowest?



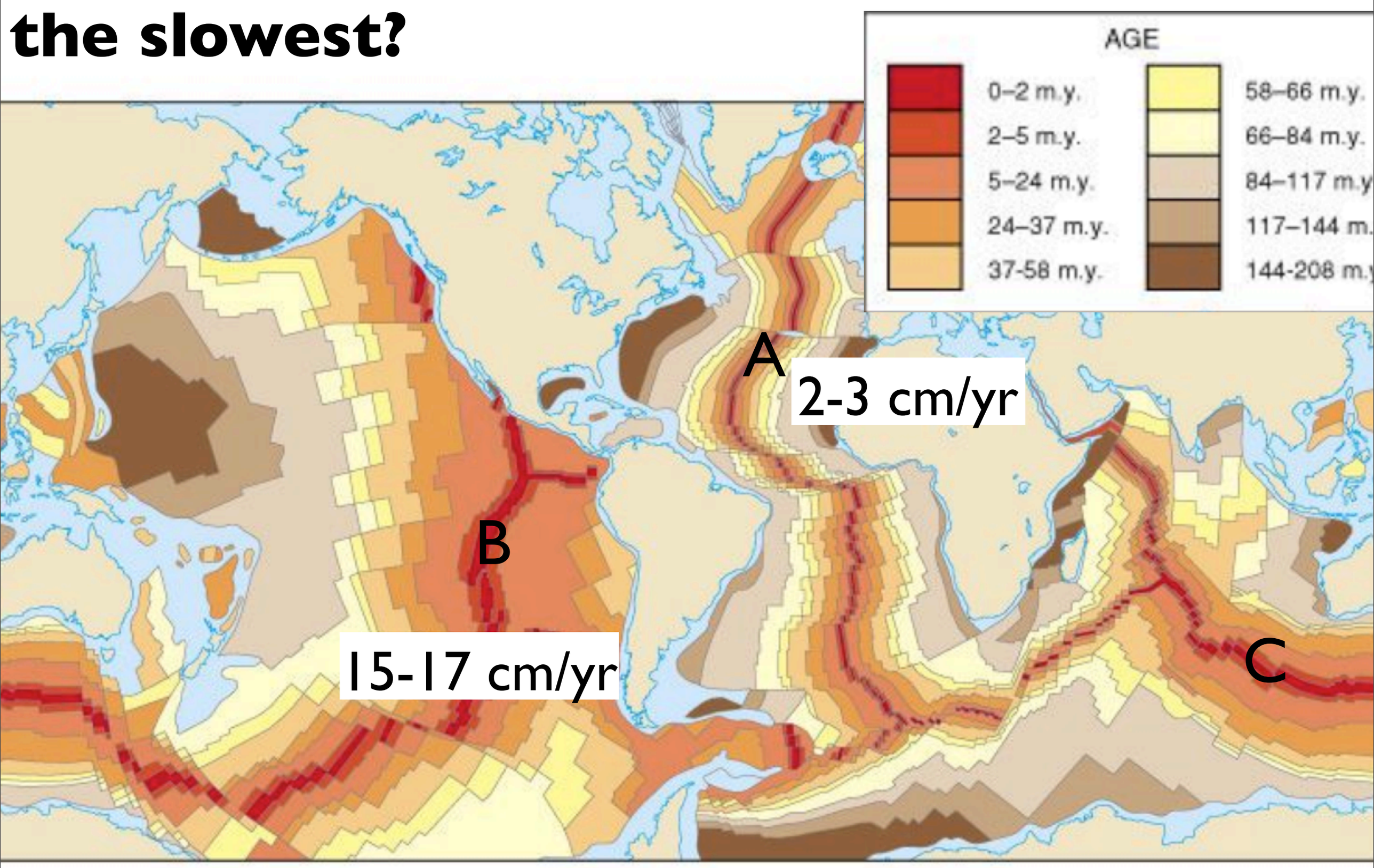
D) All spreading at the same rate

In which location is Sea-floor spreading the slowest?



D) All spreading at the same rate

In which location is Sea-floor spreading the slowest?



D) All spreading at the same rate

No Quiz Next Meeting