

# A journey Through the Interior of the Earth

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Who is an earth scientist?

One who studies the sciences related to the planet Earth

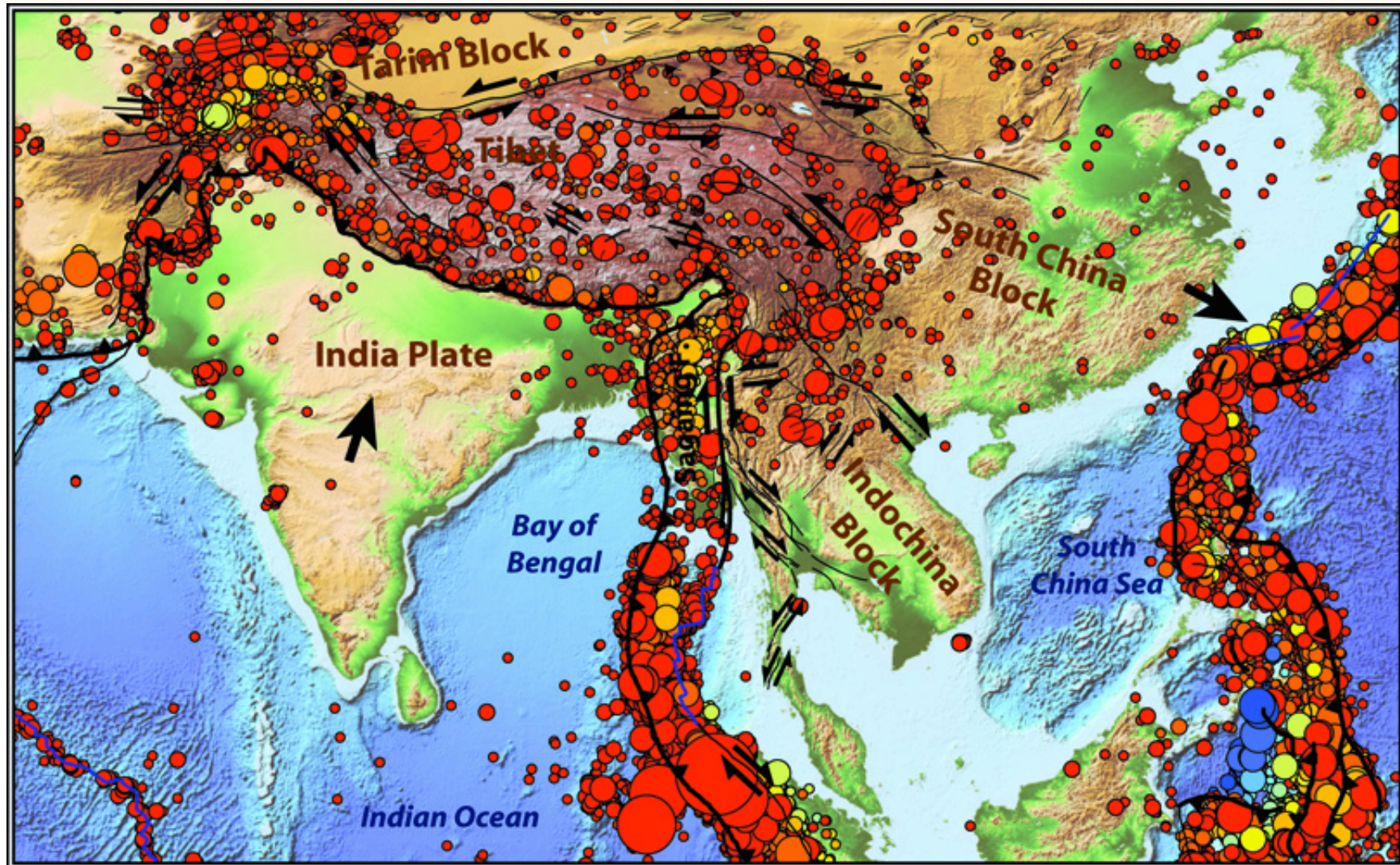
Uses tools such as physics, chemistry, mathematics, biology to develop an understanding about how this planet works







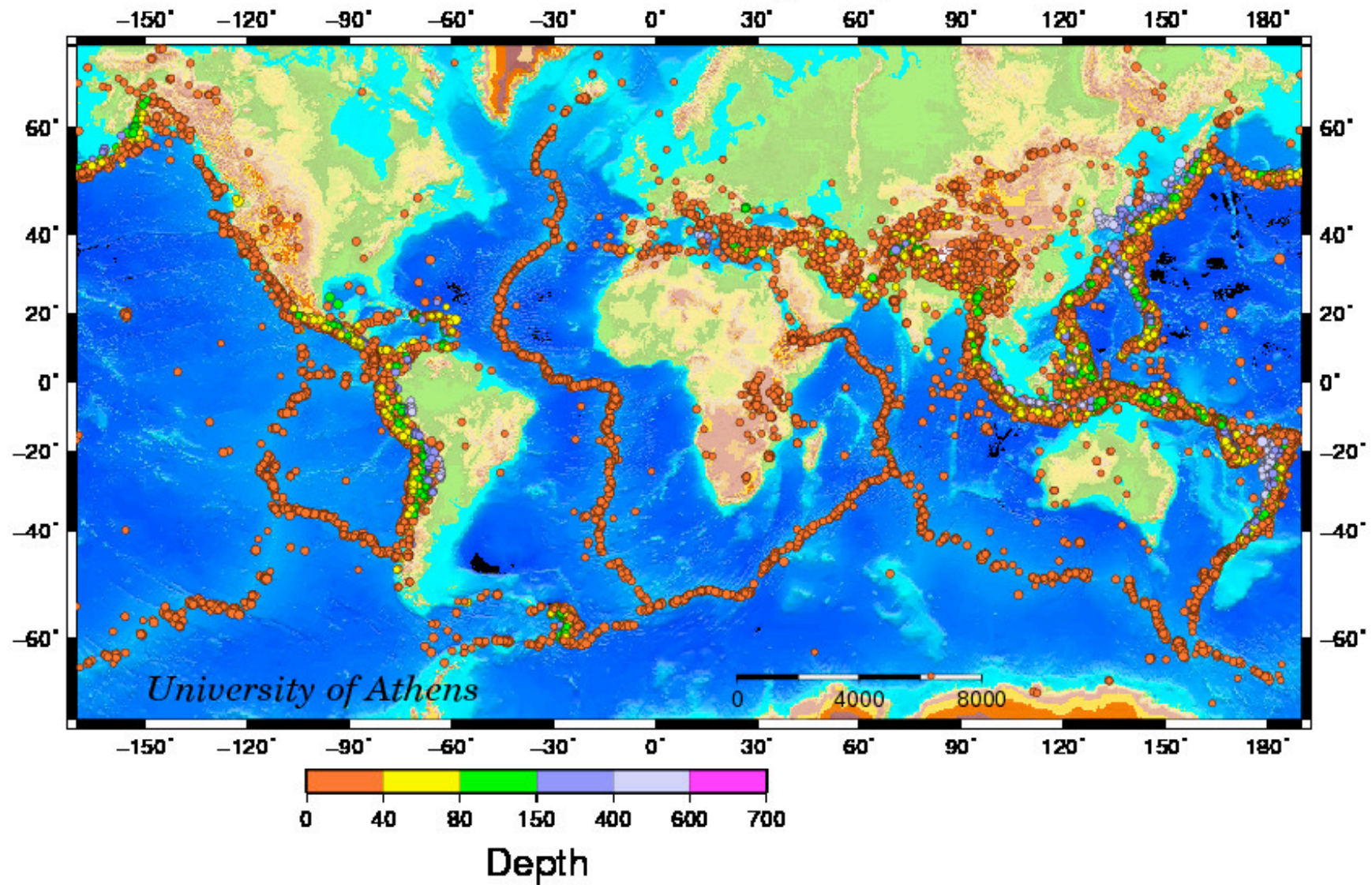




<http://www.sagaingfault.info>



2000–2009 M > 4.8 (USGS)

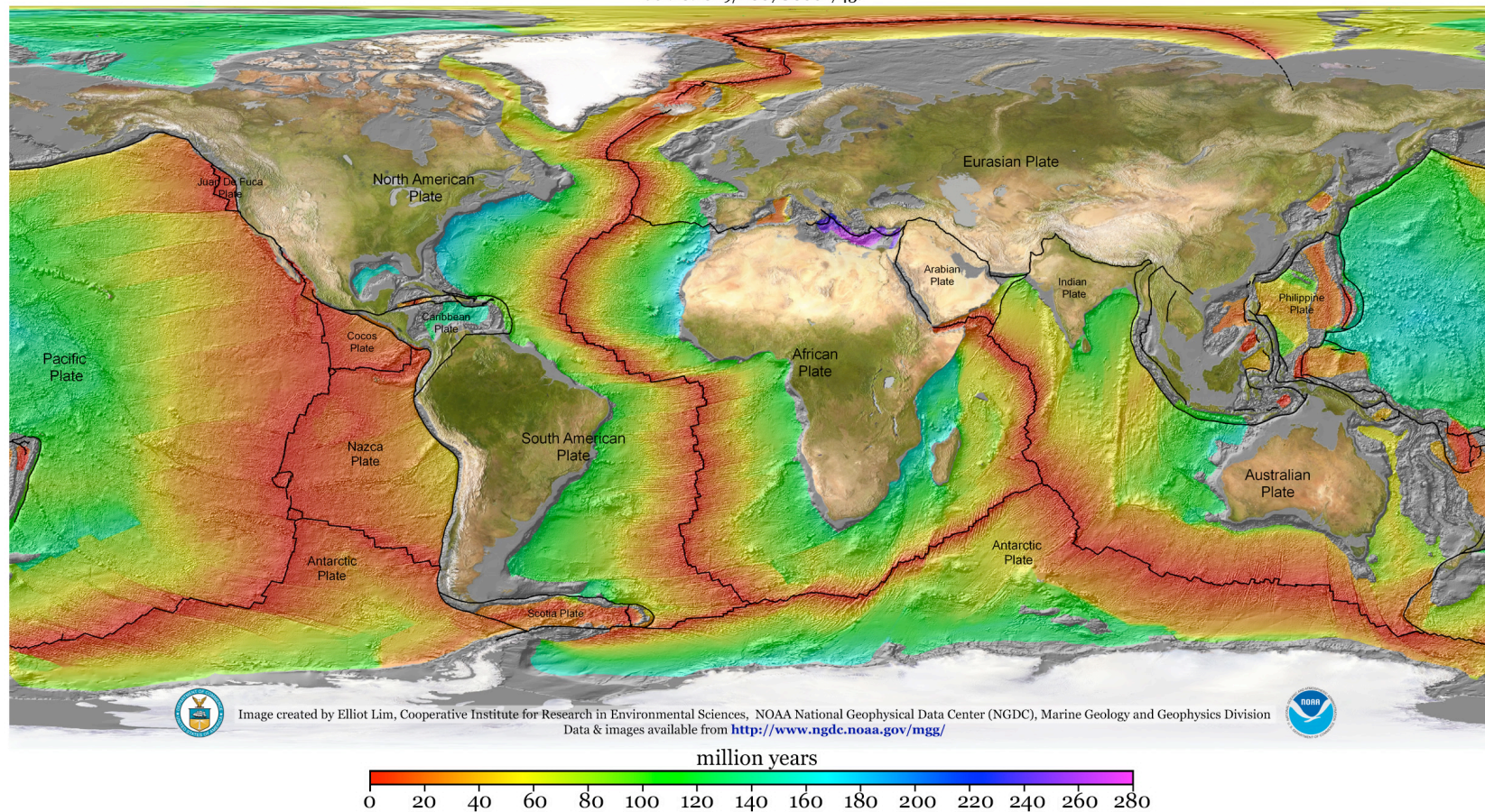




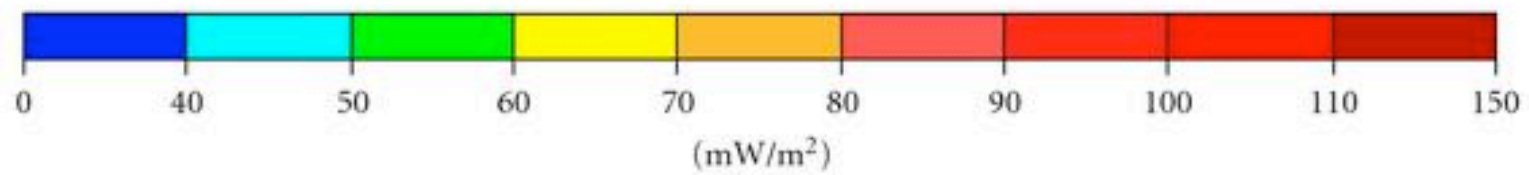
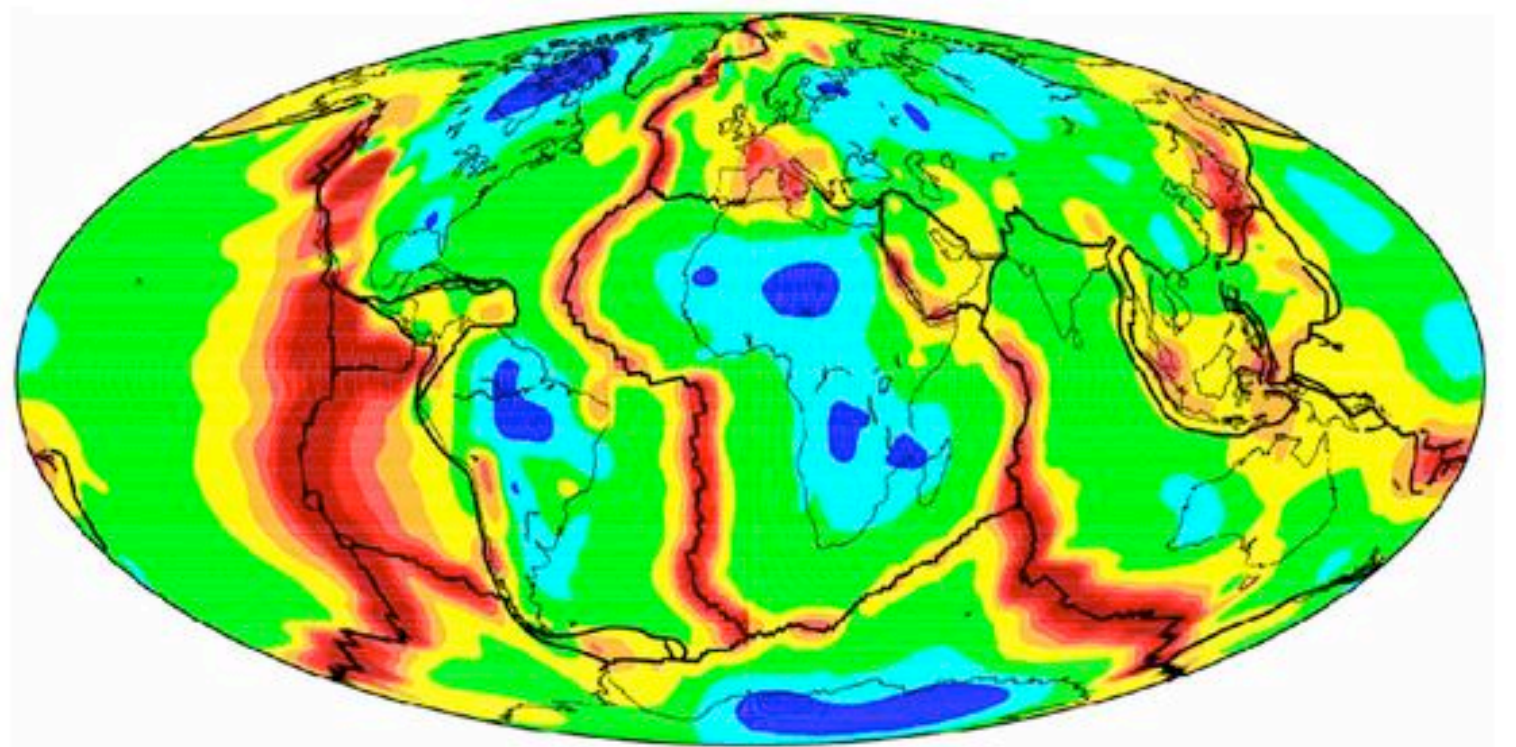
# World Encircling Mid-oceanic Ridges

## Data source:

Muller, R.D., M. Sdrolias, C. Gaina, and W.R. Roest 2008. Age, spreading rates and spreading symmetry of the world's ocean crust, *Geochem. Geophys. Geosyst.*, 9, Q04006, doi:10.1029/2007GC001743.



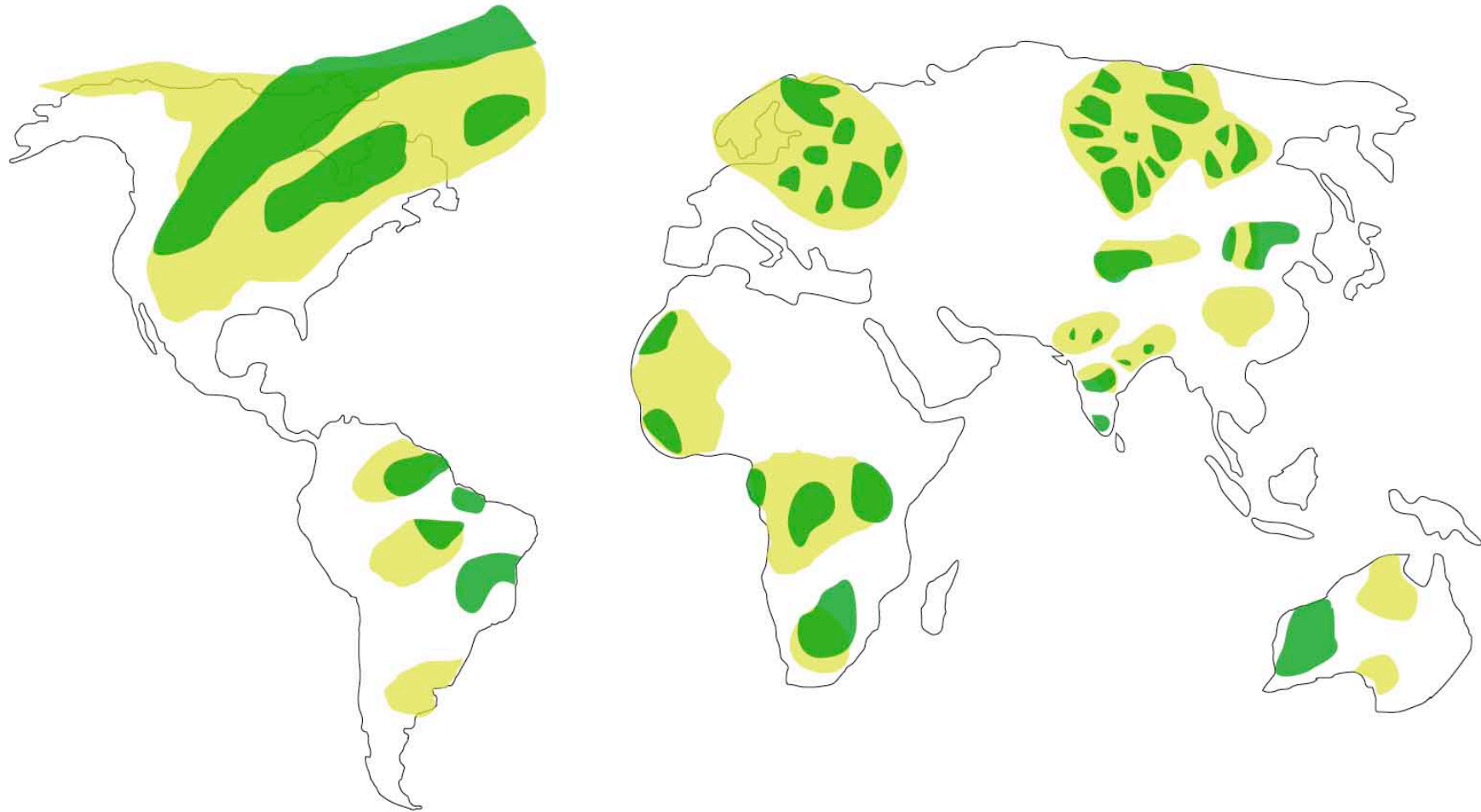





*Hamza et al. (2010)*

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Distribution of cratonic blocks (redrawn from King 2005)

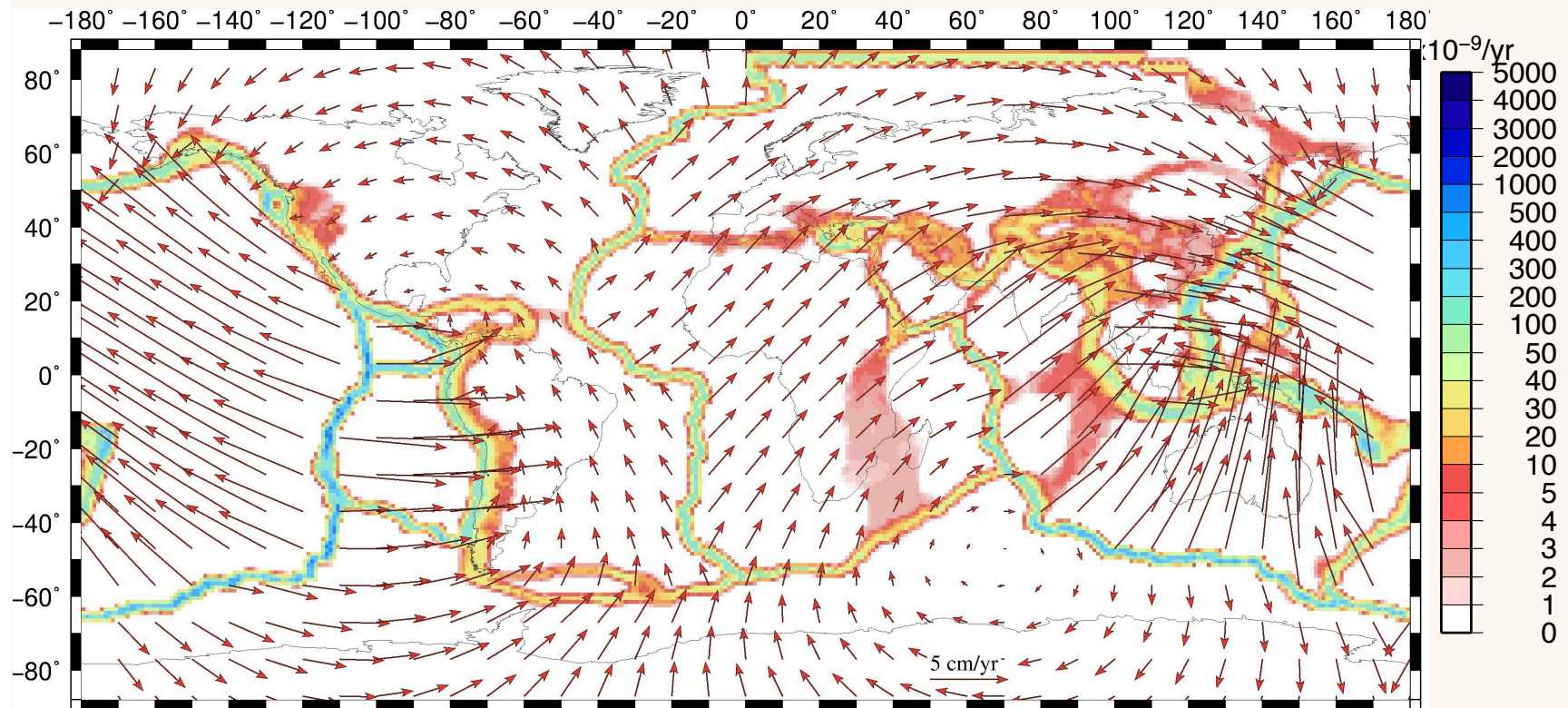


 Archaean (4000-2500 Million Years before Present) Cratonic Blocks

 Proterozoic (2500-590 Million Years before Present) Cratonic Blocks

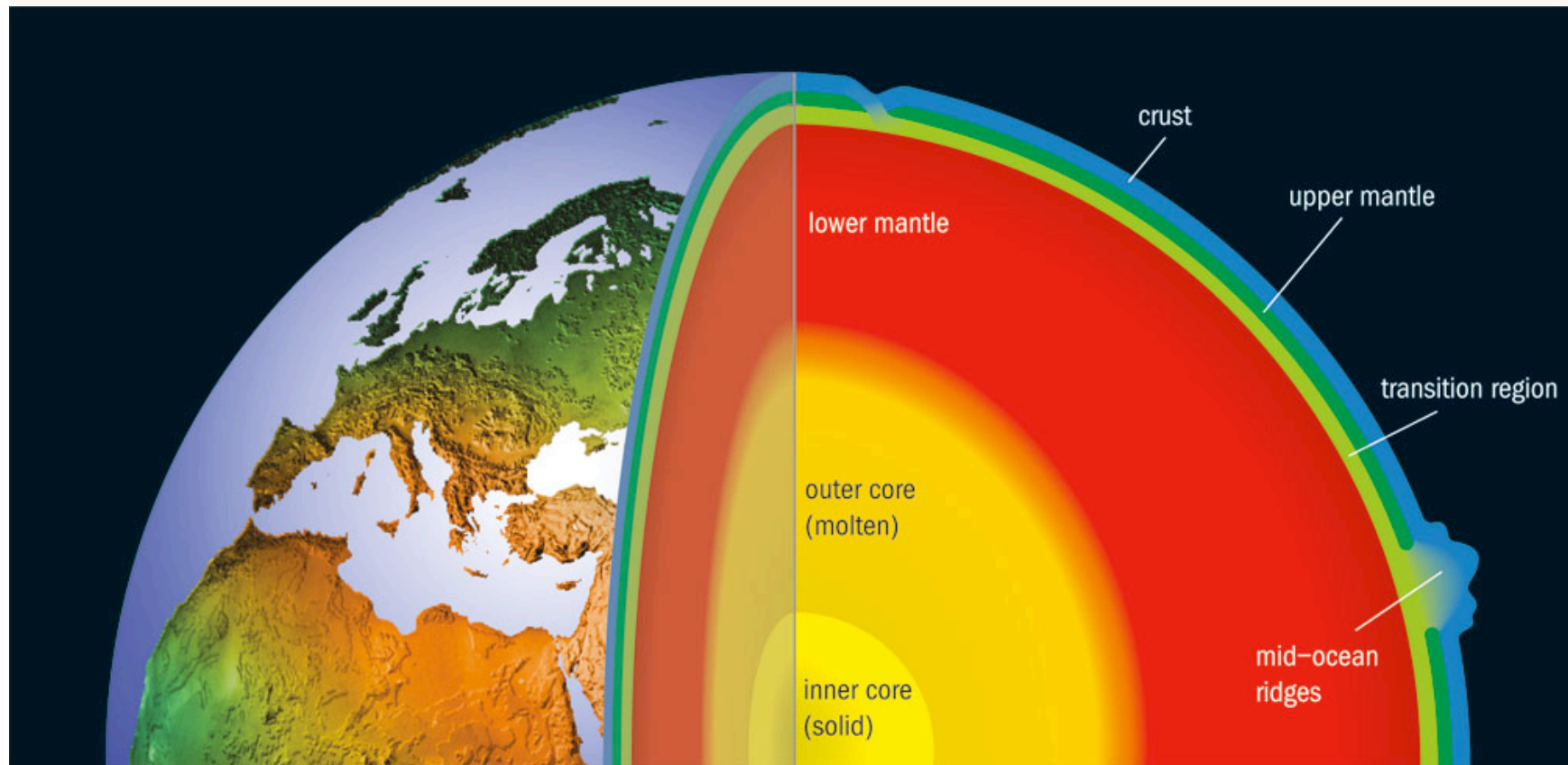
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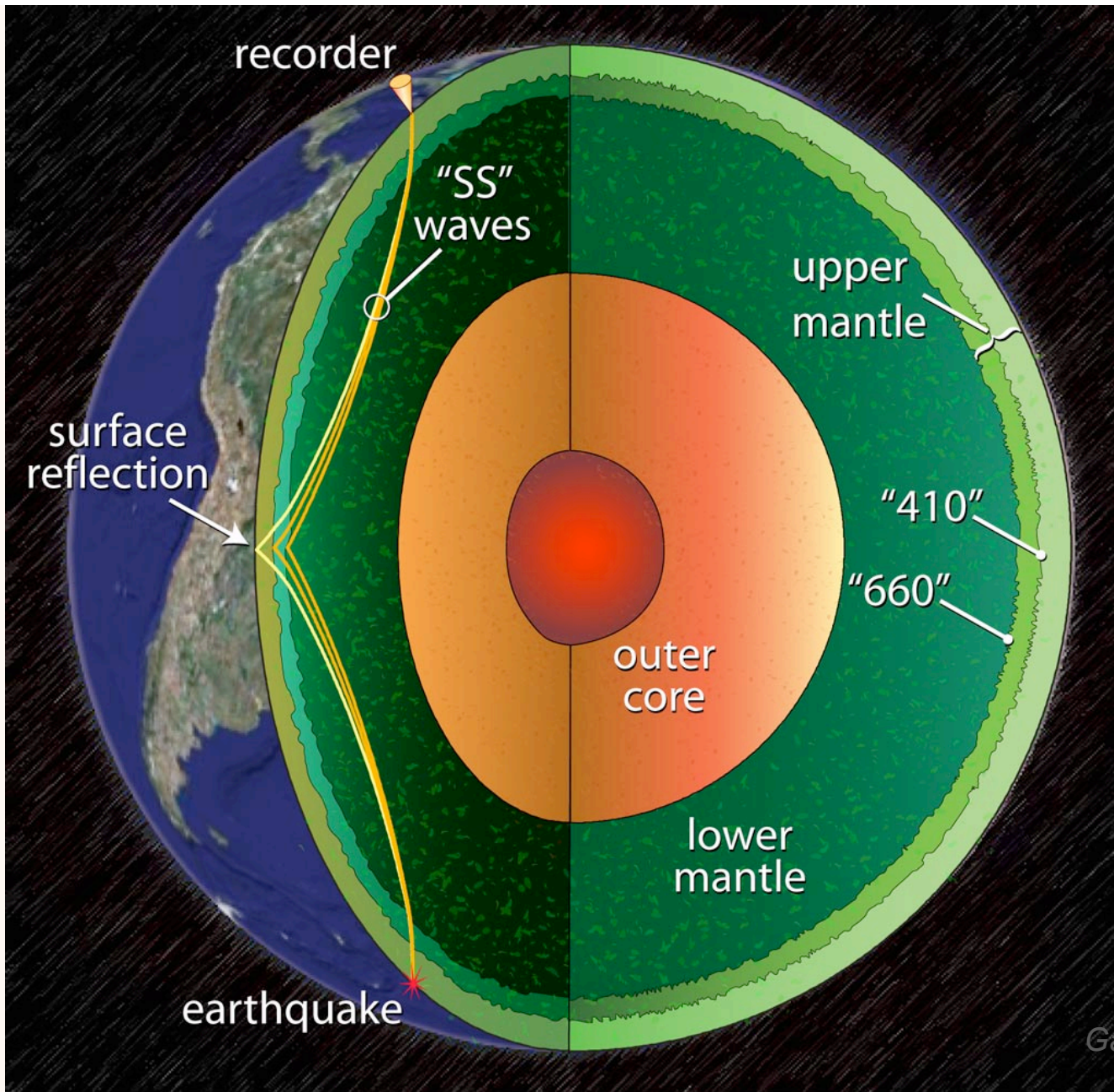
- Plate velocities
- Strain rates

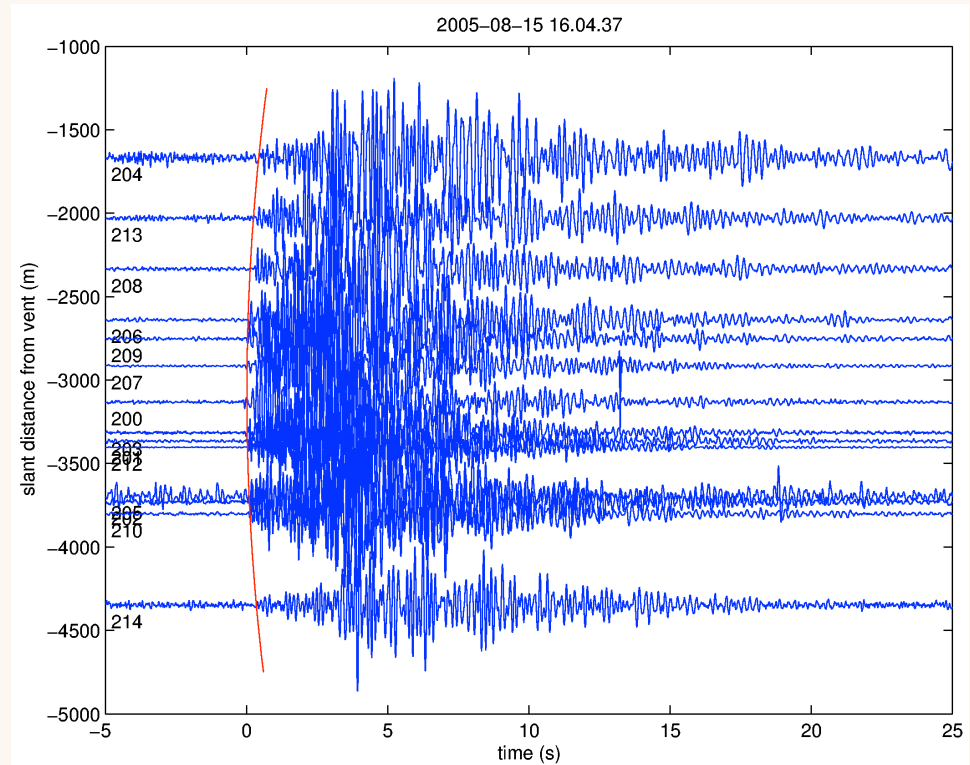
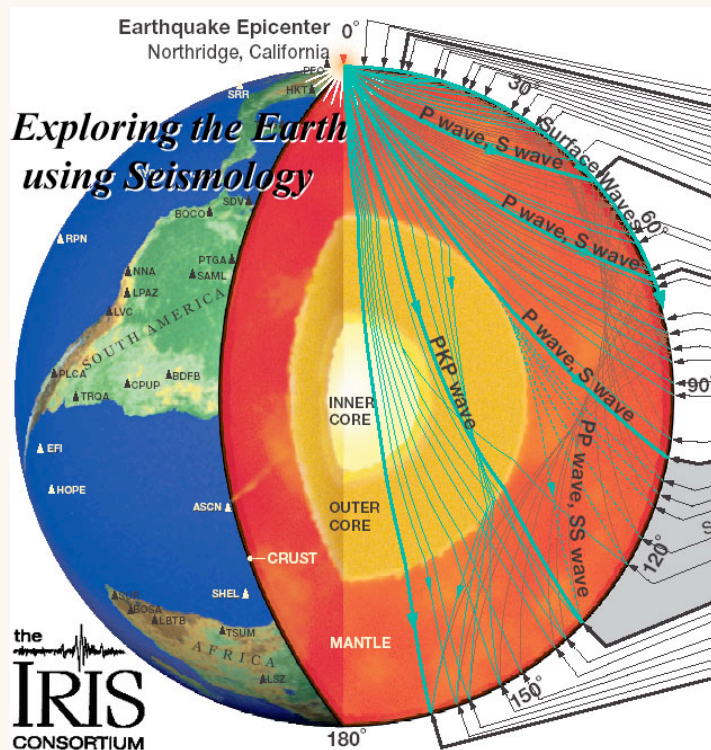


*Kreemer et al. (2003, 2006)*

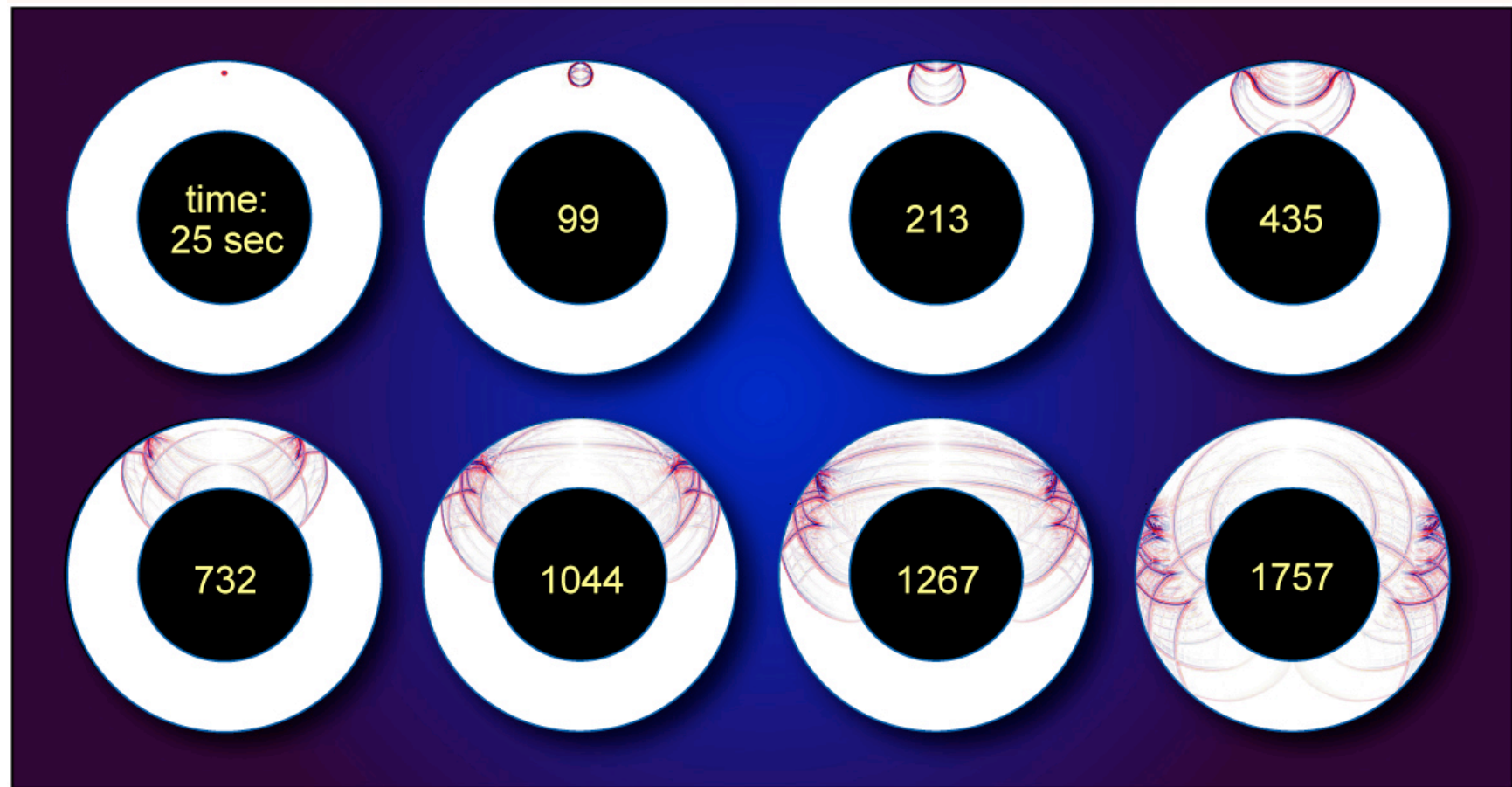


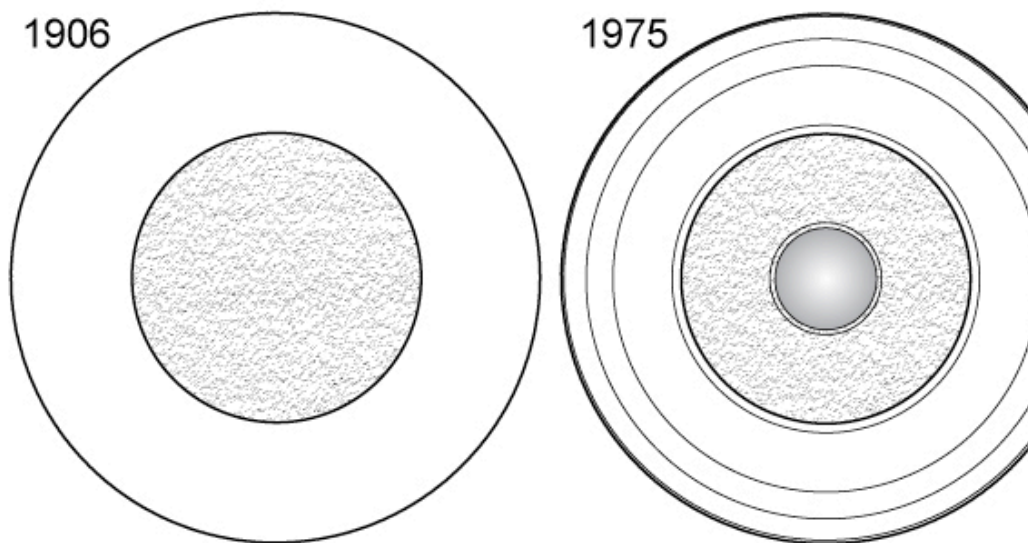




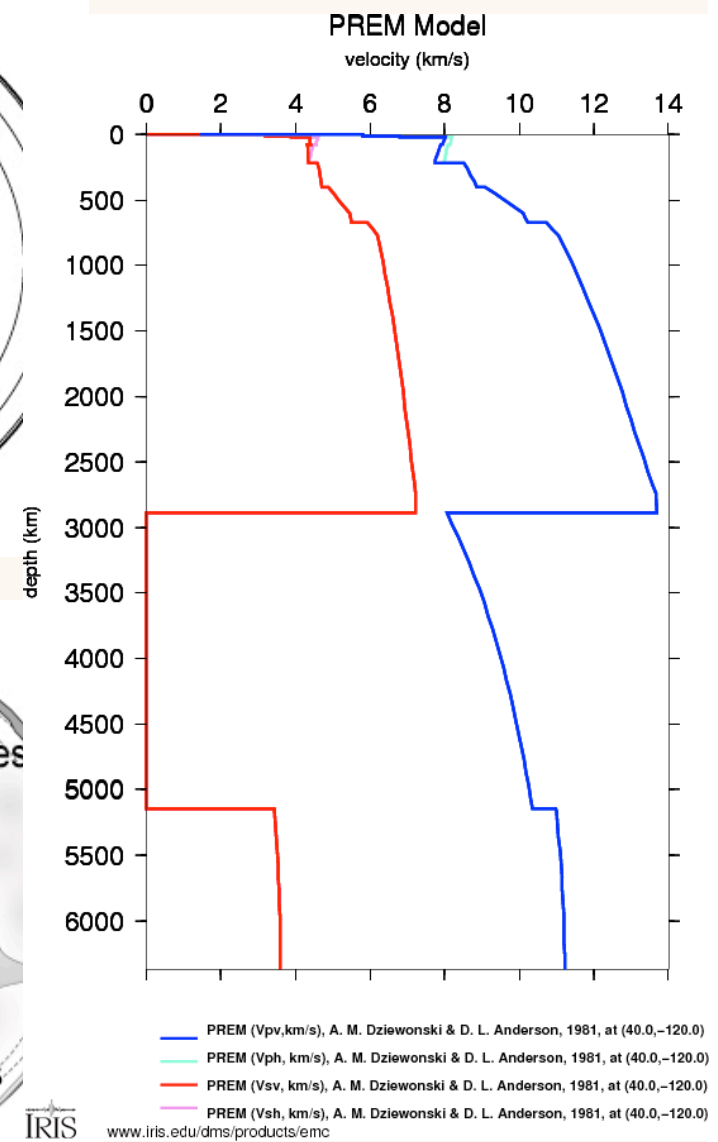
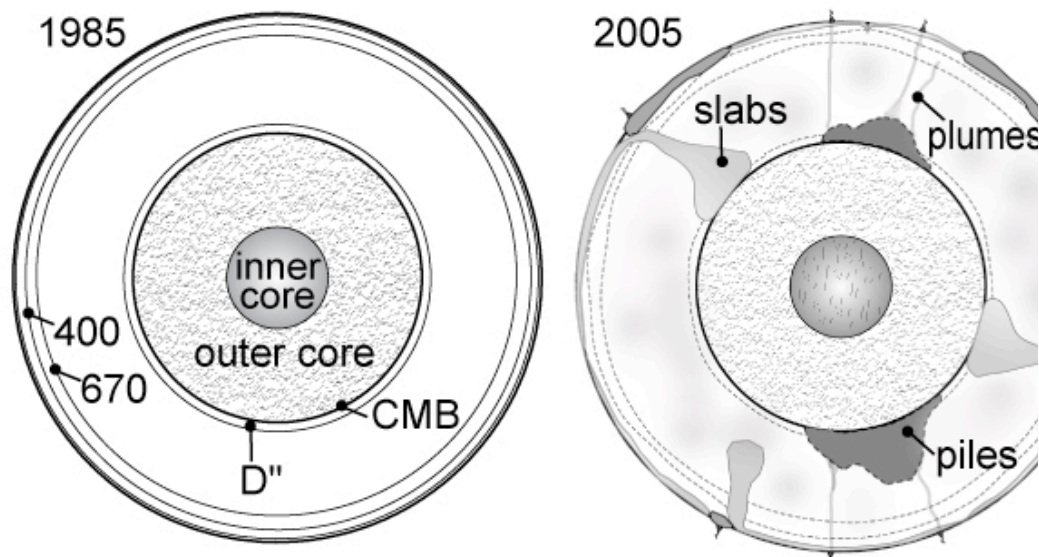


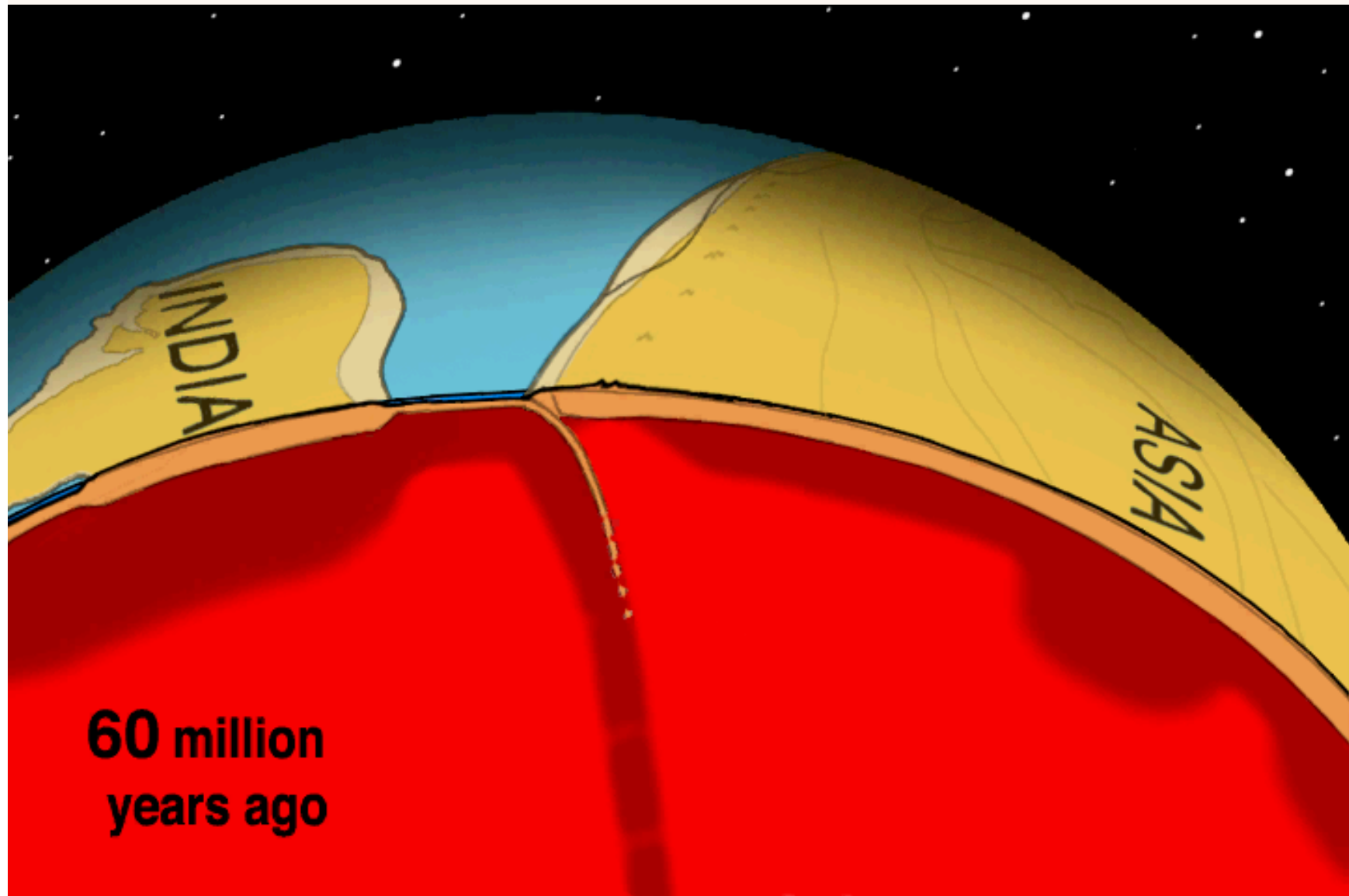




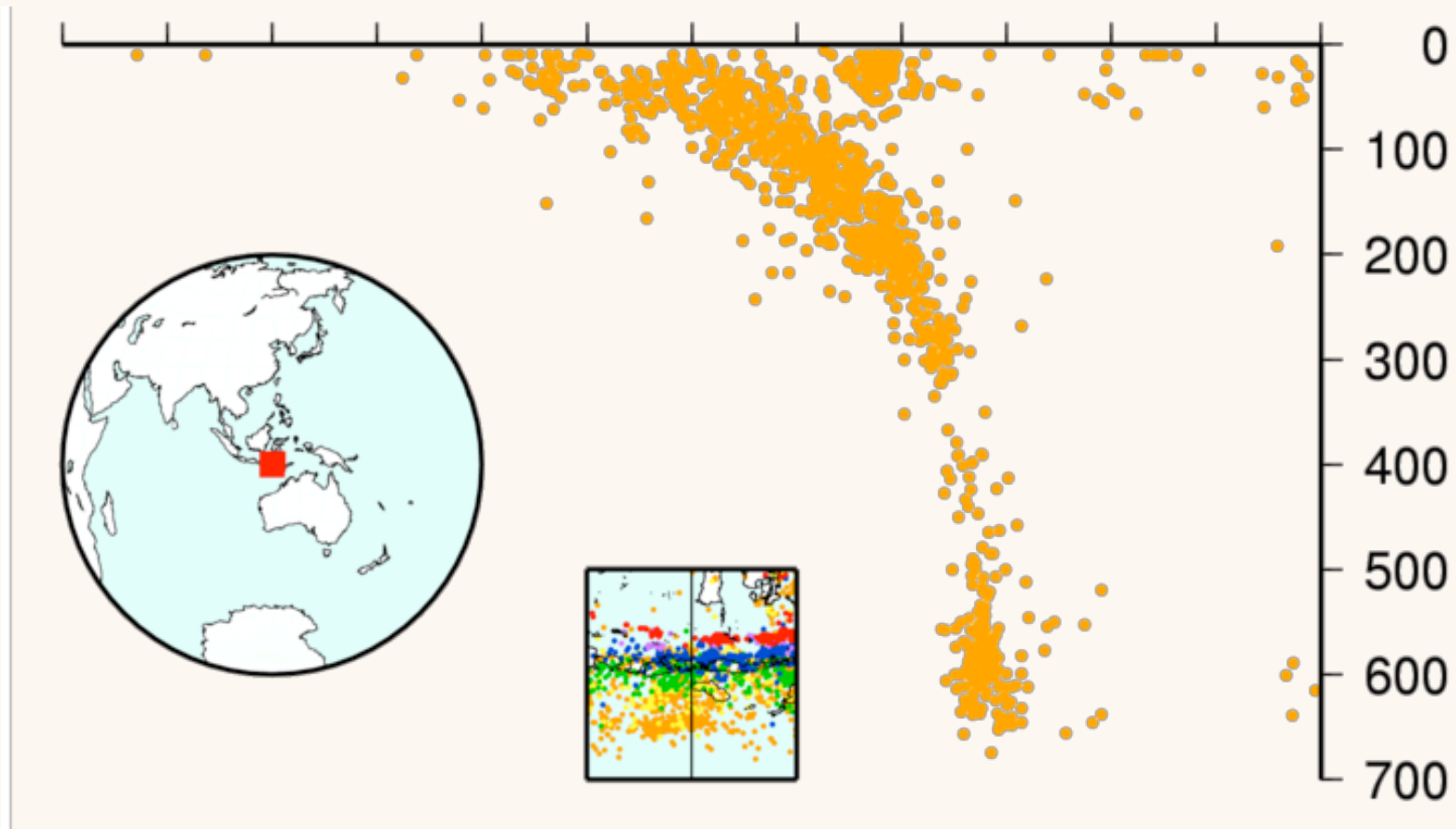


*Garnero.asu.edu*





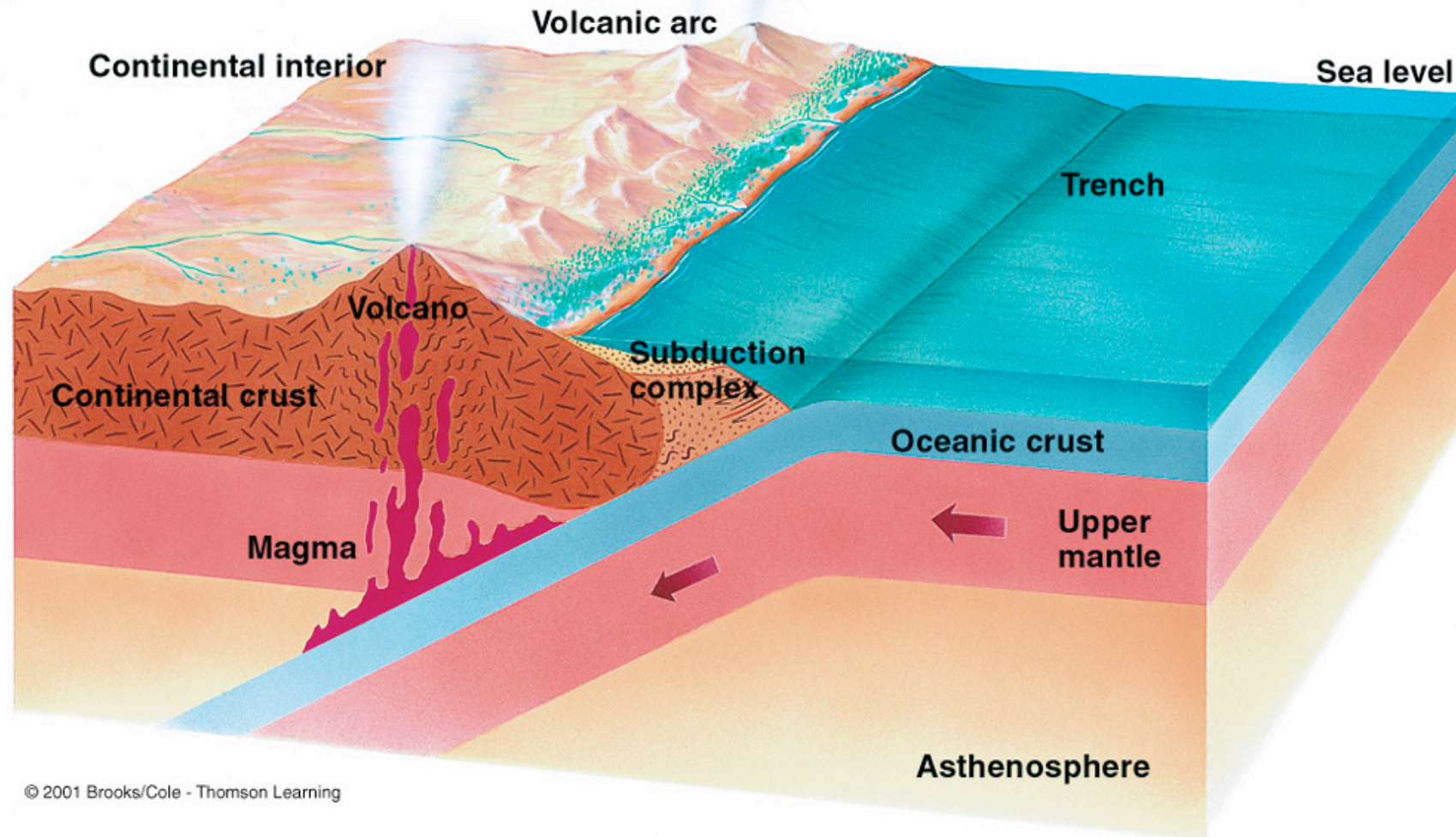
# Benioff Zone



USGS

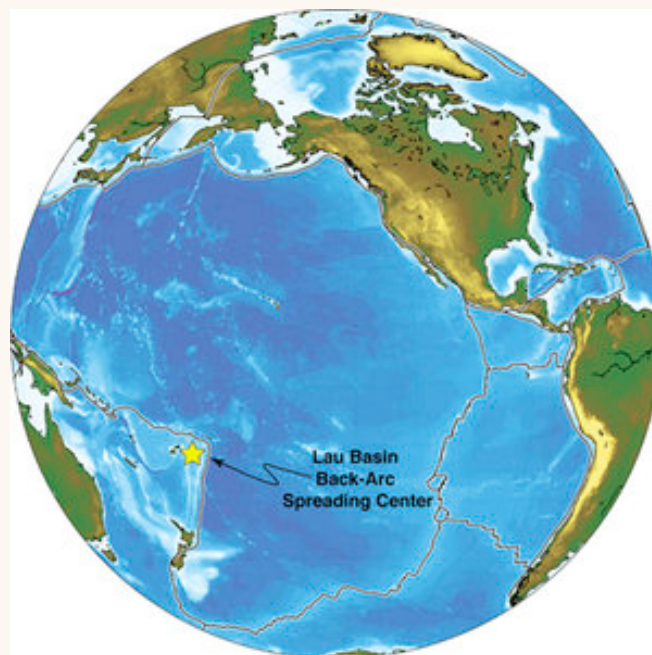


# Collisional Boundary









## P-wave Tomography

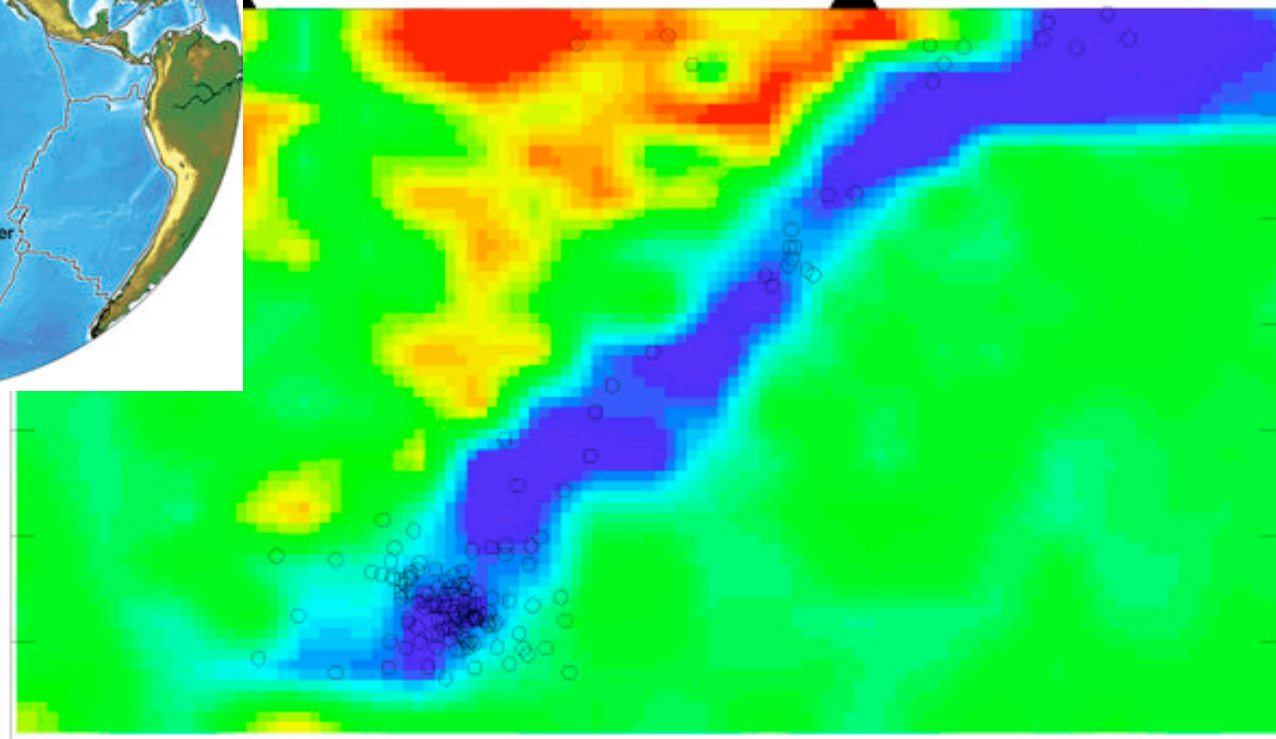
Lau  
Spreading  
Center

Tonga  
Arc

Pacific  
Plate

Depth

400  
500  
600  
700



-6%

0%

6%

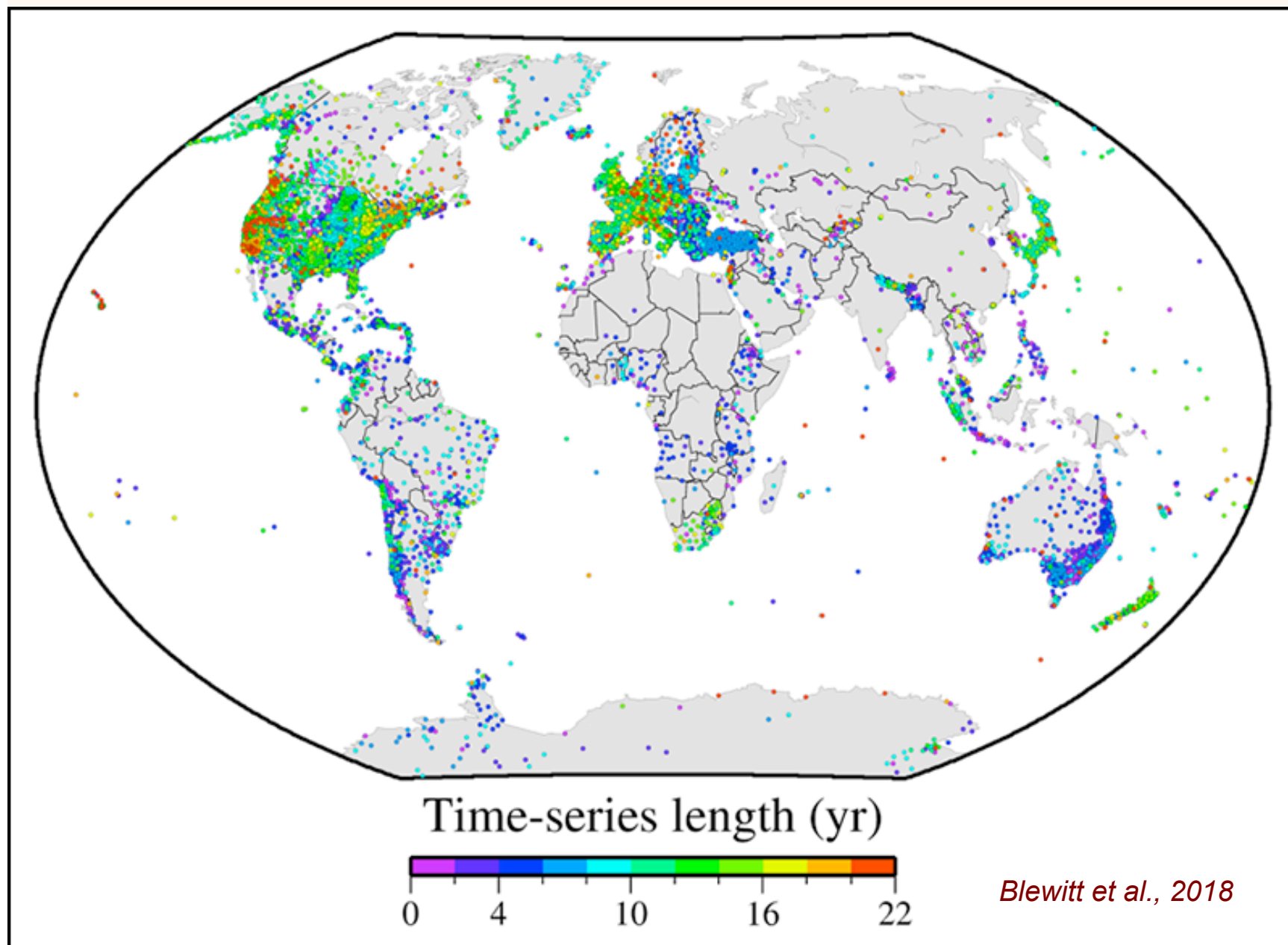
P velocity anomaly

*Zhao et al., Science, 1997*



UNAVCO





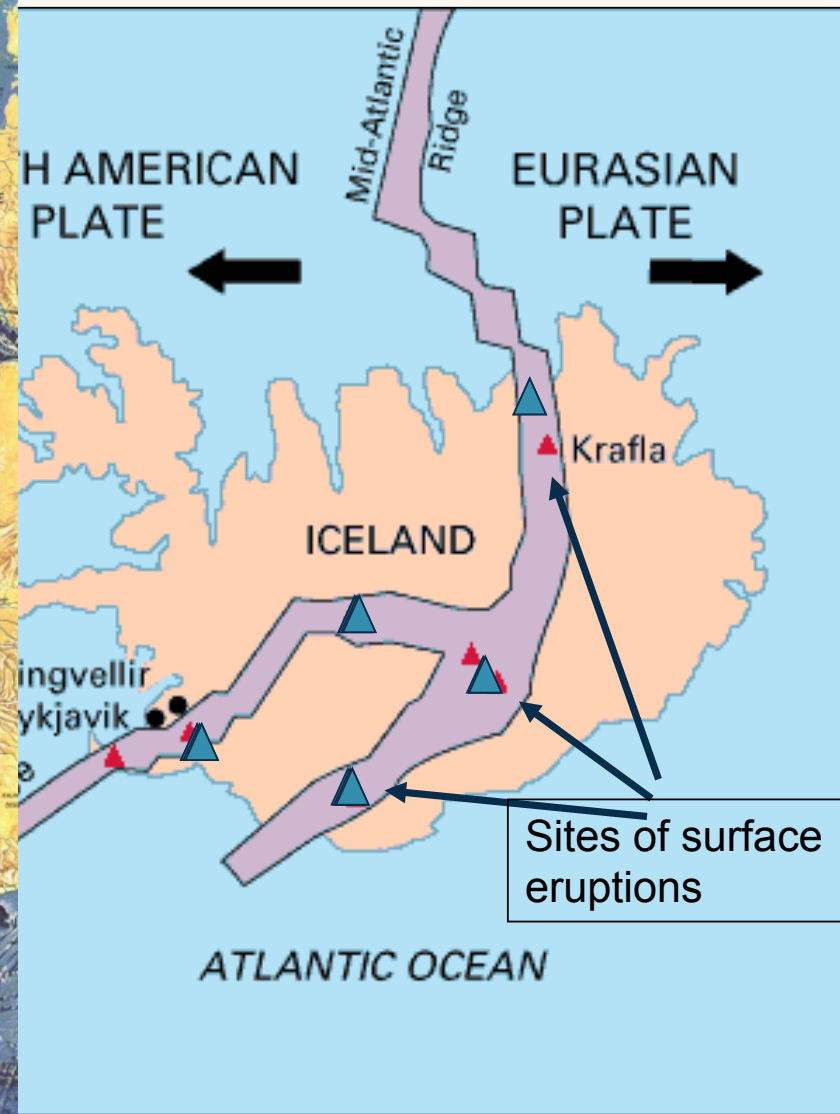


# Iceland's GPS data

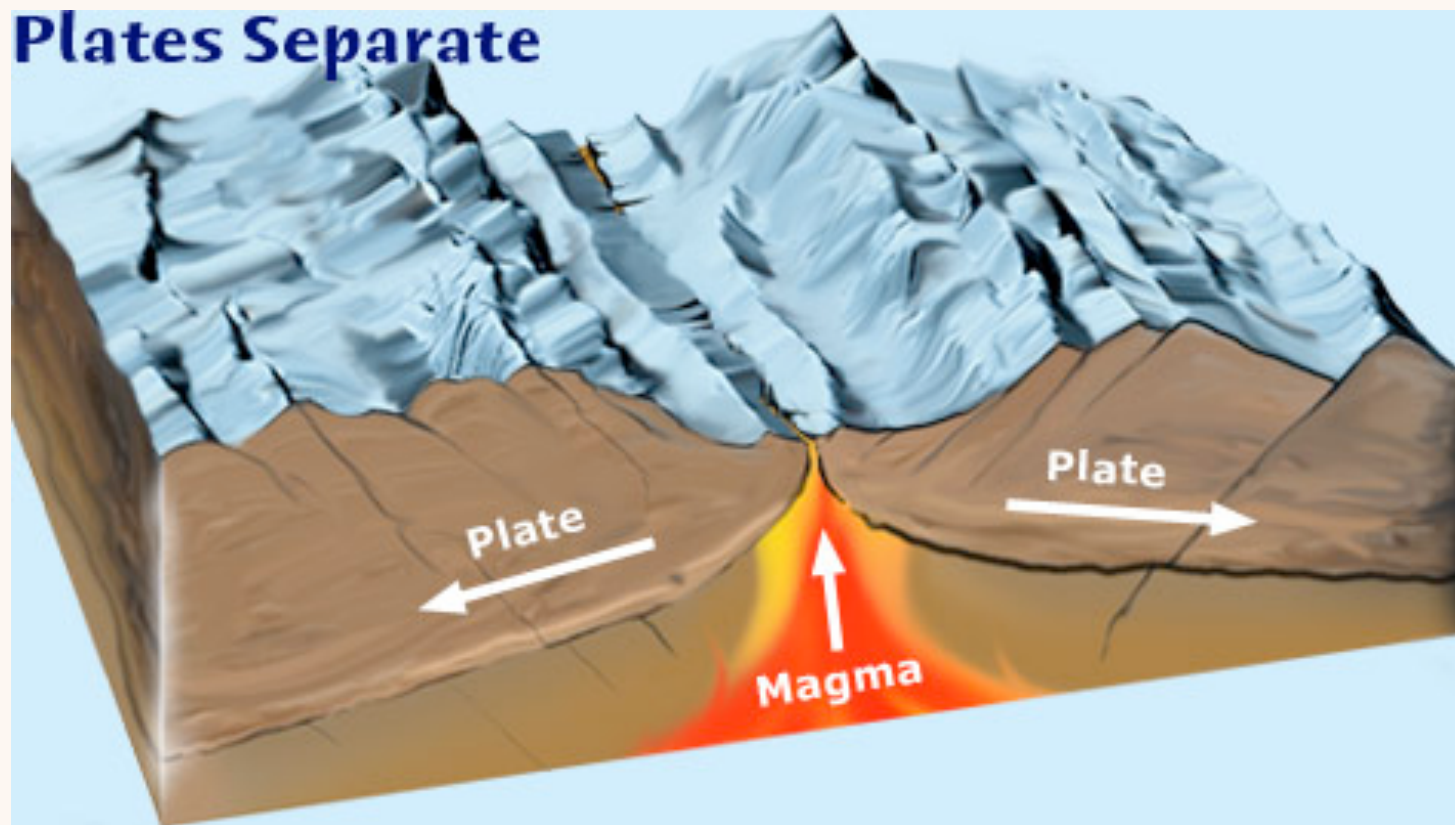




ng



## Divergent Boundary

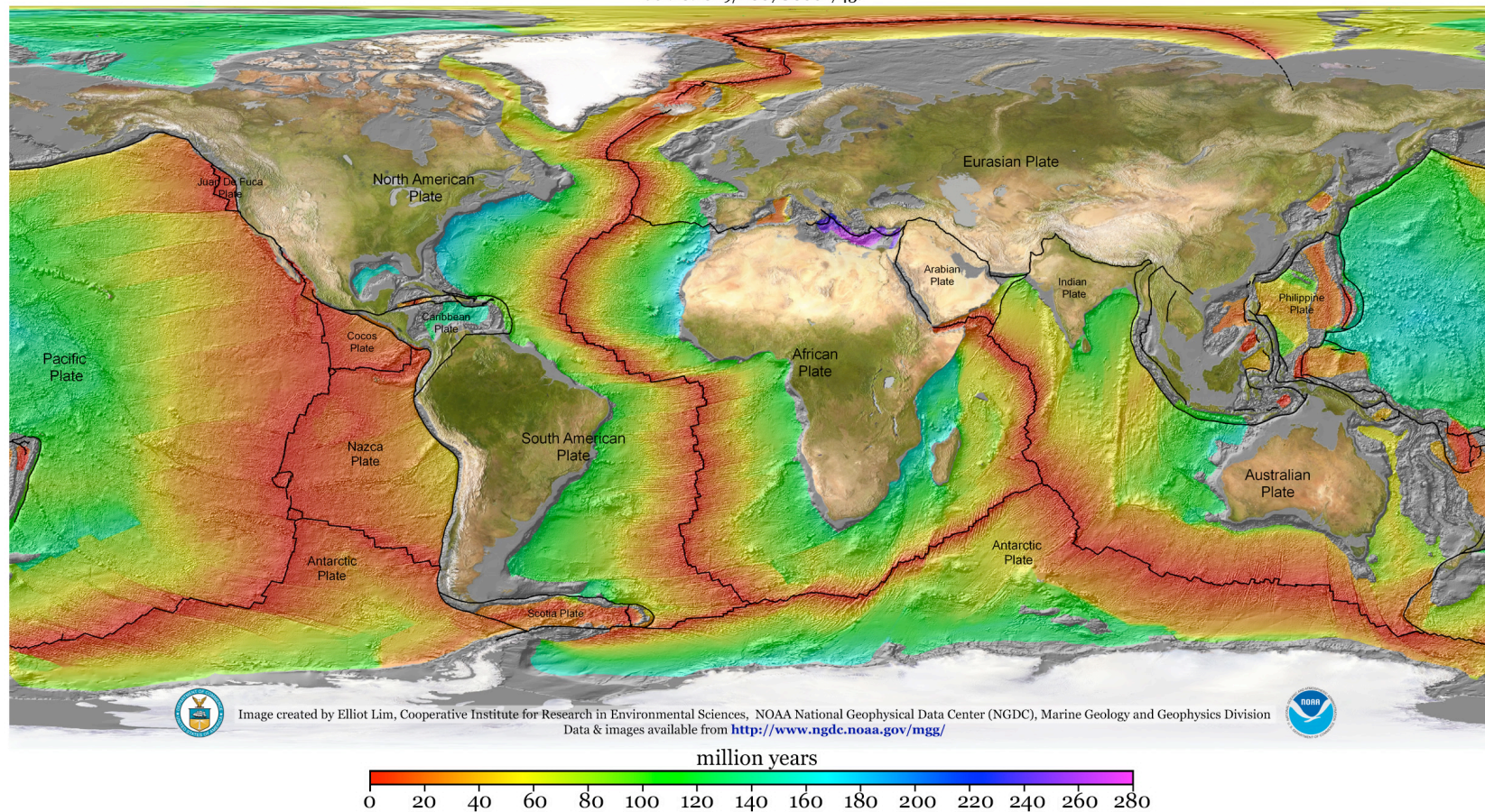




# World Encircling Mid-oceanic Ridges

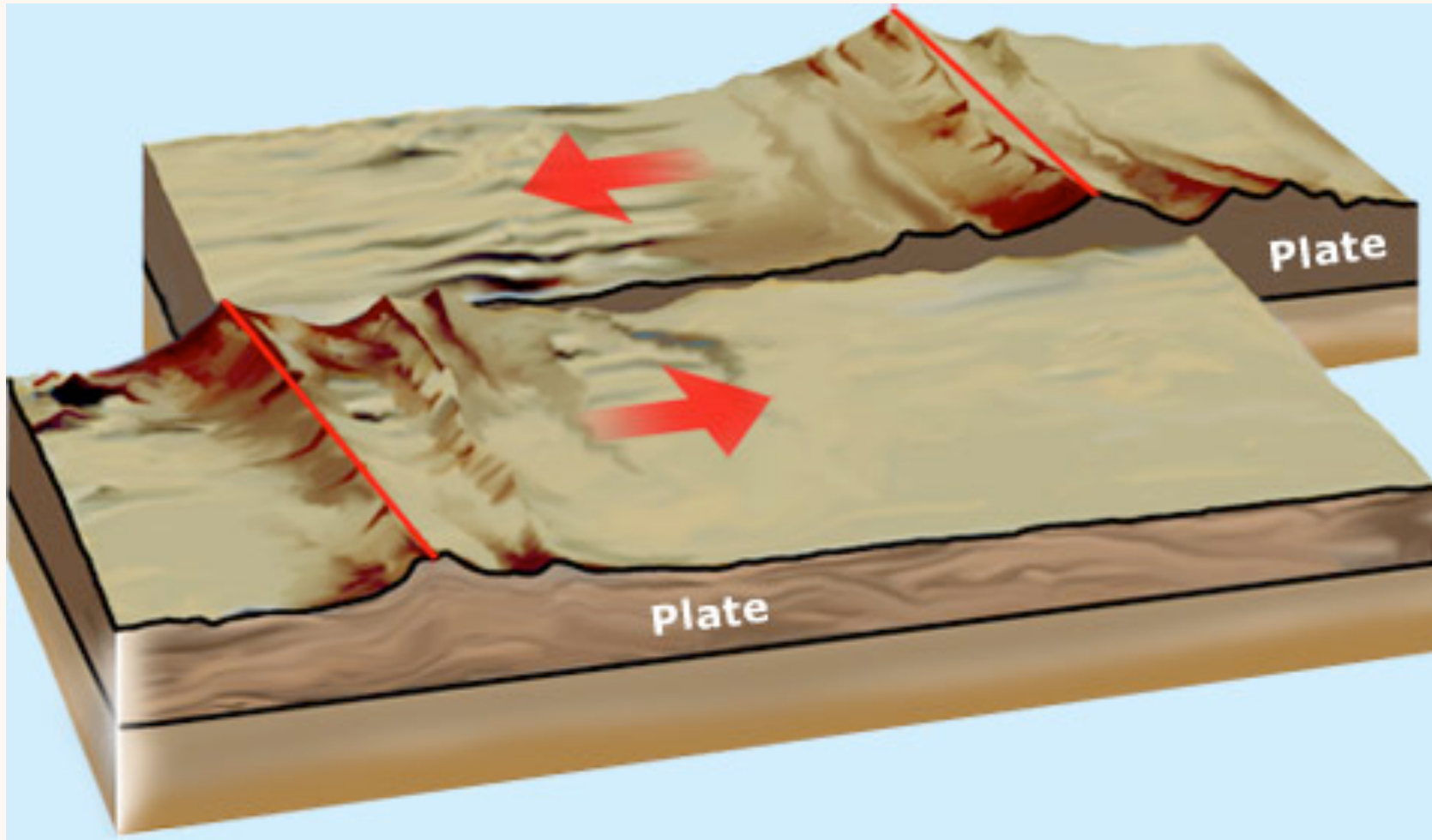
## Data source:

Muller, R.D., M. Sdrolias, C. Gaina, and W.R. Roest 2008. Age, spreading rates and spreading symmetry of the world's ocean crust, *Geochem. Geophys. Geosyst.*, 9, Q04006, doi:10.1029/2007GC001743.





## Transform Boundary



*Woodshole Oceanographic Institute*



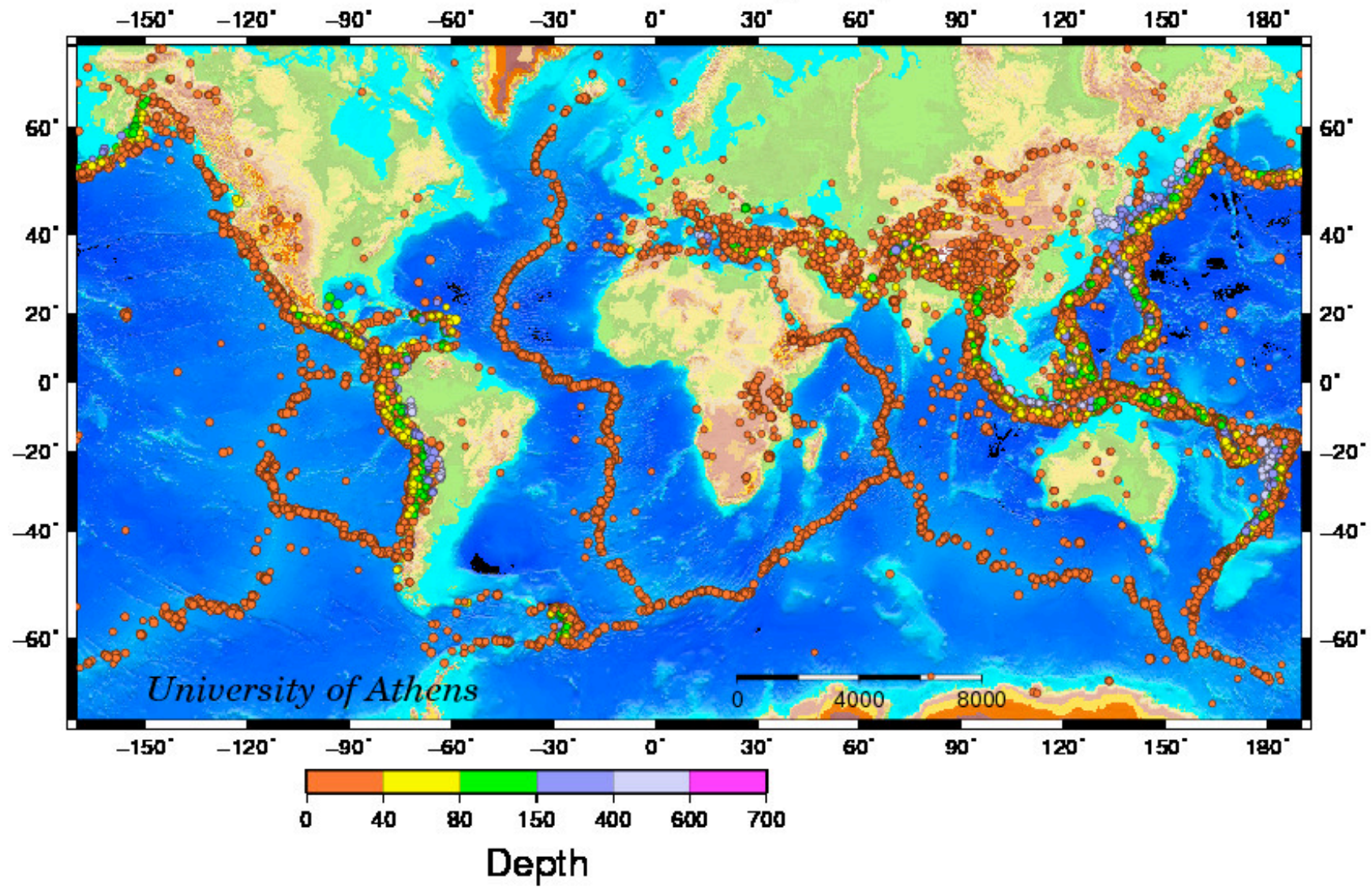


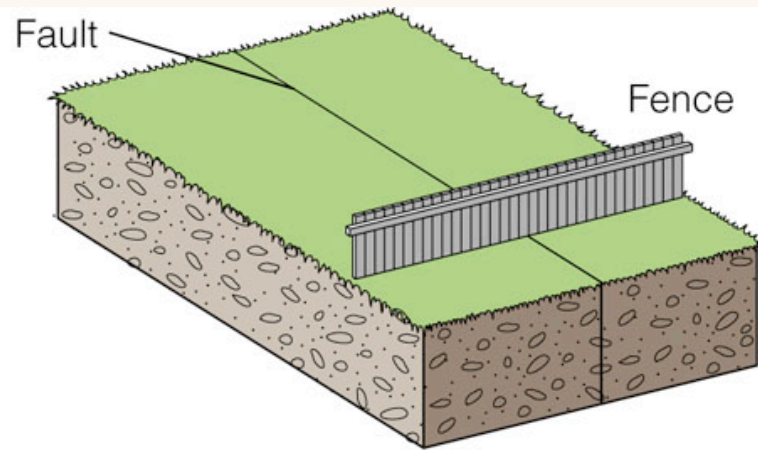


[Sanandreasfault.org](http://Sanandreasfault.org)

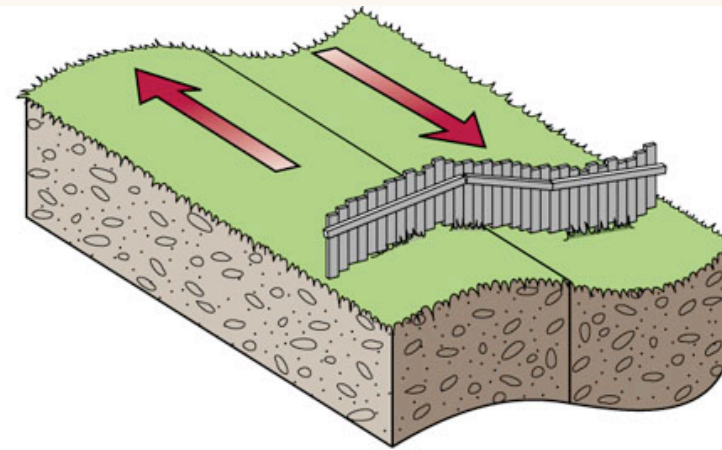


2000–2009 M > 4.8 (USGS)

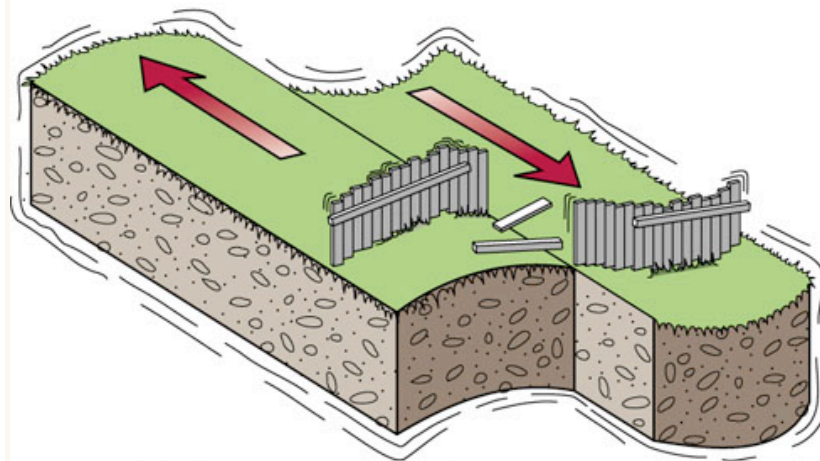




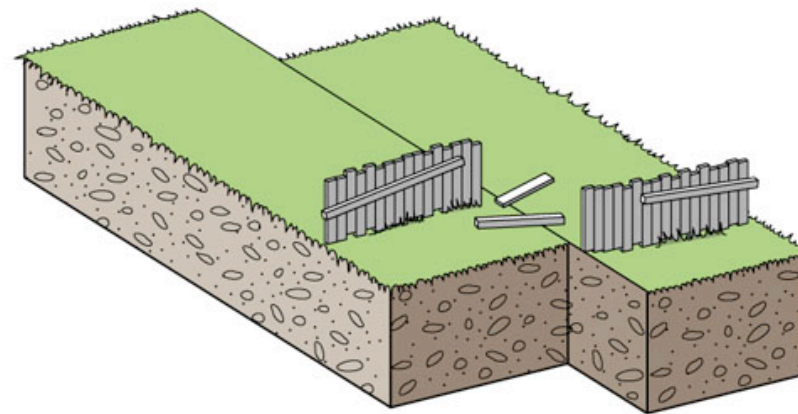
(a) Original position



(b) Deformation



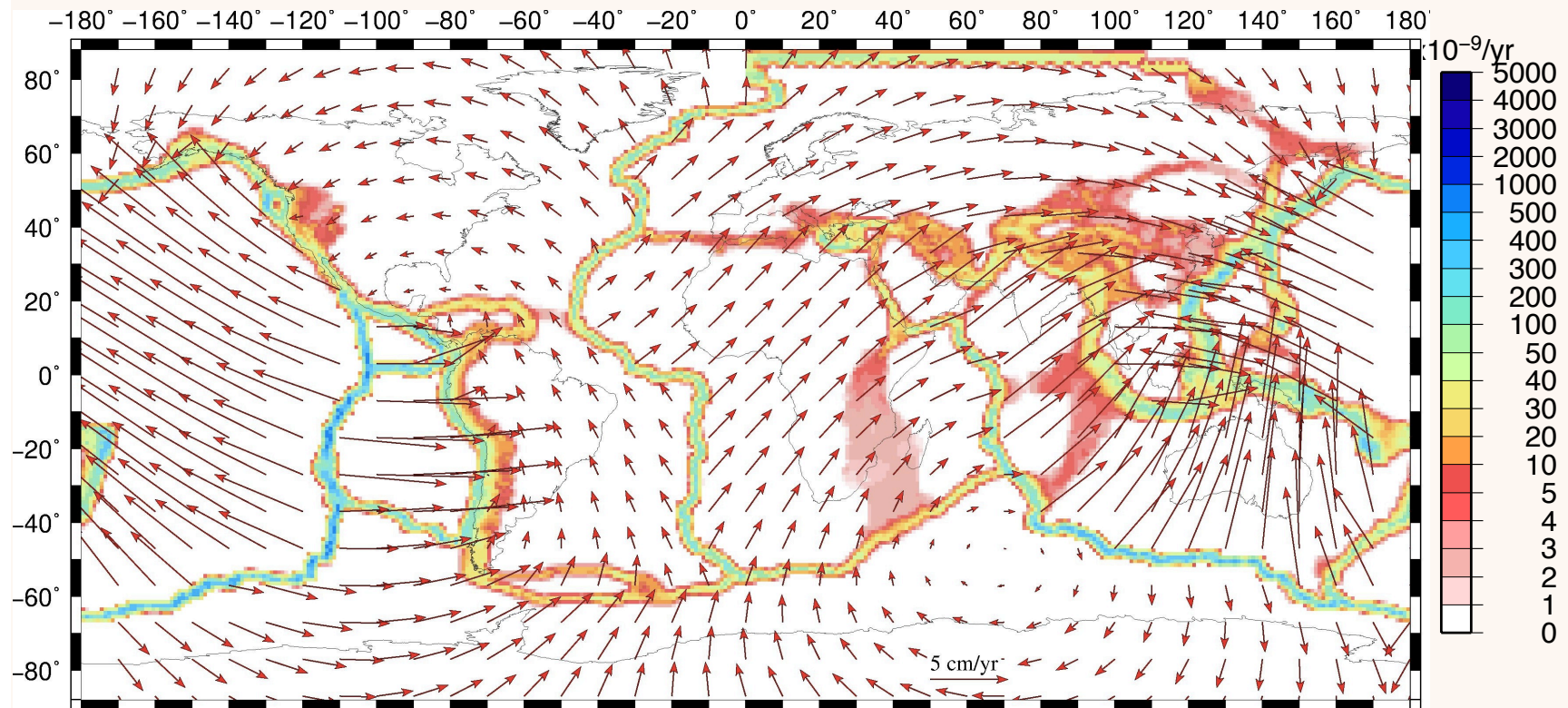
(c) Rupture and release of energy



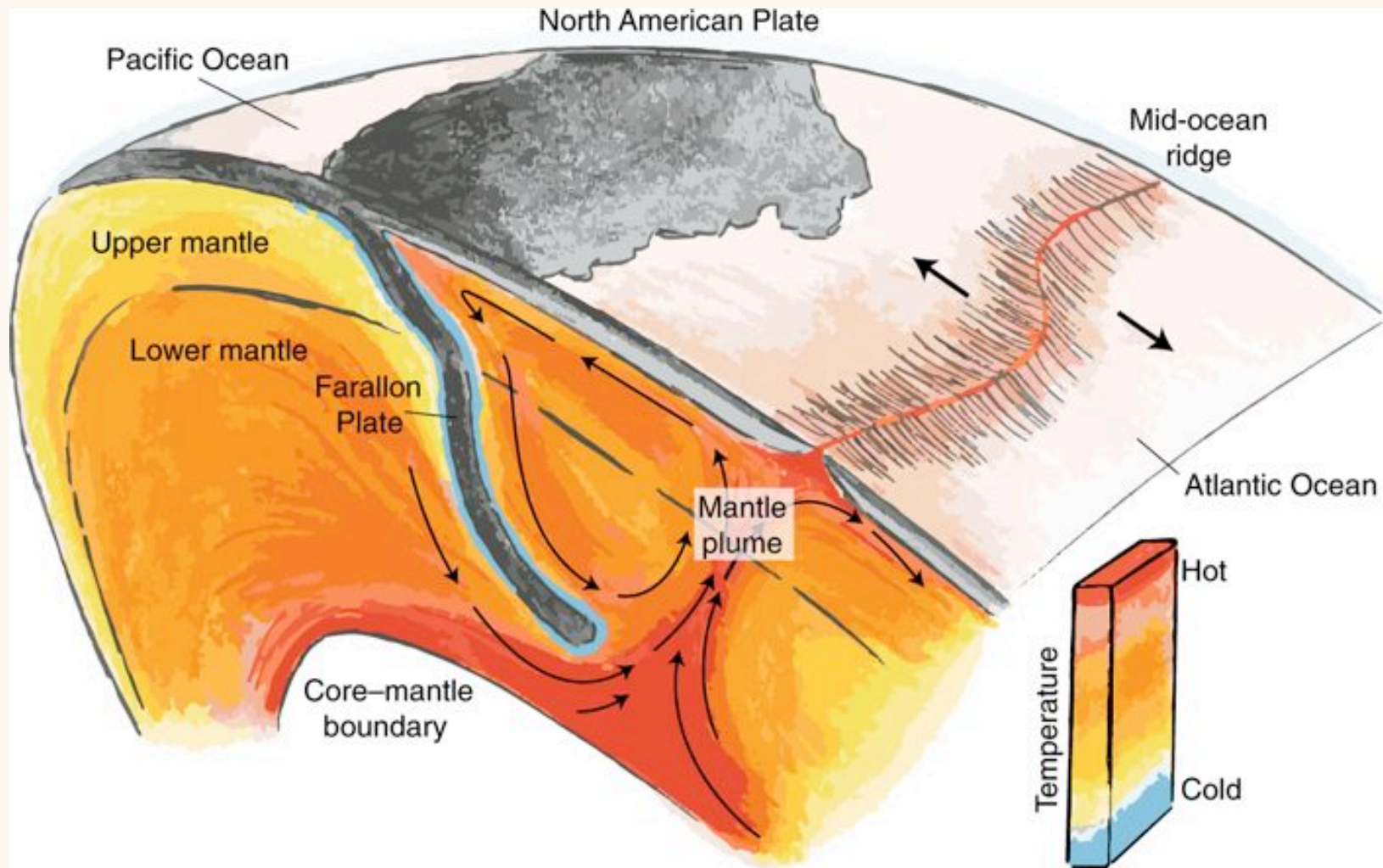
(d) Rocks rebound to original undeformed shape



- Plate velocities
- Strain rates



*Kreemer et al. (2003, 2006)*

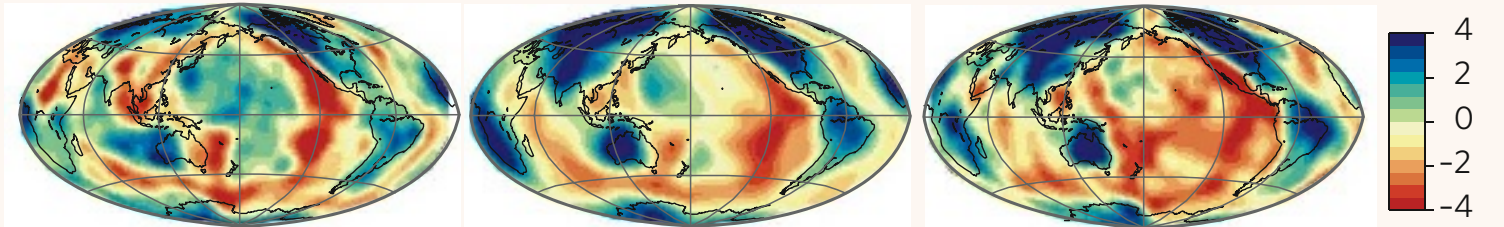


Zilio, *Nature* (2018)

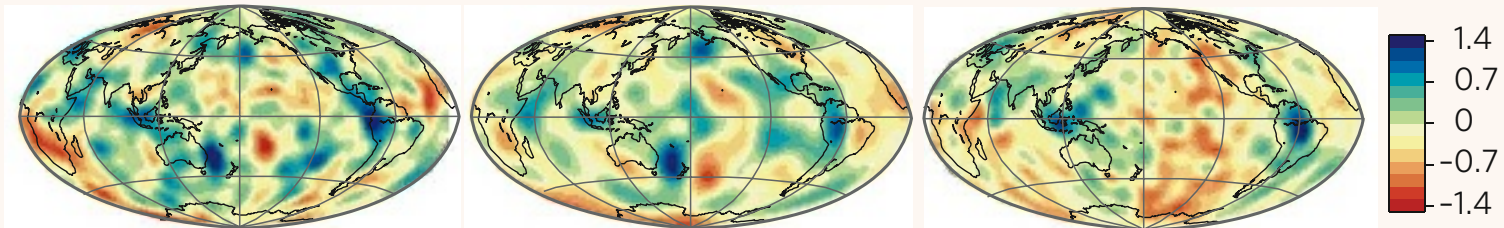


# Velocity Models for the Earth

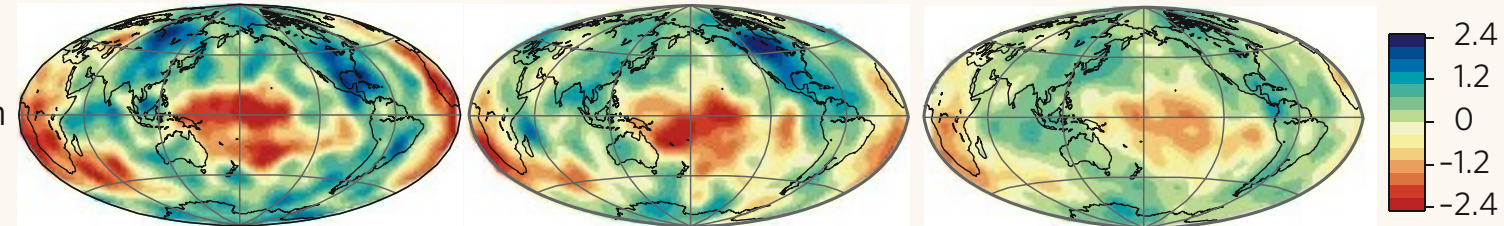
140 km



925 km



2,770 km



SAW24B16

S362D1

S20RTS

*Romanowicz, Nature 2008*



## Some Unanswered Questions

What are the material properties of the rocks that make up the Earth's interior?

What are the forces that drive the plates?

How was plate tectonics initiated on early Earth?

How does the deep Earth interact with the surface?

