

# FUNDAMENTALS OF PLATE TECTONICS

1. Introduction
2. Continental drift
3. Sea-floor spreading
4. Earth's interior
5. Plate boundaries

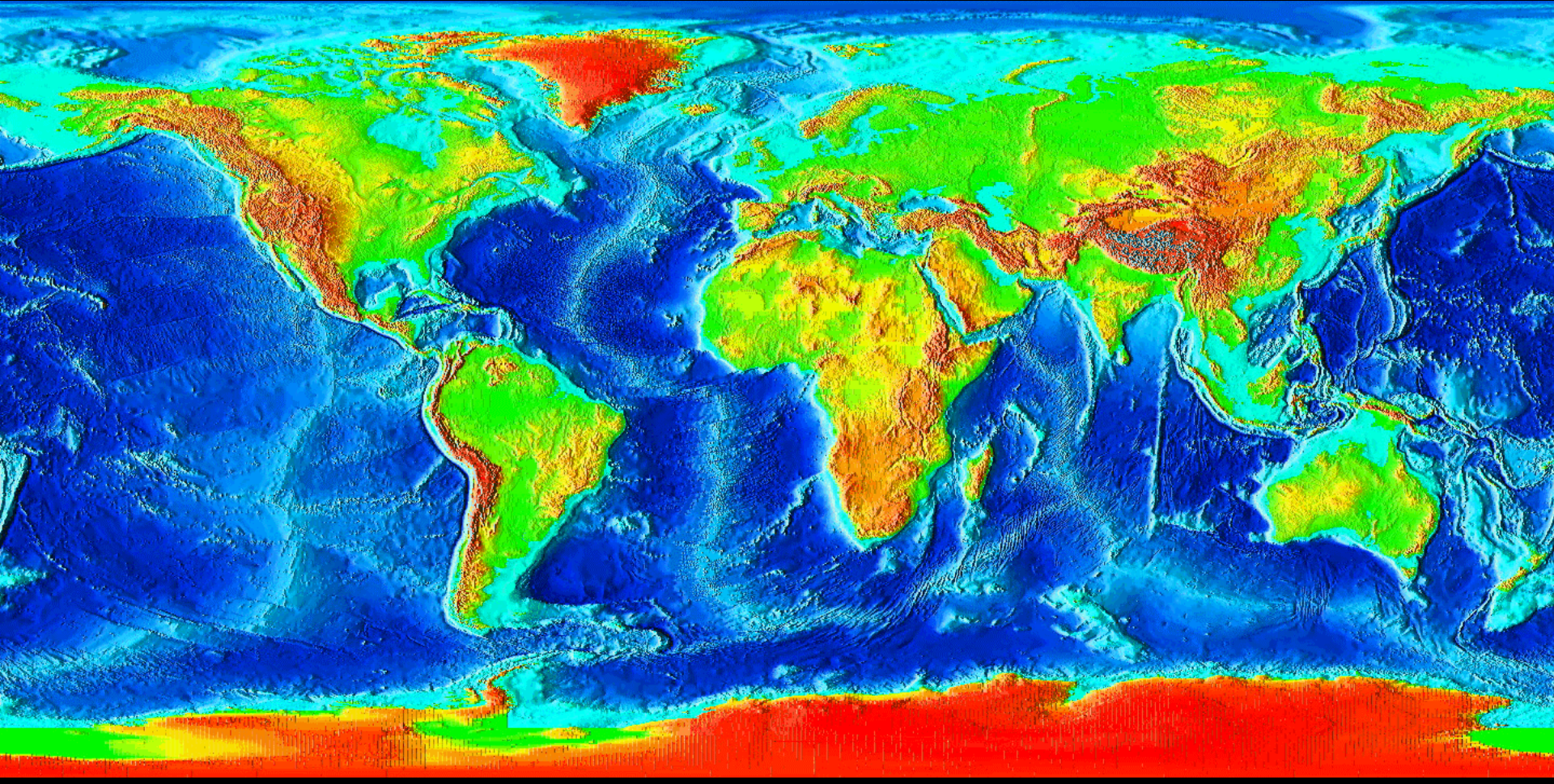
AVANT LA SEPARATION

Graphic from  
1858 book by  
geographer  
Antonio Snider-  
Pellegrini

(Source: USGS website  
*This Dynamic Earth*,  
<http://pubs.usgs.gov/publications/text/historical.html>)

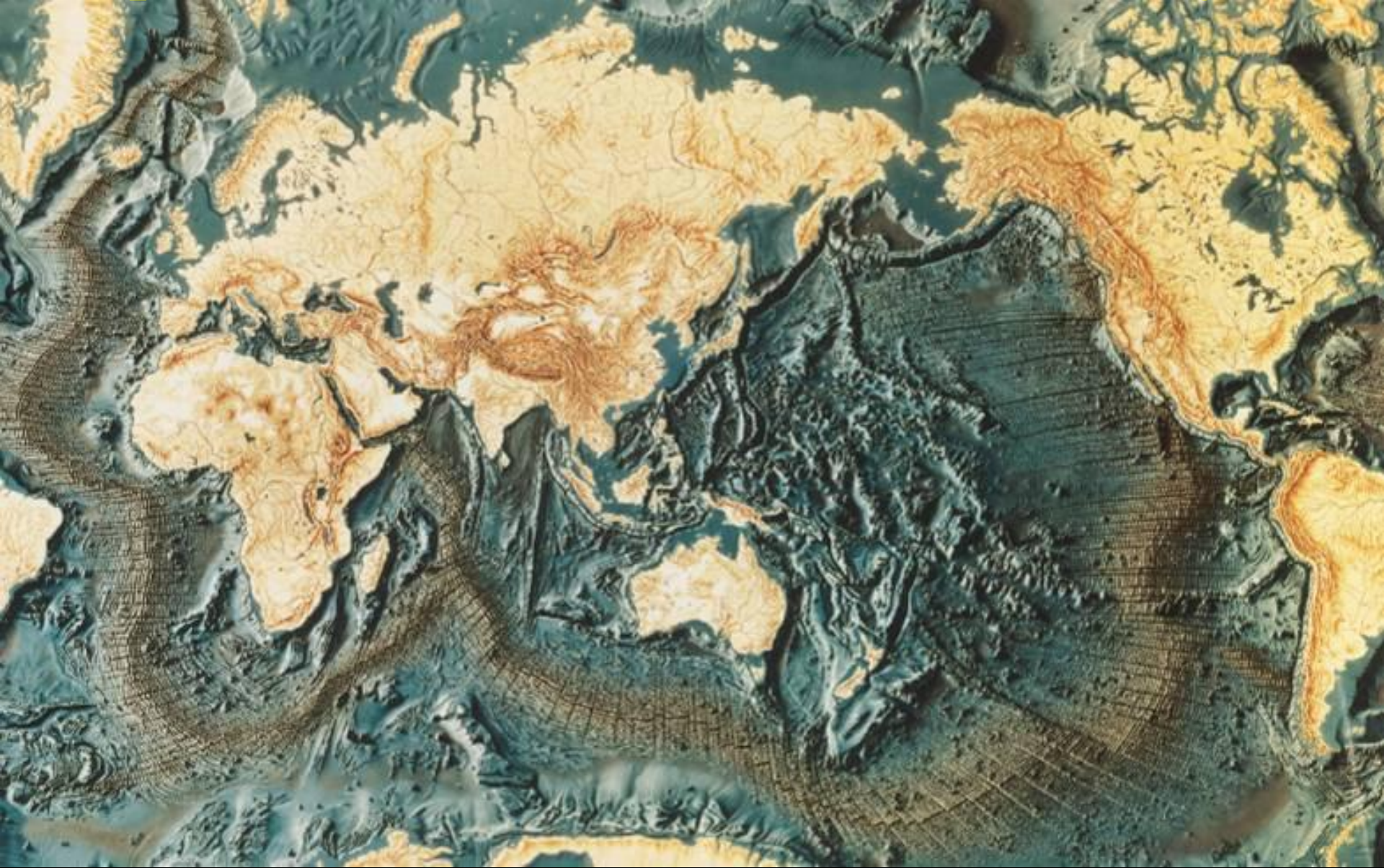


# Map of Global Relief: note mid-ocean ridges

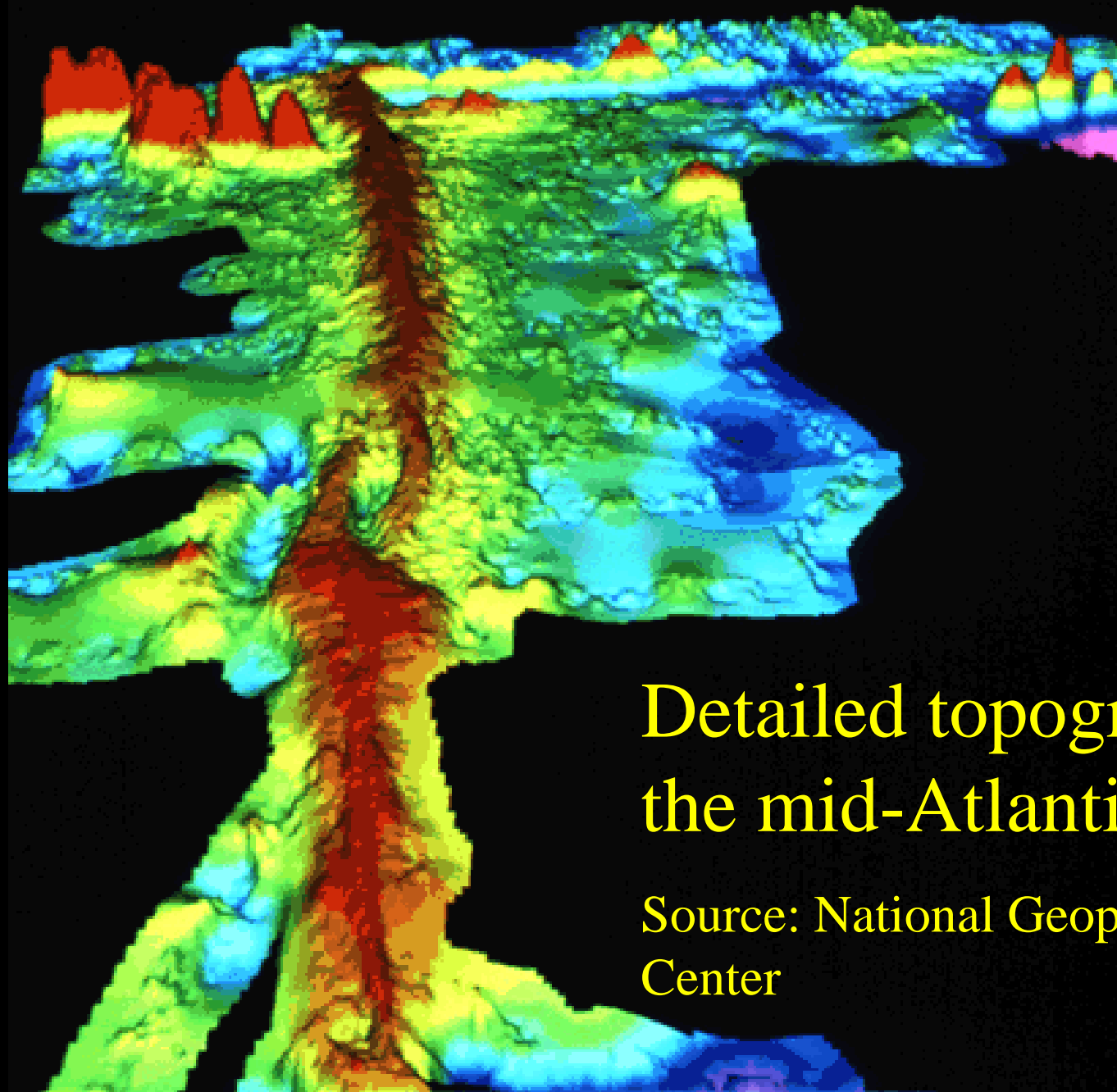


Source: National Geophysical Data Center

# Map of Global Relief: note mid-ocean ridges



Source: Christopherson, 2012, p. 330.

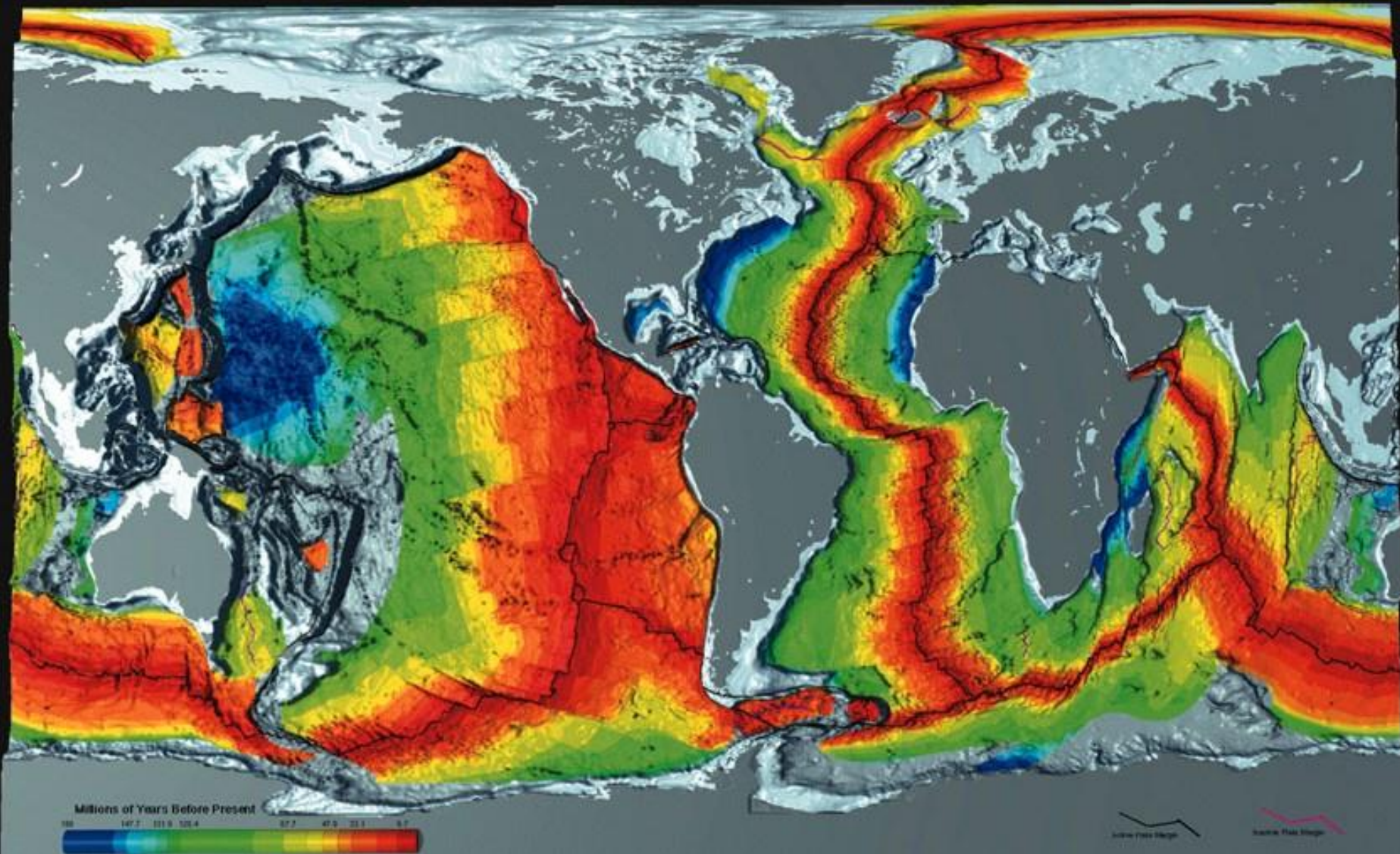


## Detailed topography of the mid-Atlantic ridge

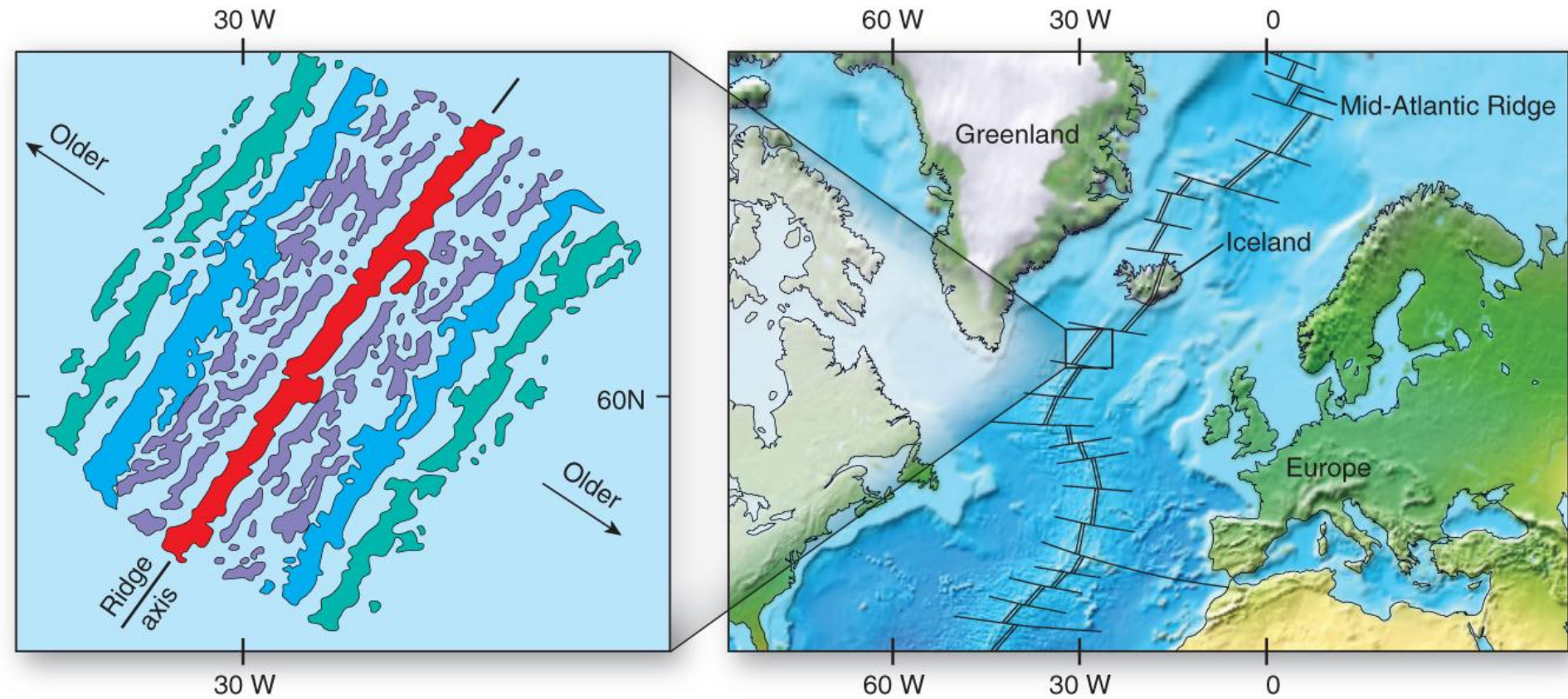
Source: National Geophysical Data  
Center

# Age of the Ocean Floor

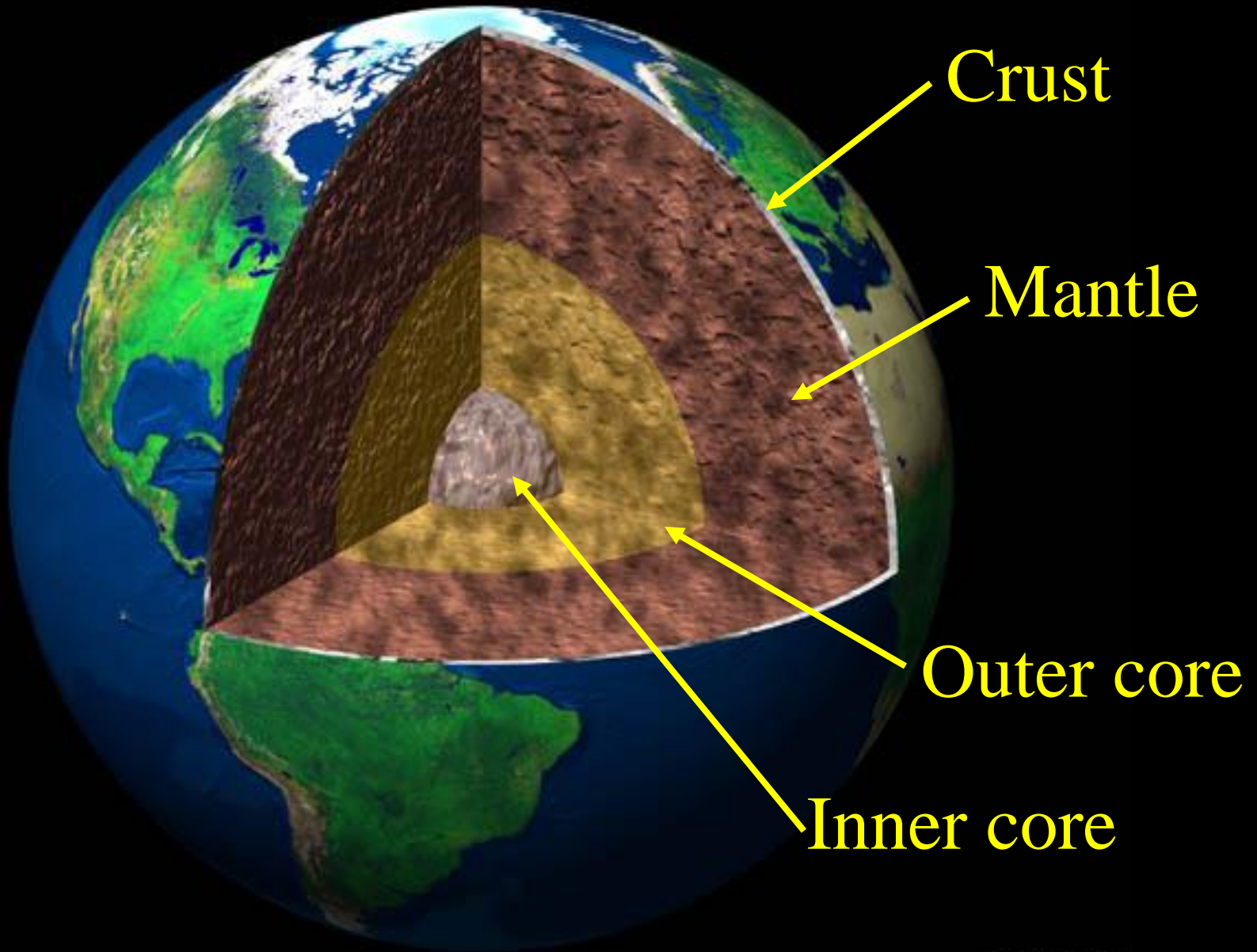
Source: National Geophysical Data Center



# Paleomagnetism provides evidence of sea-floor spreading. Source: Christopherson, 2012, p. 317.

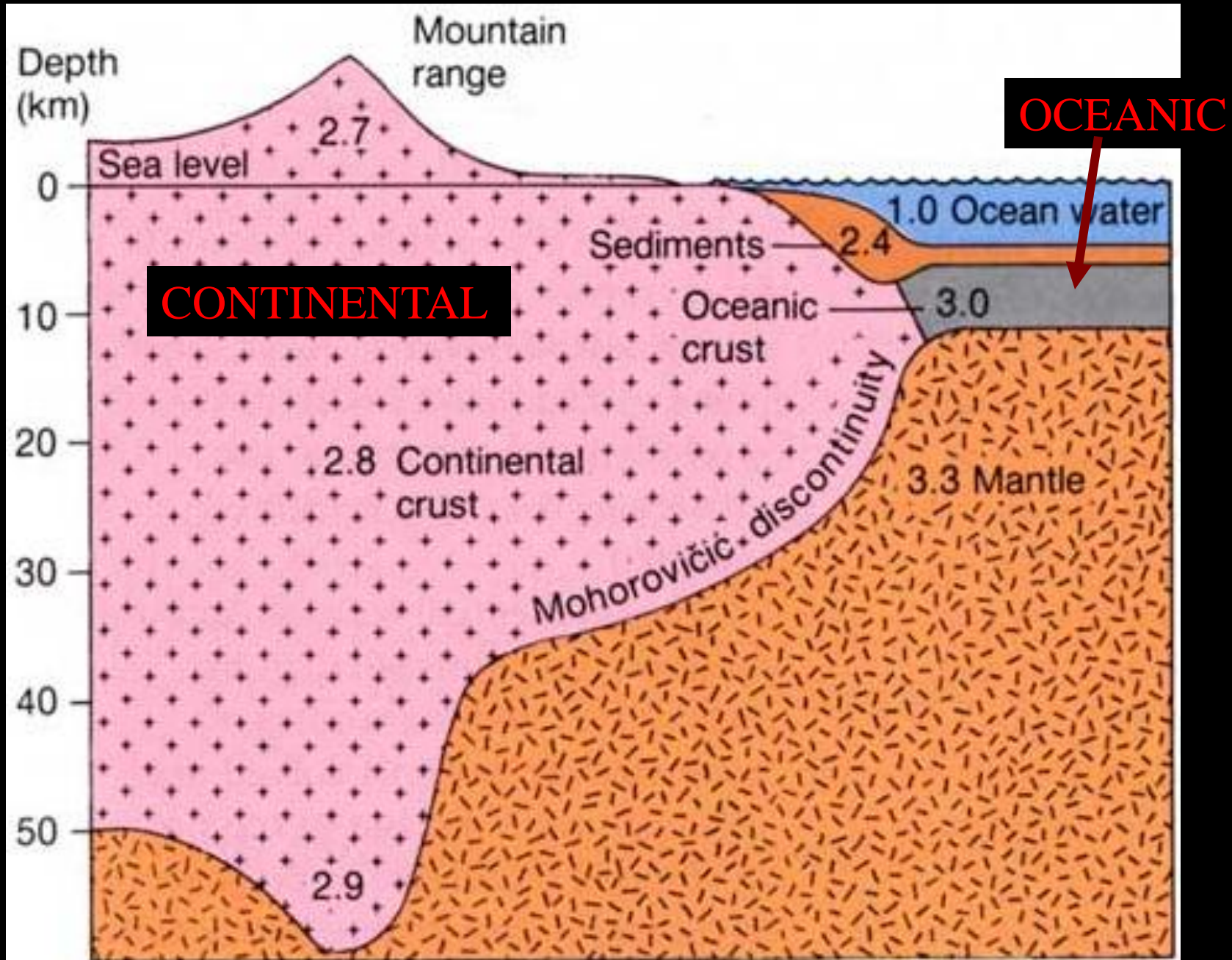


# Earth's Interior: crust vs. mantle

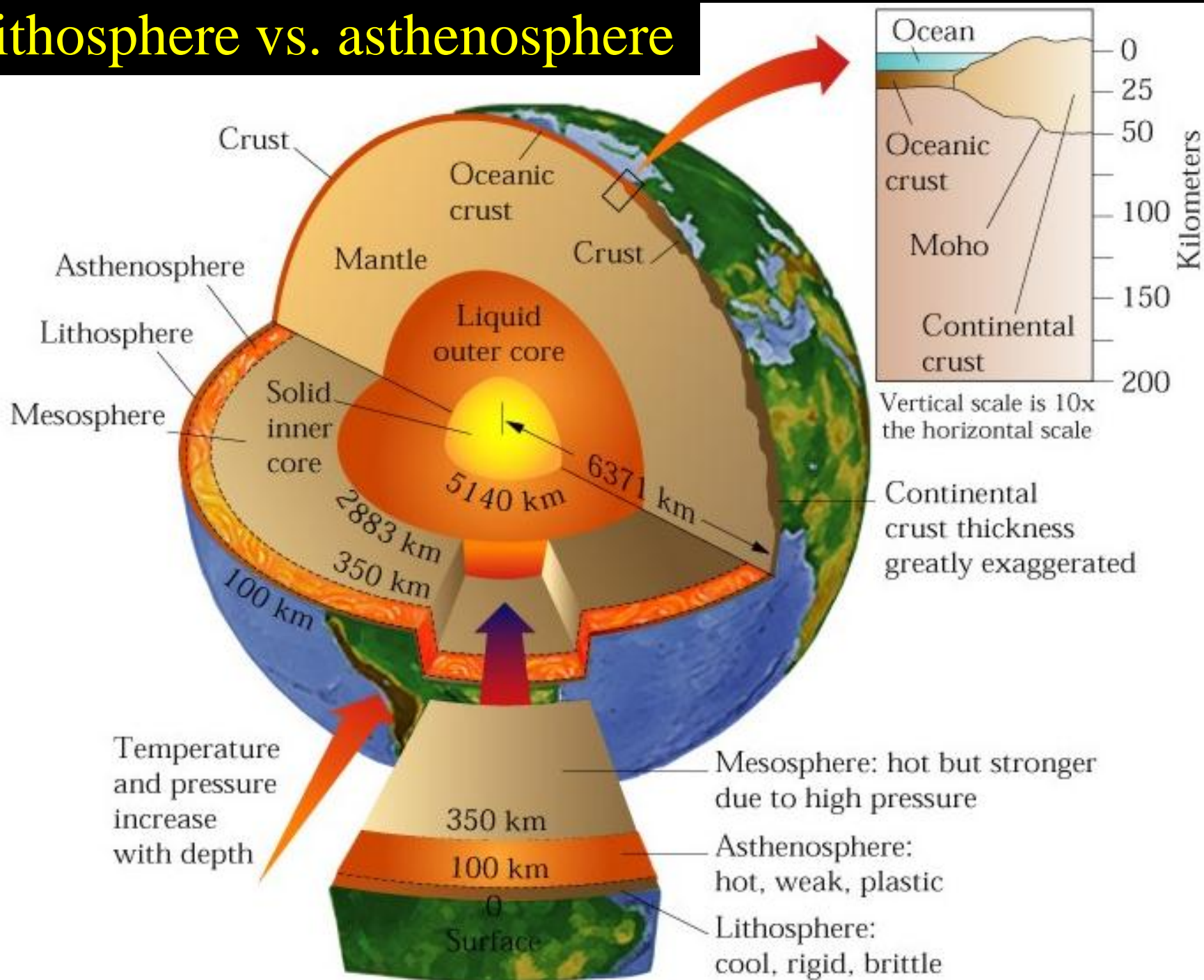




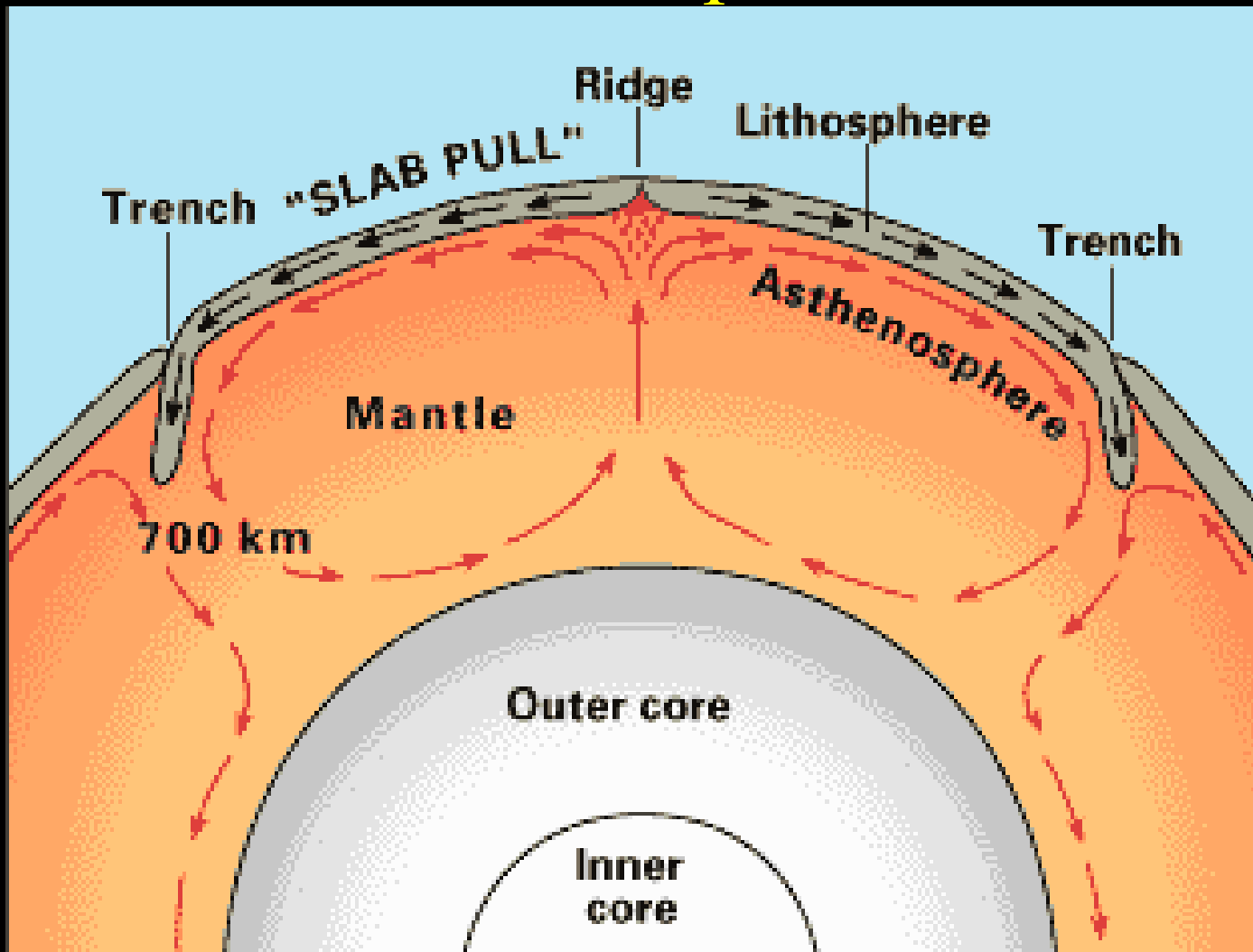
# Continental vs. oceanic crust



# Lithosphere vs. asthenosphere



# Convection currents in the mantle drive plate motion over the asthenosphere...somehow



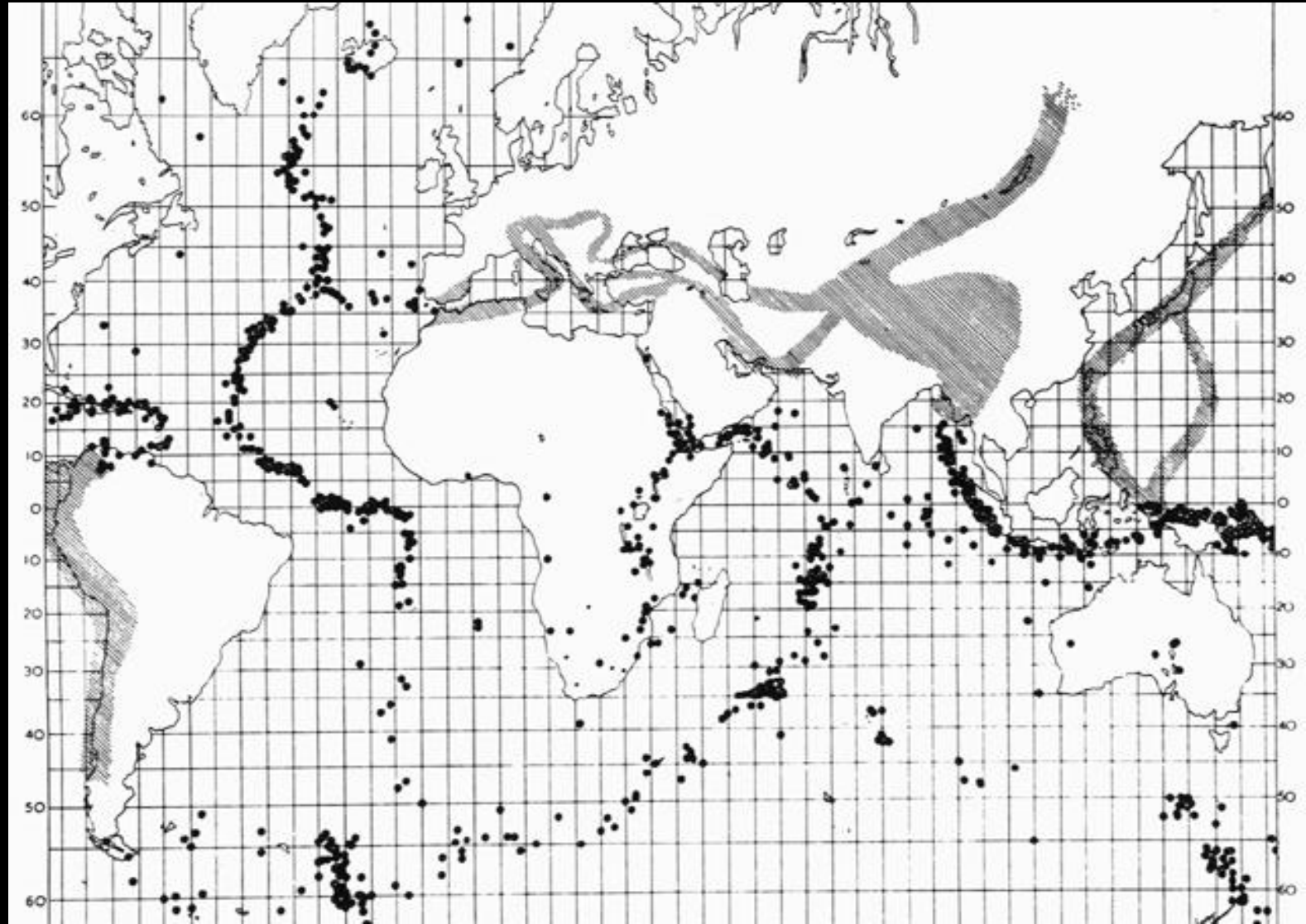
(Source: USGS website *This Dynamic Earth*,  
<http://pubs.usgs.gov/publications/text/historical.html>)

This provides a plausible mechanism for continental drift.....

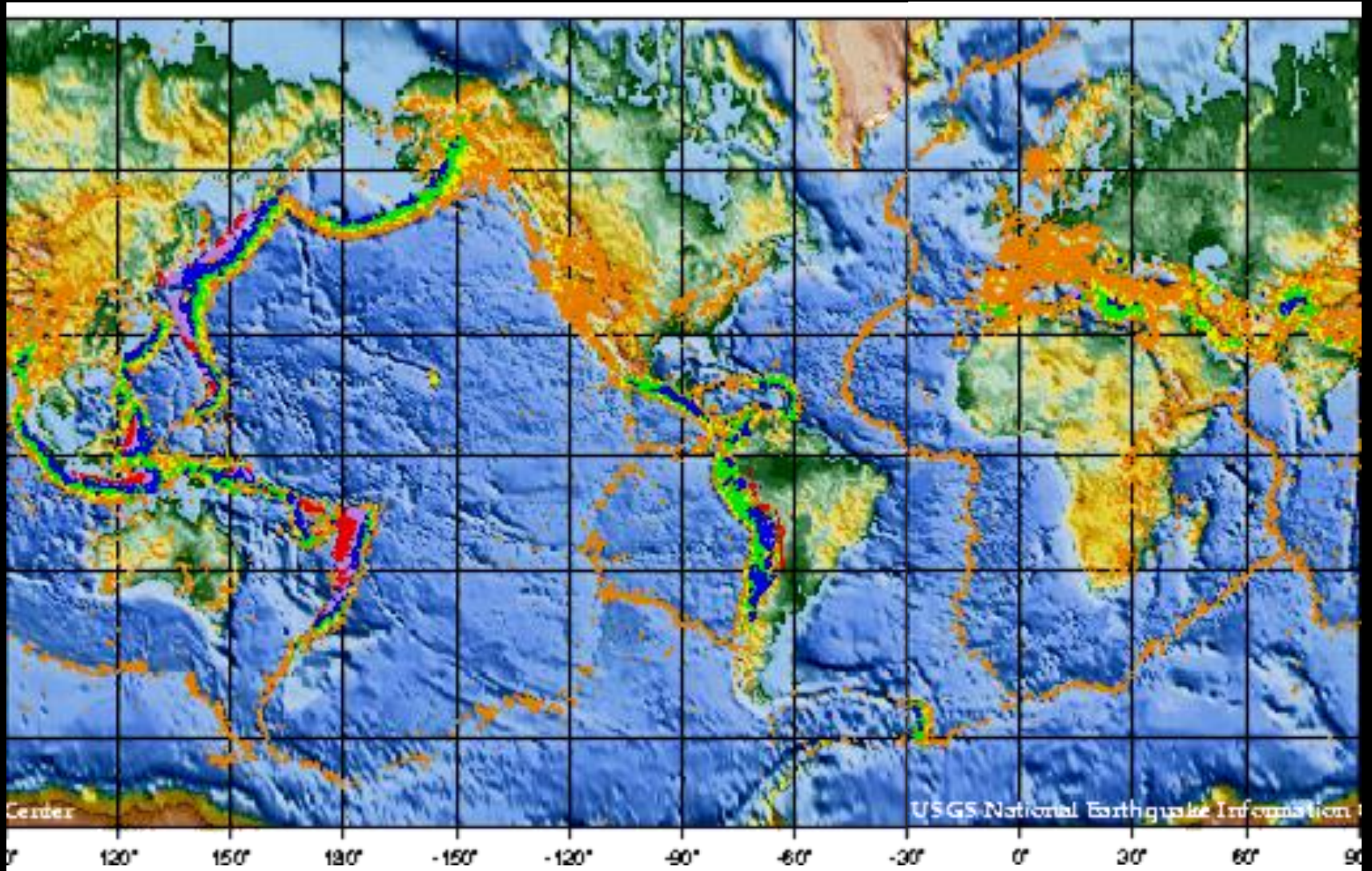
(cue animation)

# 1954 earthquake map by J.P. Rothe

Source: USGS website *This Dynamic Earth*,  
<http://pubs.usgs.gov/publications/text/historical.html>

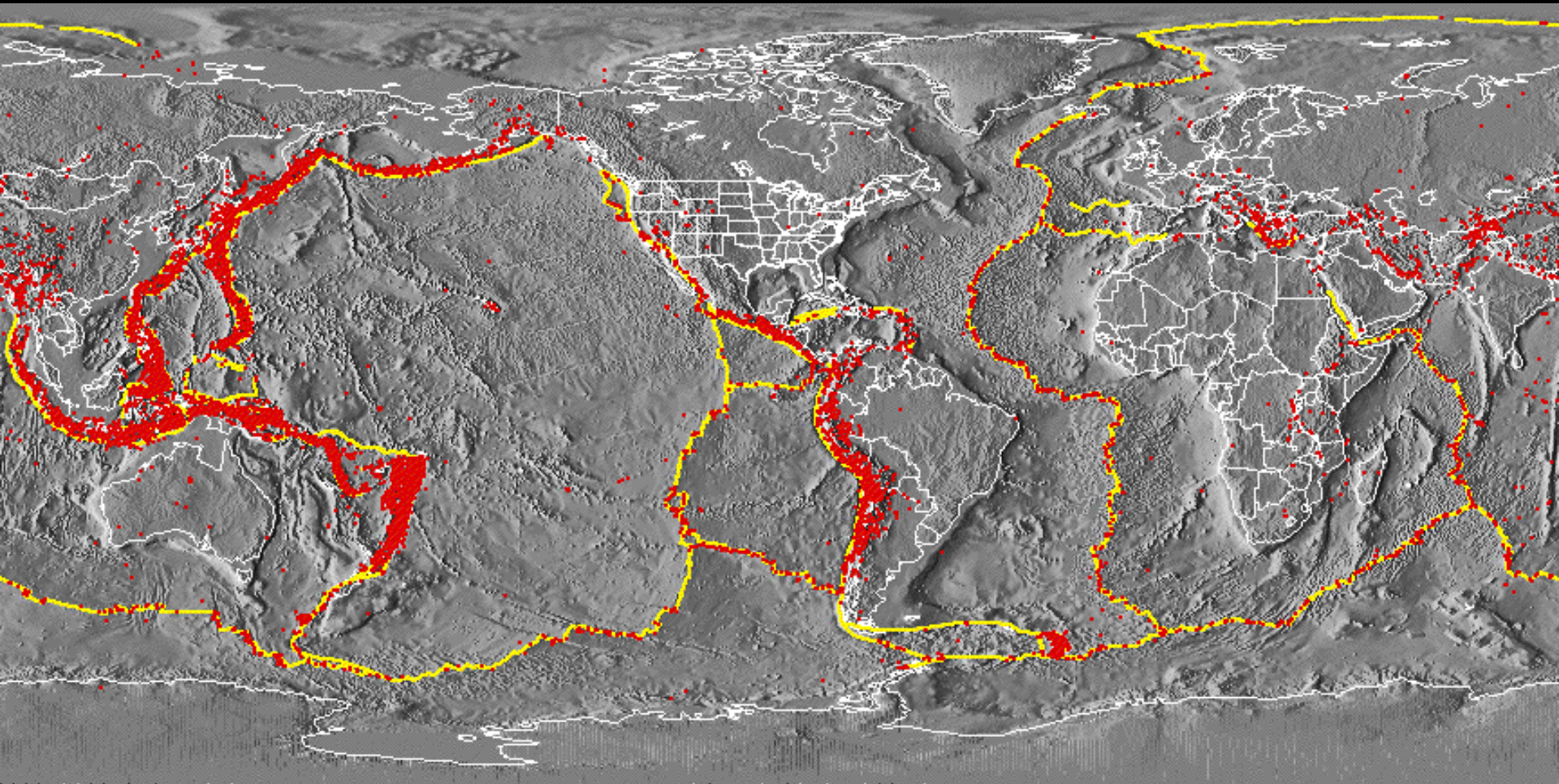


# Map of world seismicity, 1990-2000.

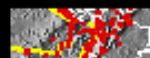


Source: USGS National Earthquake Information Center.

# Map of global earthquake epicenters, 1980-1990

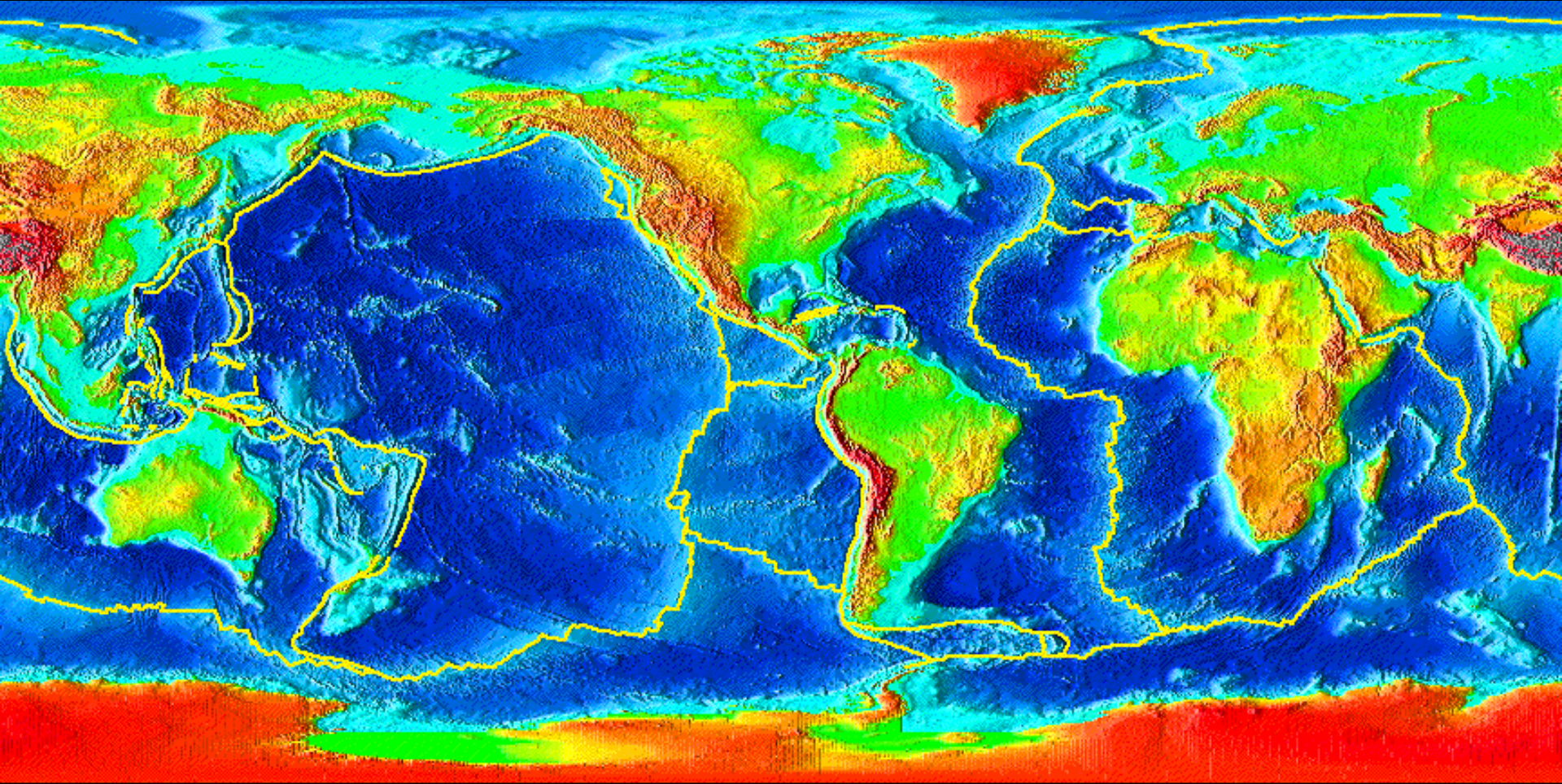


Crustal Plate Boundaries



Earthquake Epicenters,  $M > 5$ , 1980-1990  
Coastlines, Political Boundaries

# Map of Tectonic Plate Boundaries

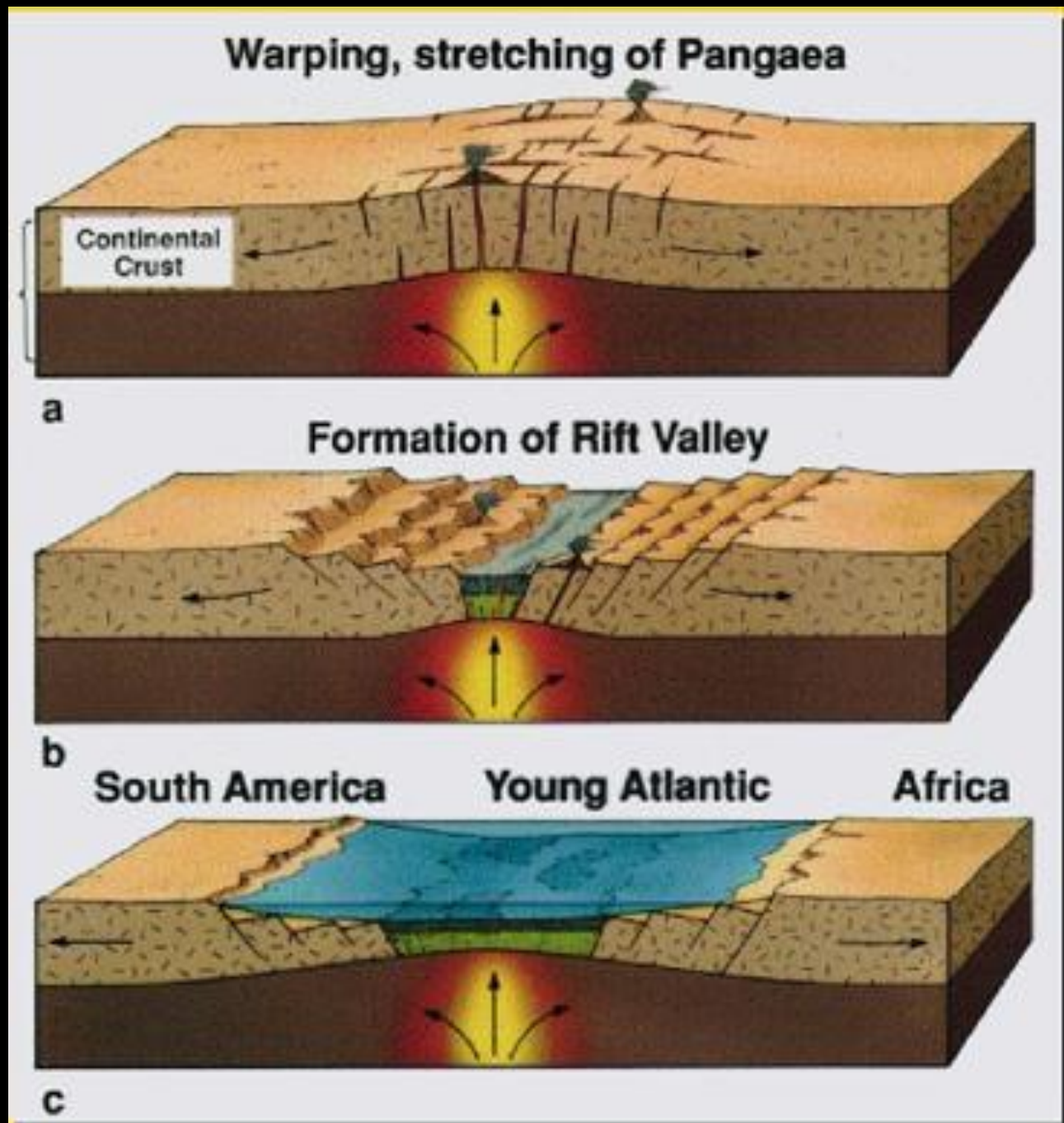


Source: National Geophysical Data Center.

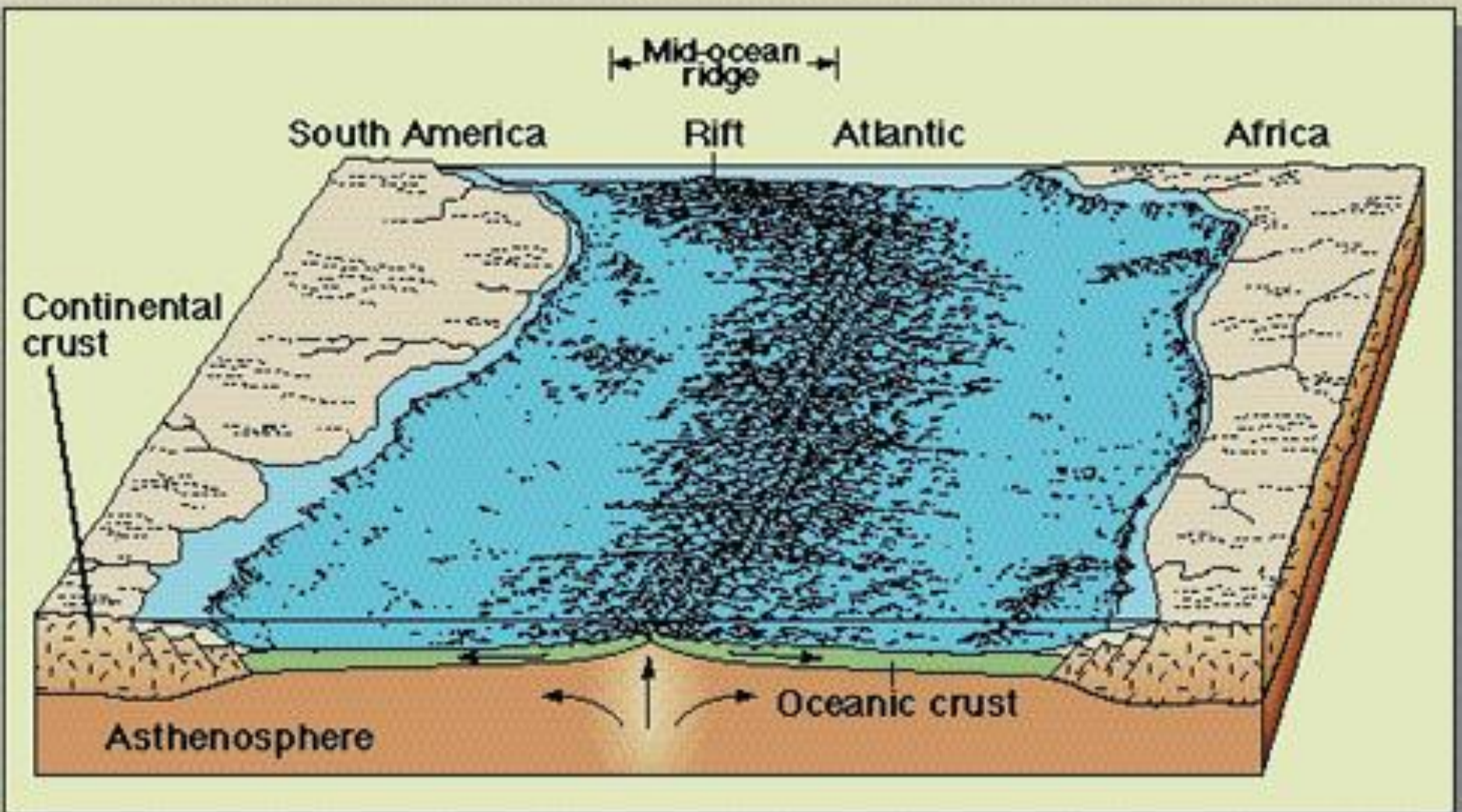


# Types of plate boundaries

# Divergent Plate Boundaries

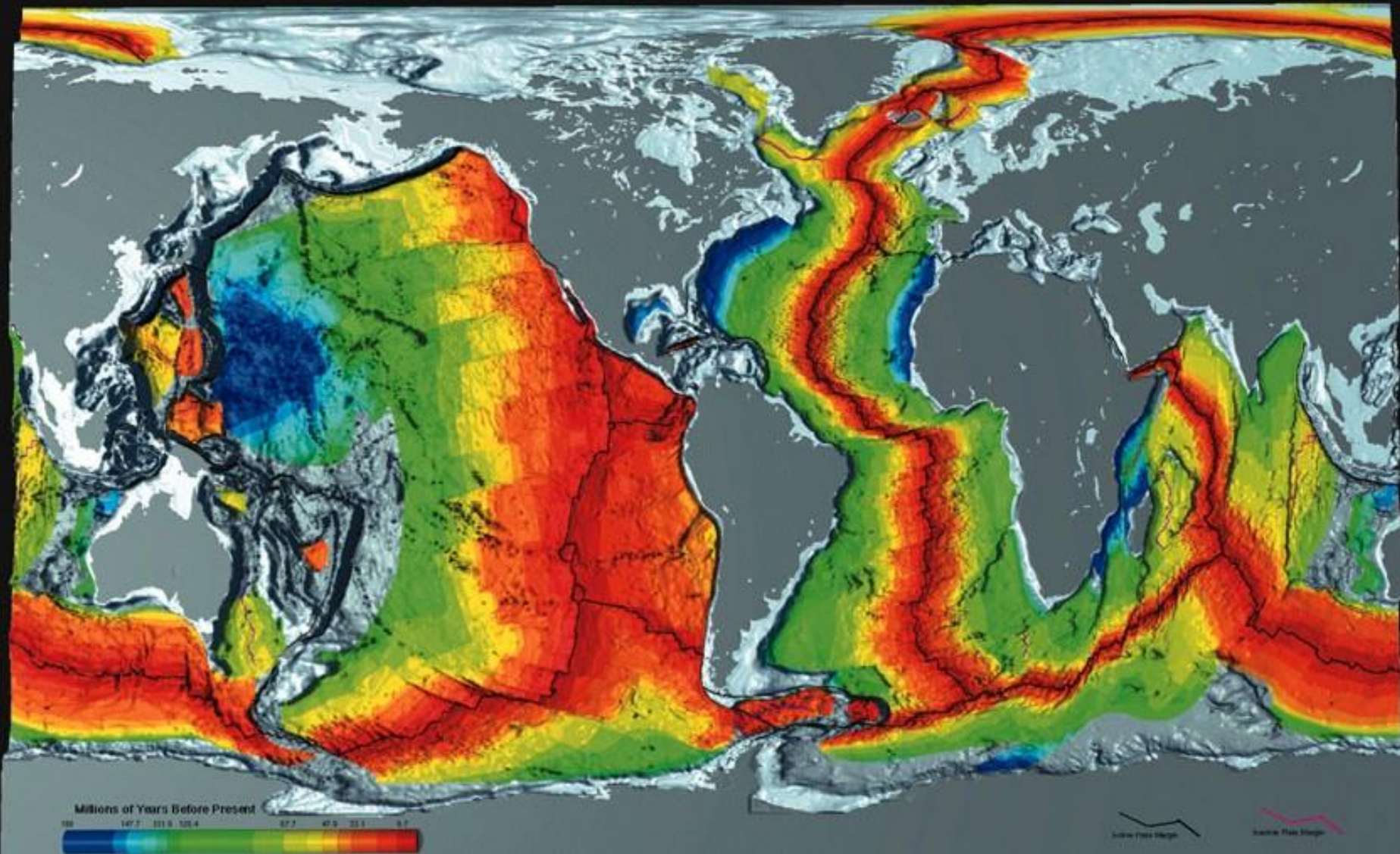


# Model of the South Atlantic Ocean

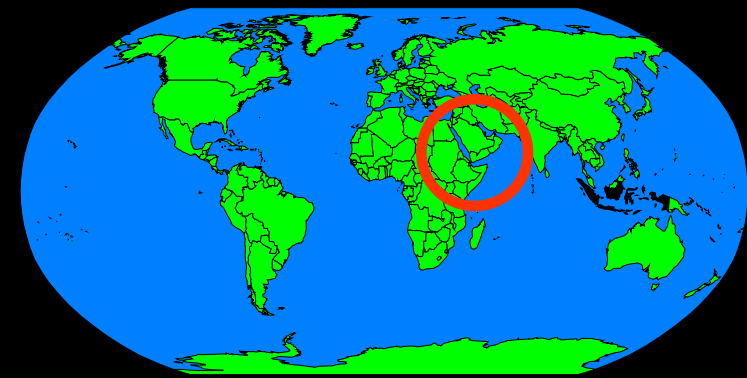
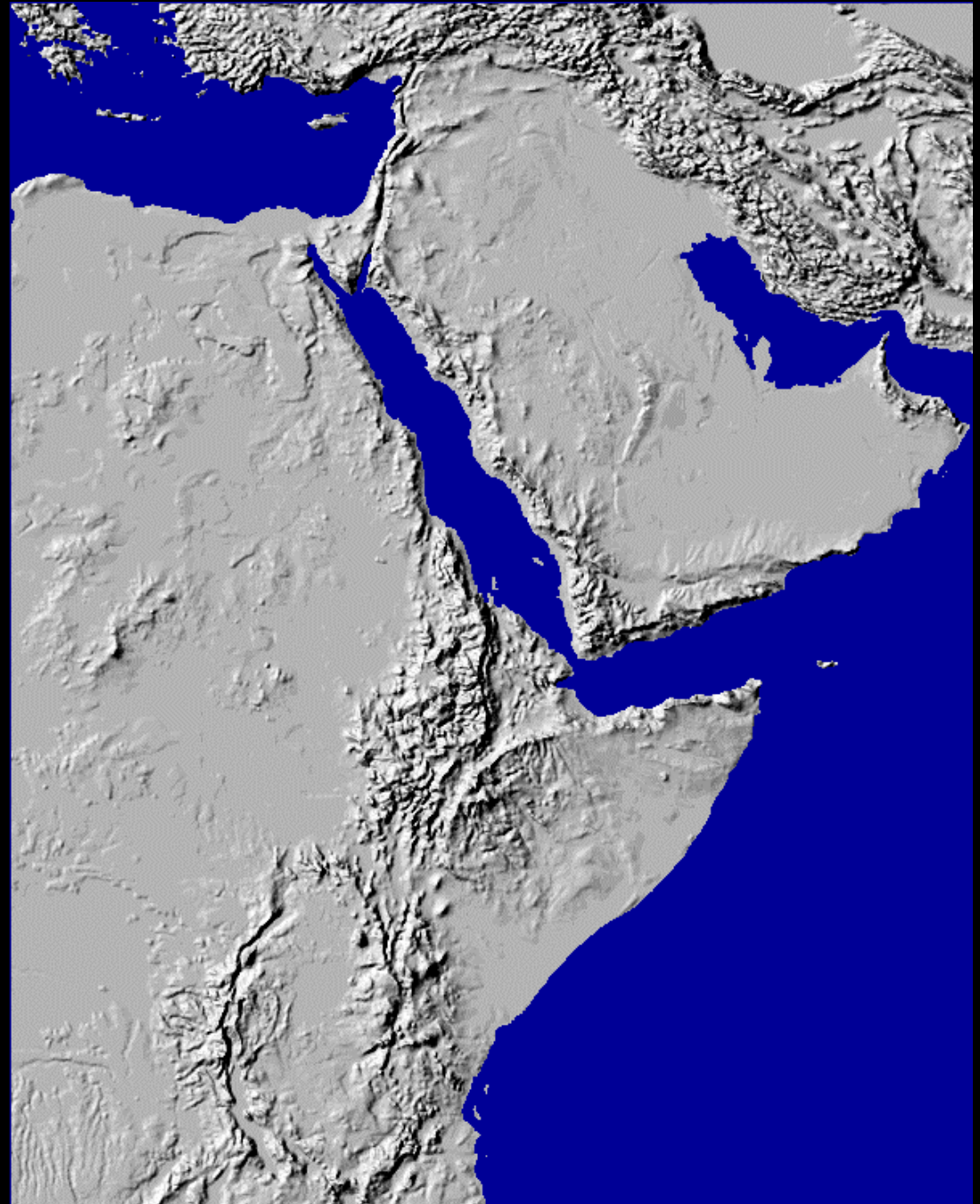


# Age of the Ocean Floor

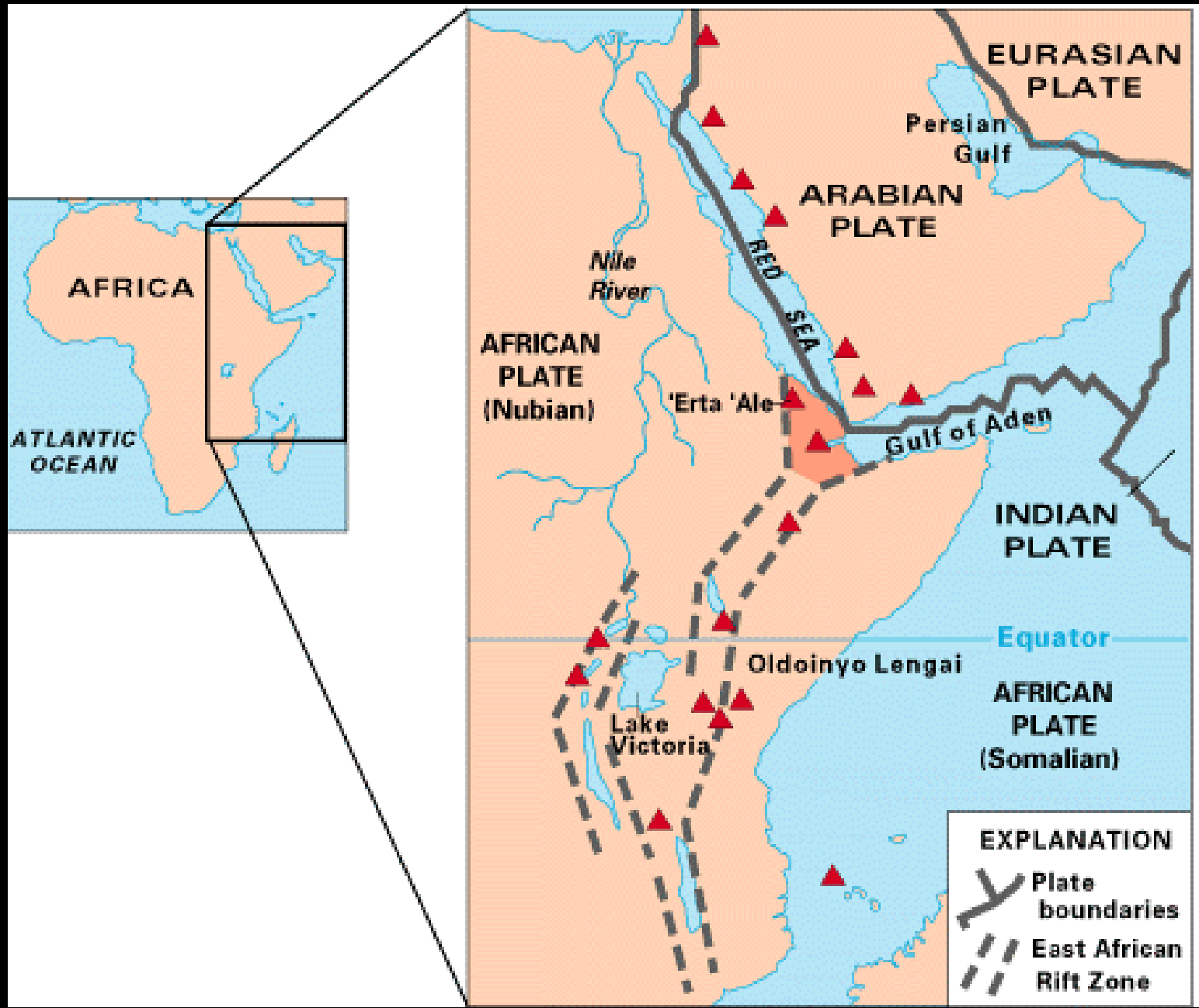
Source: National Geophysical Data Center



# The East African Rift Valley- An Example of a Divergent Plate Boundary

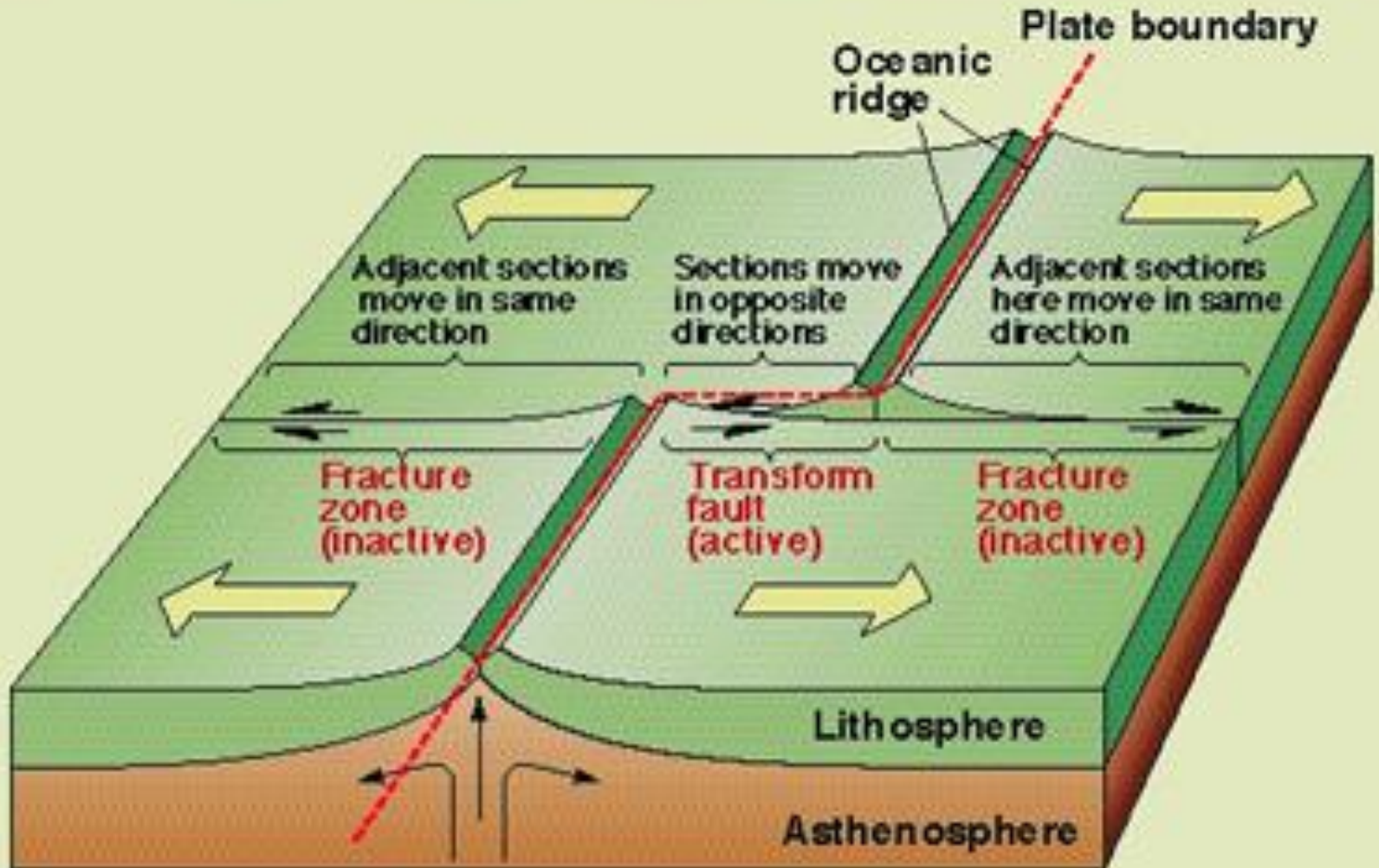


# Active East African Volcanoes

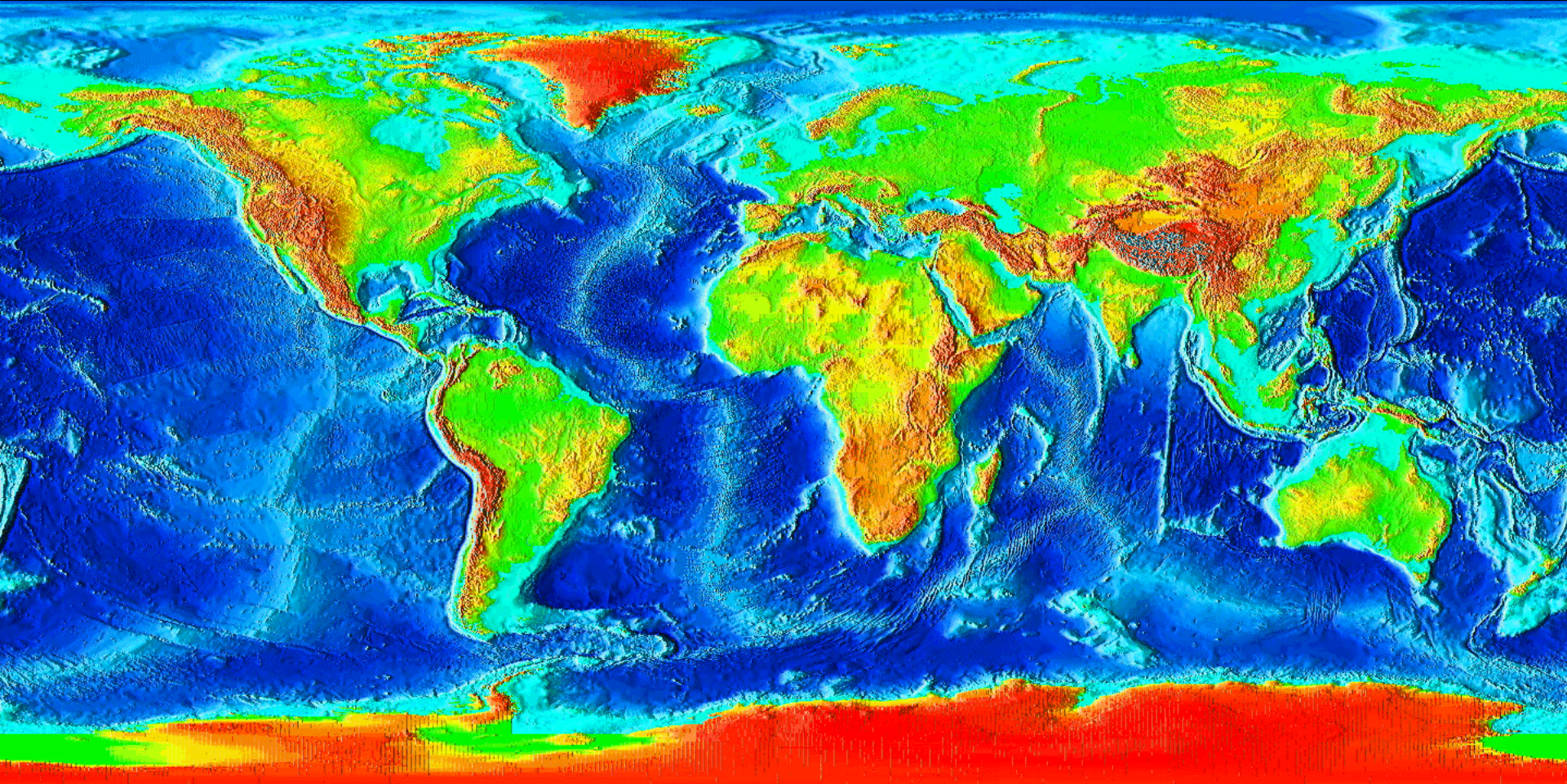


# Transform Faults

## An Oceanic Ridge Segment



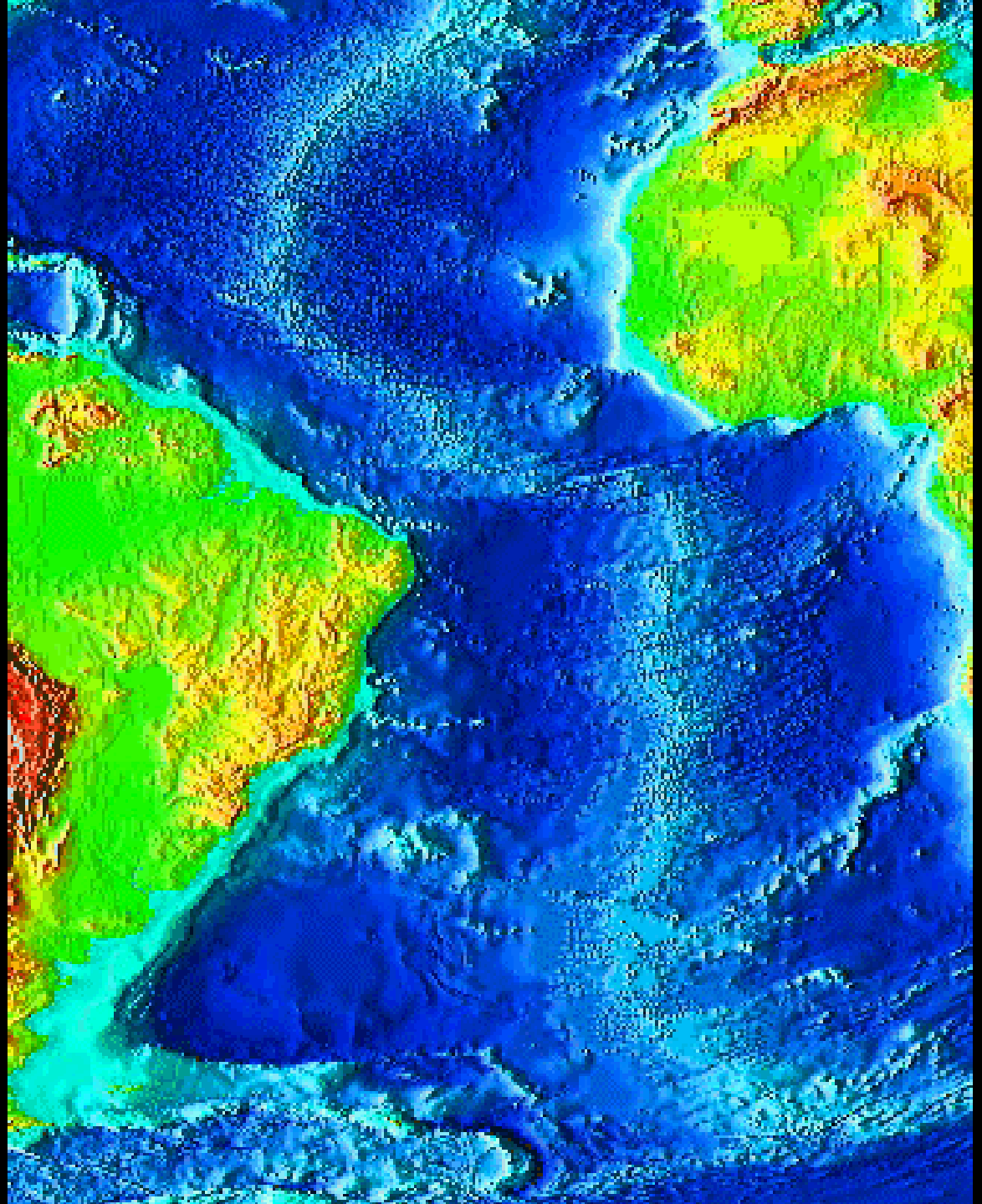
# Map of Global Relief



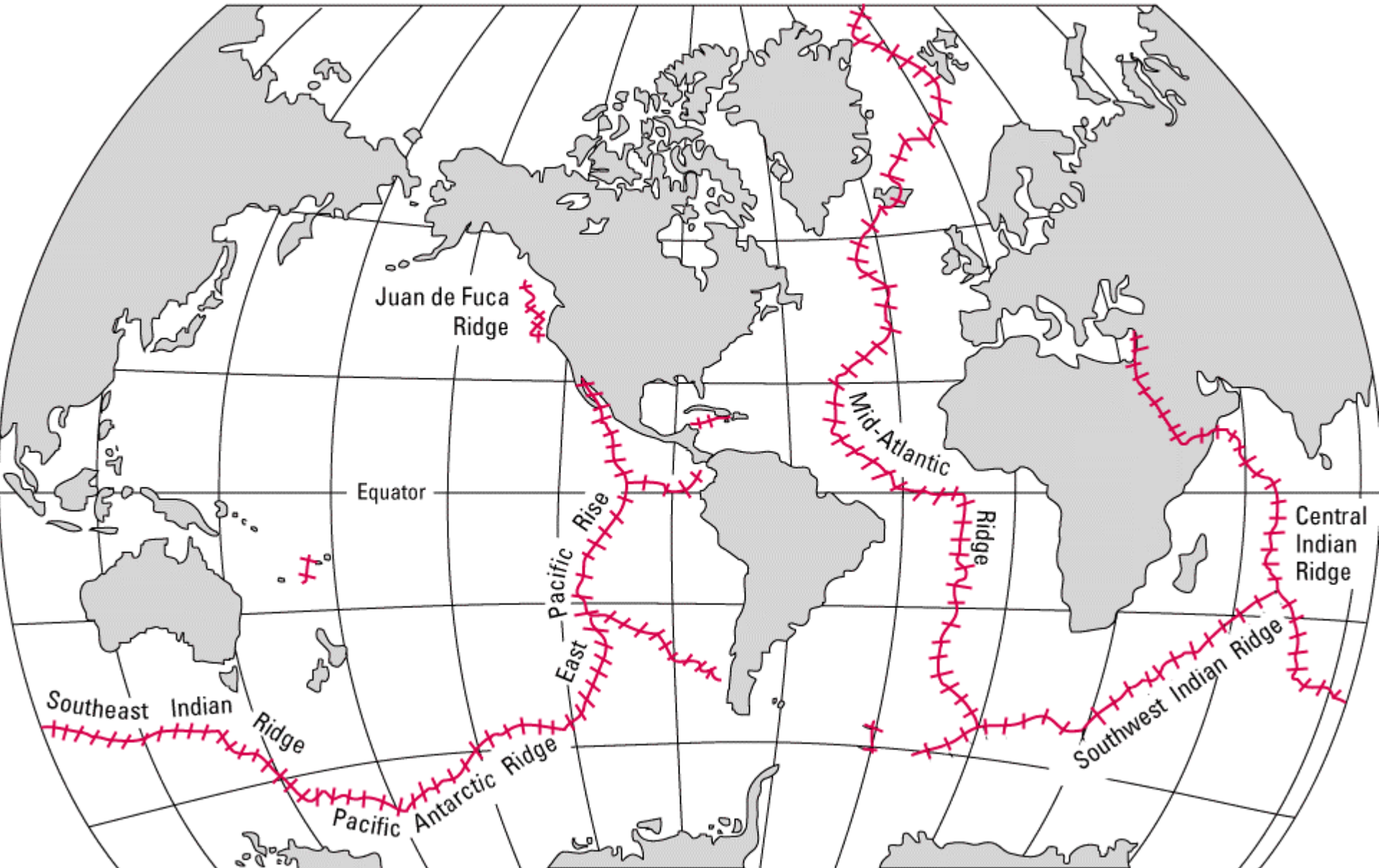
Source: National Geophysical Data Center



# Transform faults in the mid-Atlantic Ridge

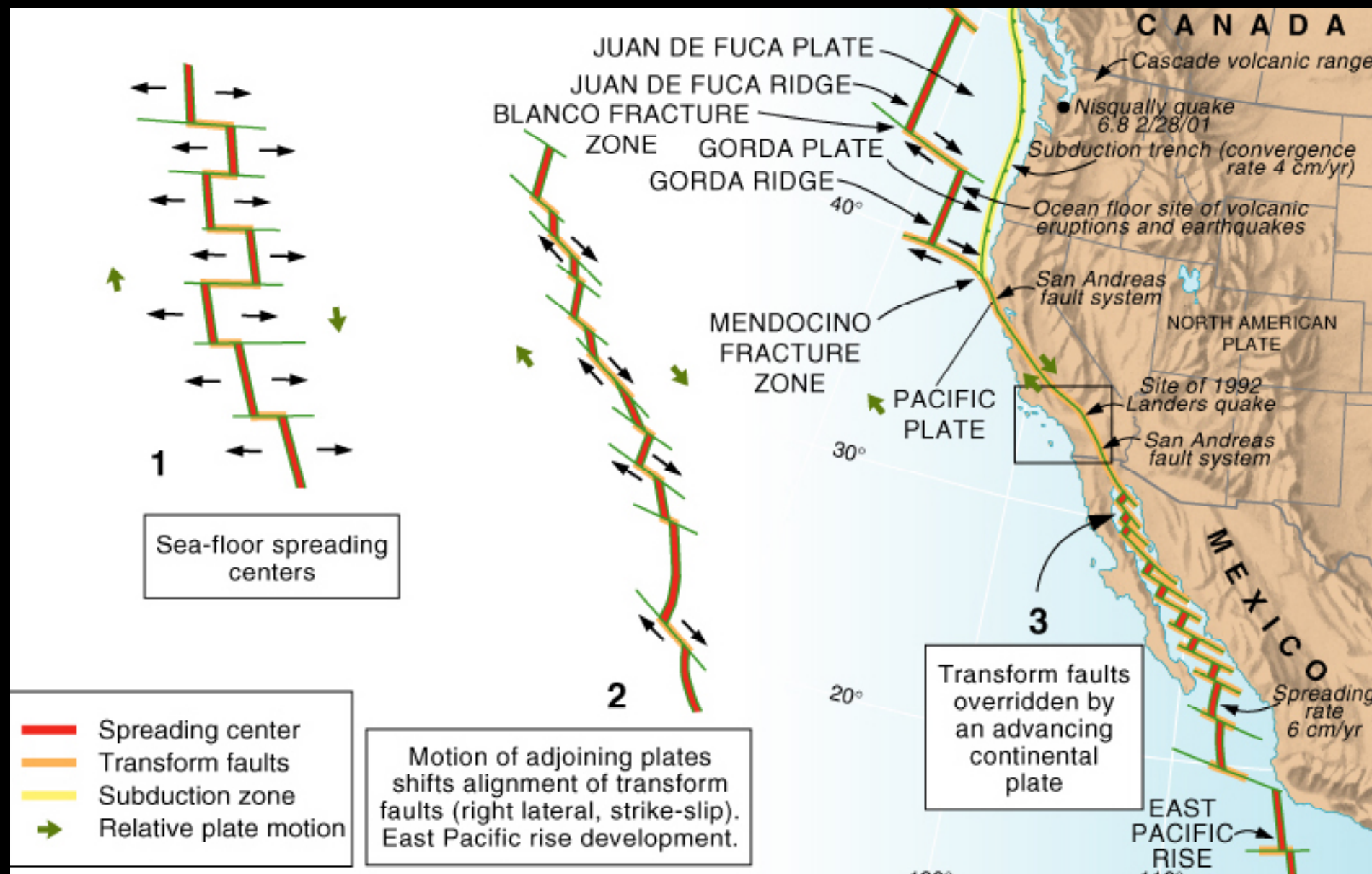


# Map of Mid-Ocean Ridges



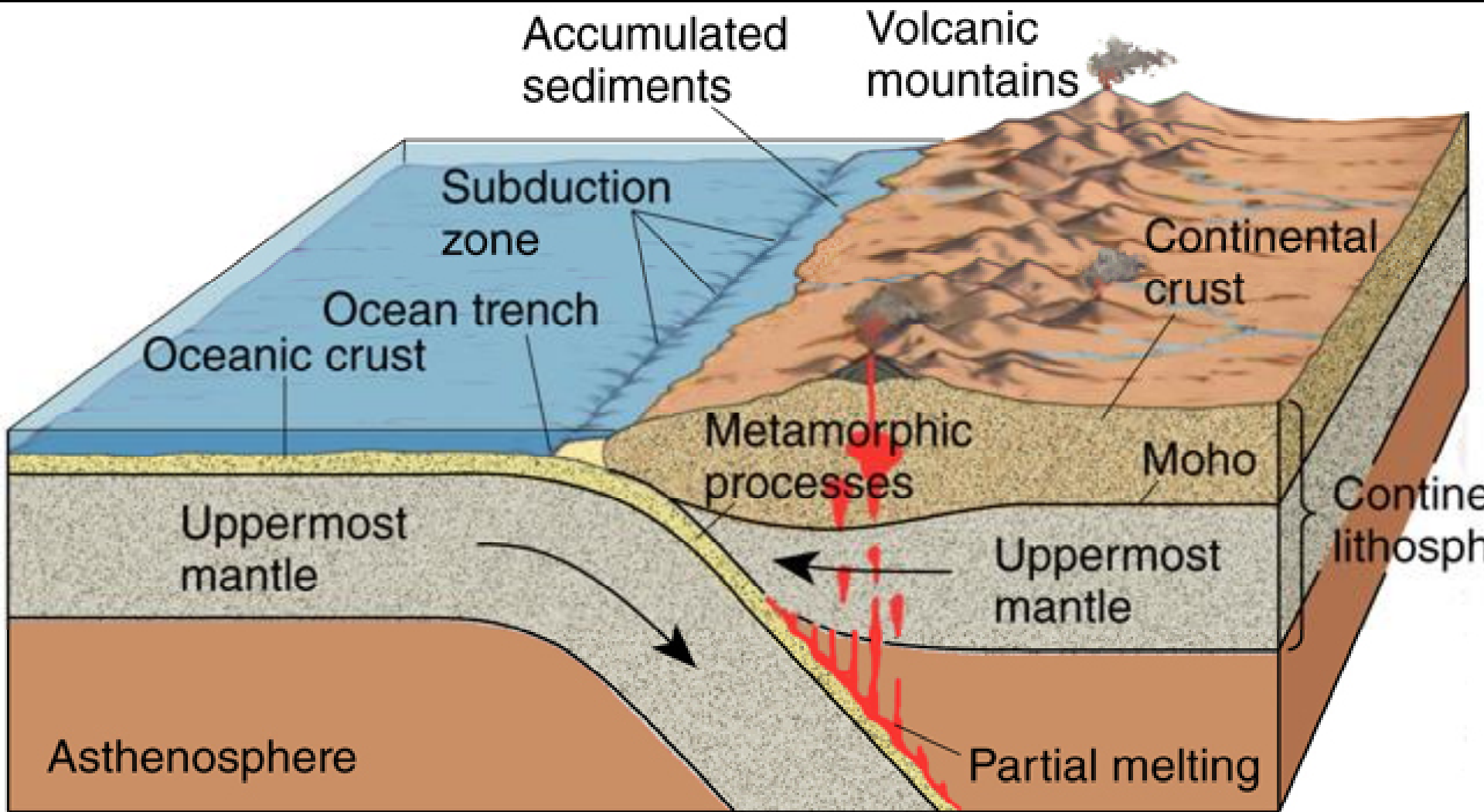
# The San Andreas Fault- An Example of a Transform Fault.

Source: Christopherson, 2012, p. 344.



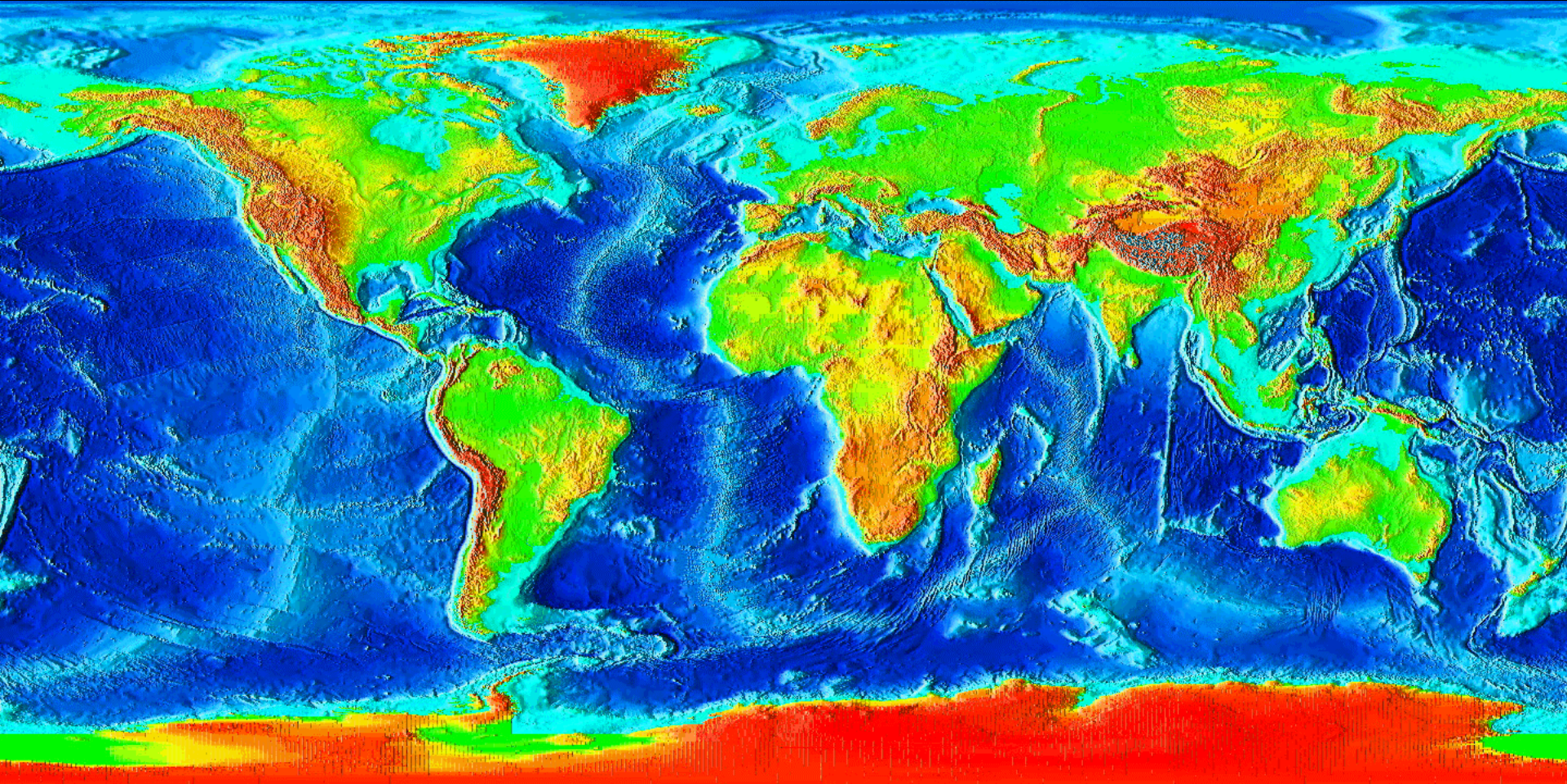
# Ocean-Continent Convergence (subduction).

Source: Christopherson, 2012, p. 346.



Example: South America and the Andes.

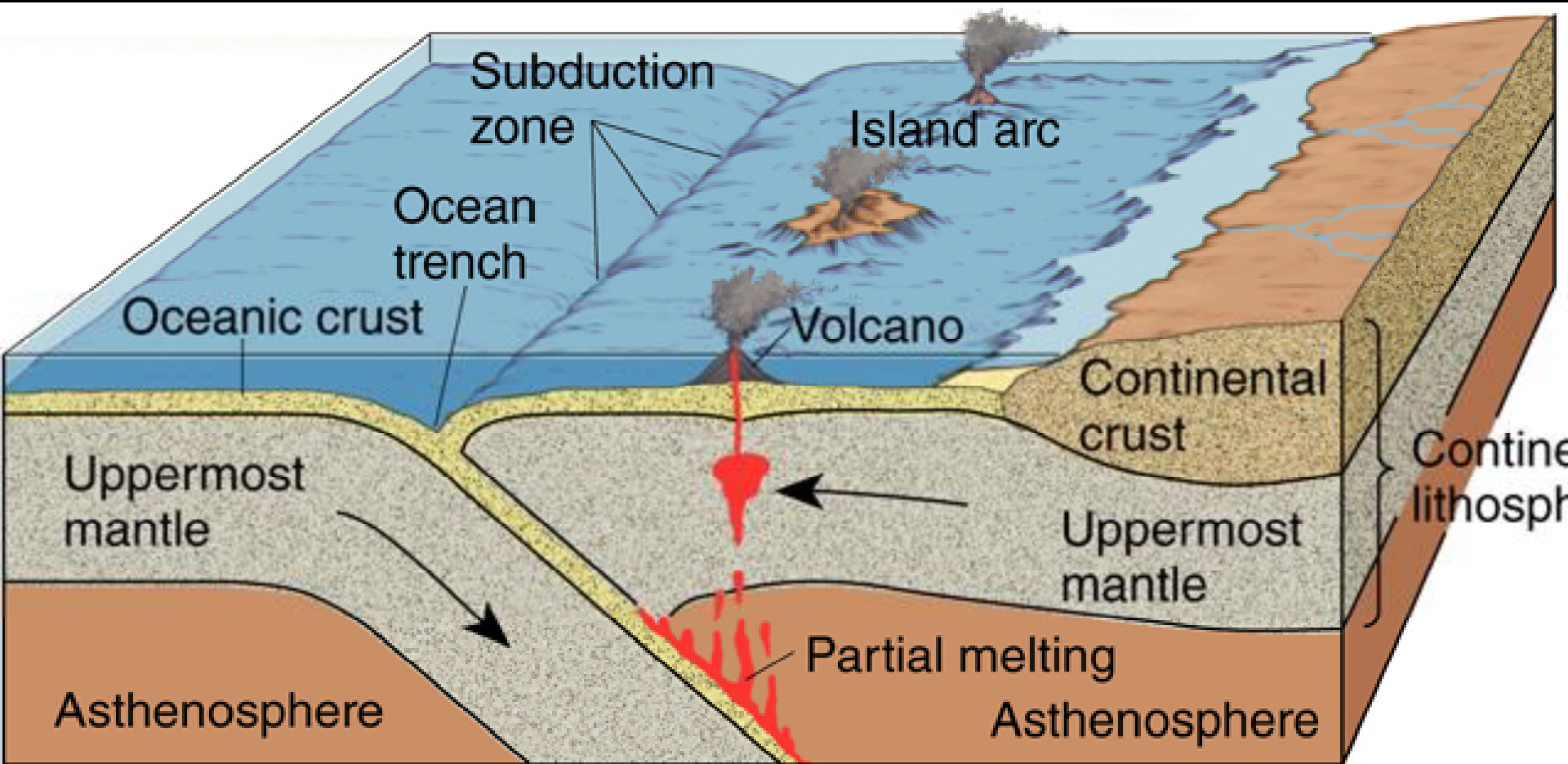
# Map of Global Relief



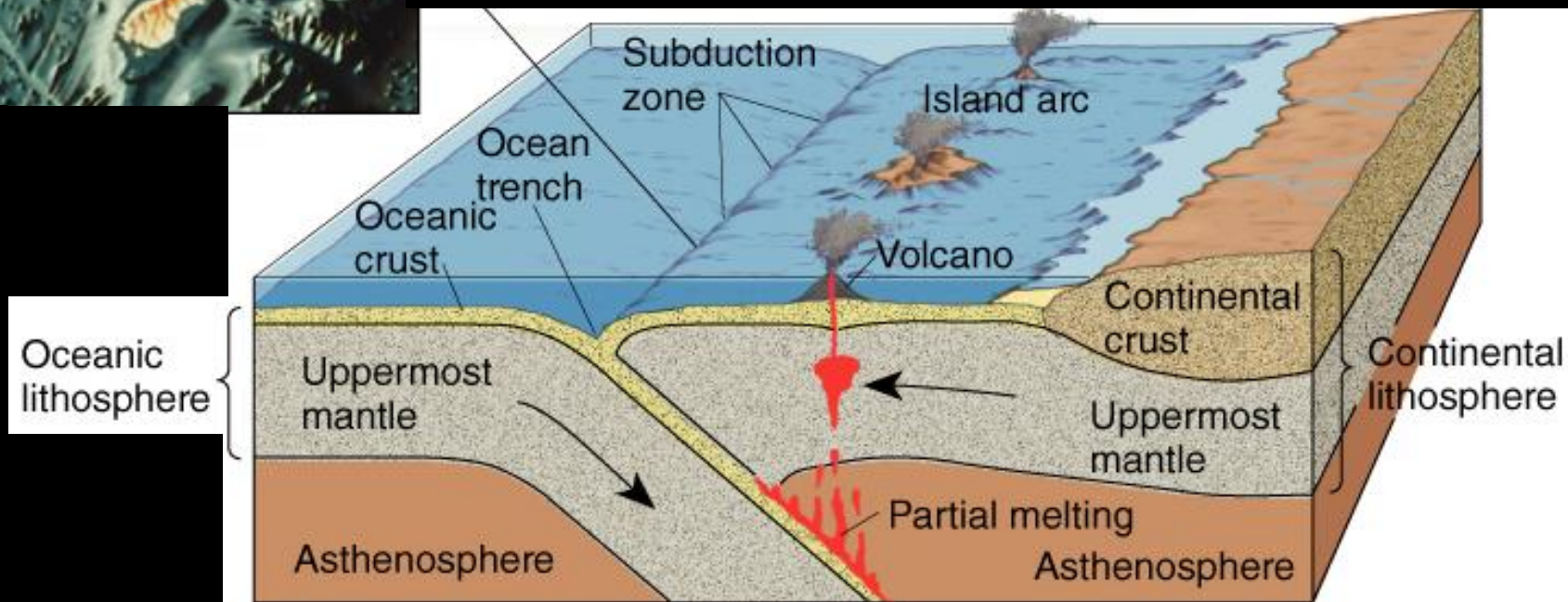
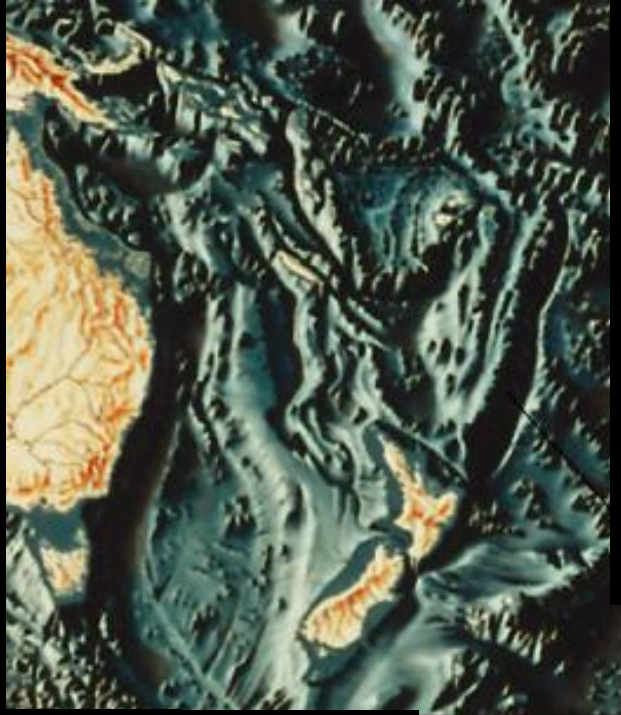
Source: National Geophysical Data Center

# Ocean-Ocean Convergence (subduction).

Source: Christopherson, 2012, p. 346.



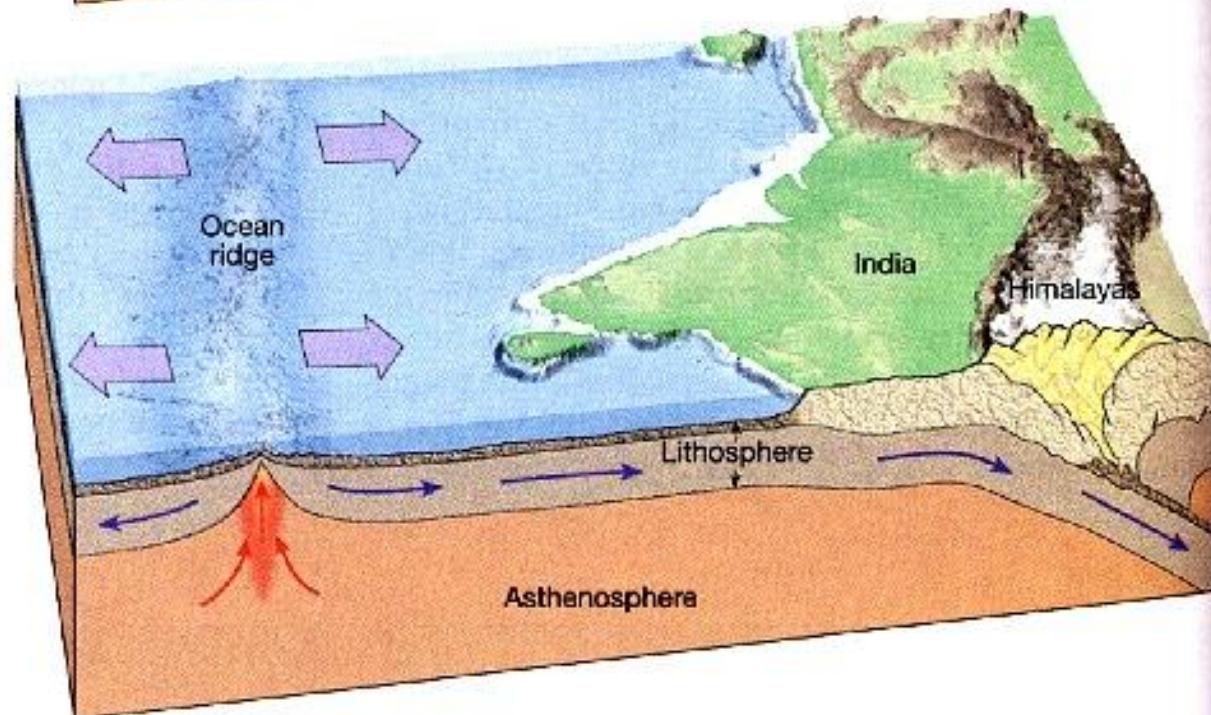
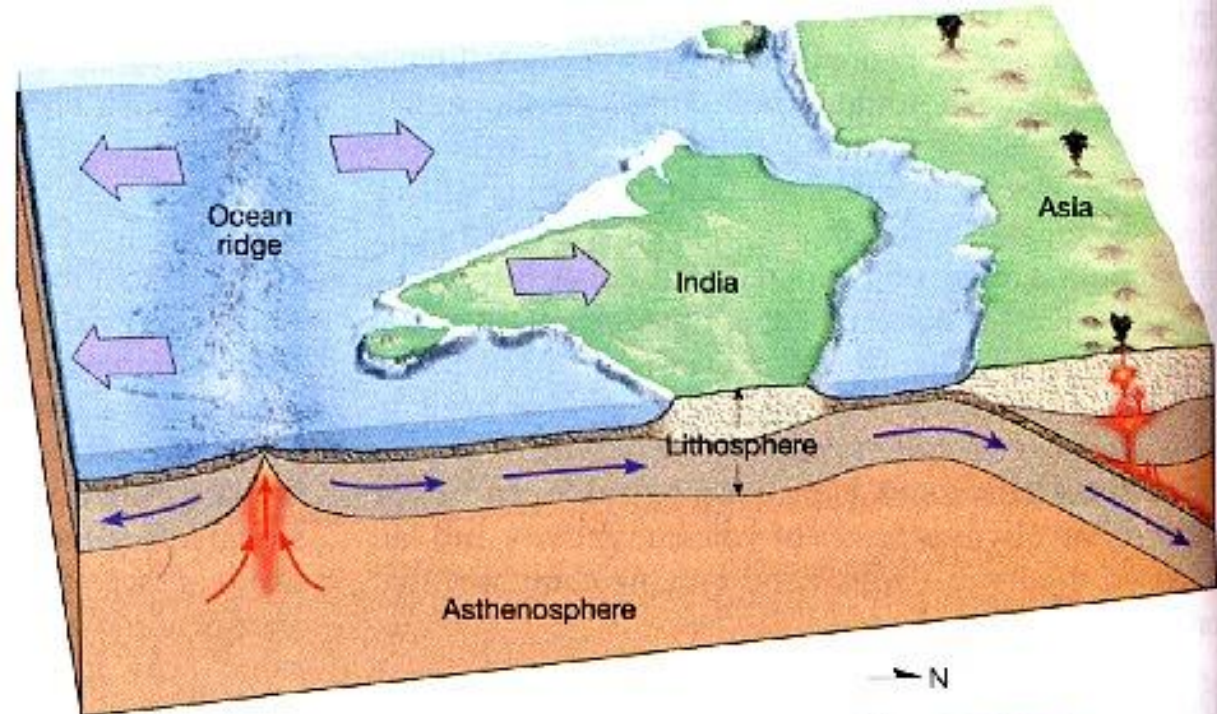
Examples: Parts of 'Pacific Ring of Fire' including New Hebrides off new Zealand.



## Ocean-Ocean Convergence (subduction).

Source: Christopherson, 2012, p. 346.

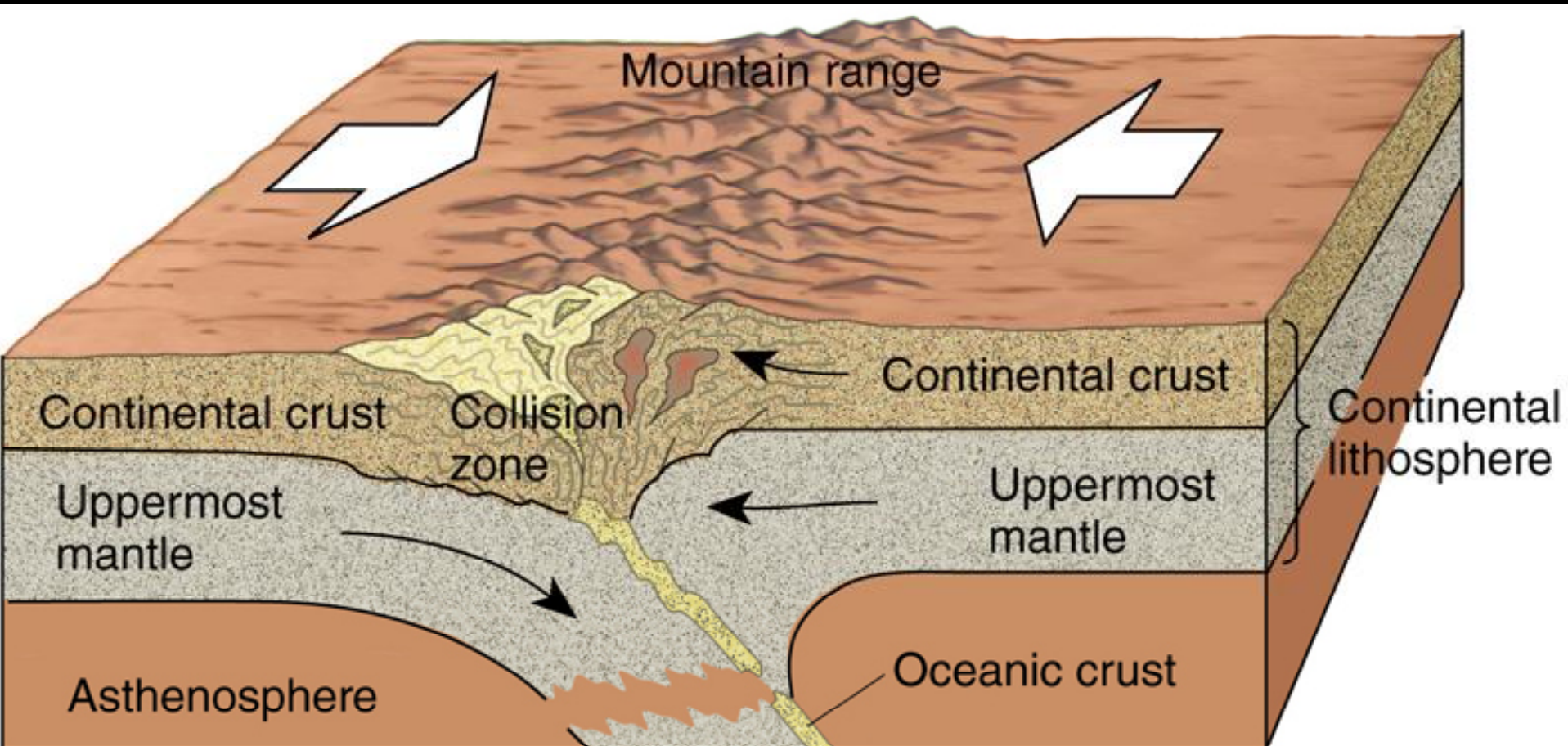
Ocean-continent convergence can become continent-continent convergence





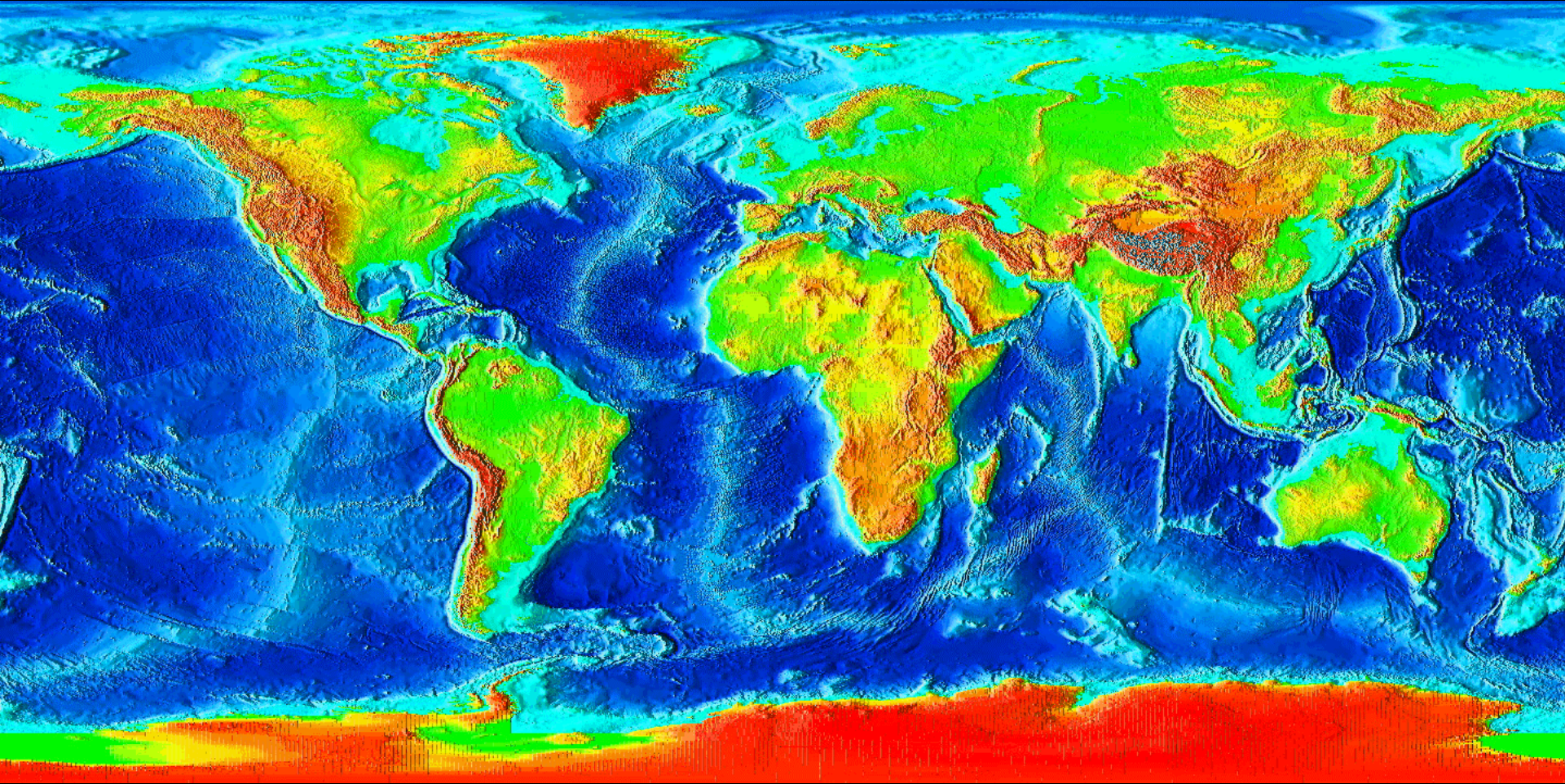
# Continent-continent convergence.

Source: Christopherson, 2012, p. 346.



**Example: India and Asia colliding to form the Himalayas.**

# Map of Global Relief



Source: National Geophysical Data Center