Continental deformation and the Mid-Lithospheric Discontinuity along the Grenville Front

Making Seismology Easy 1 step at a time

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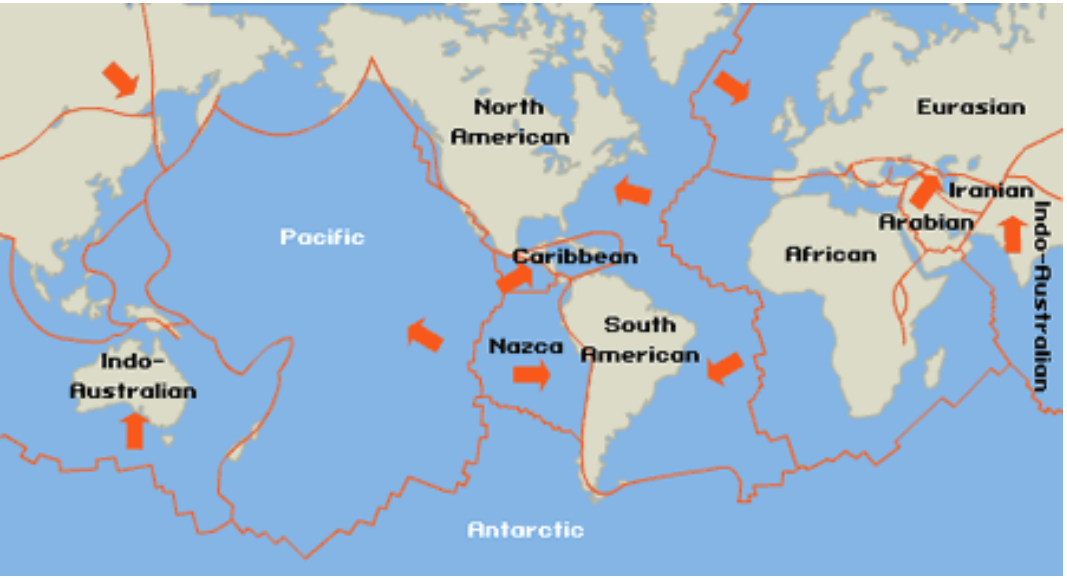
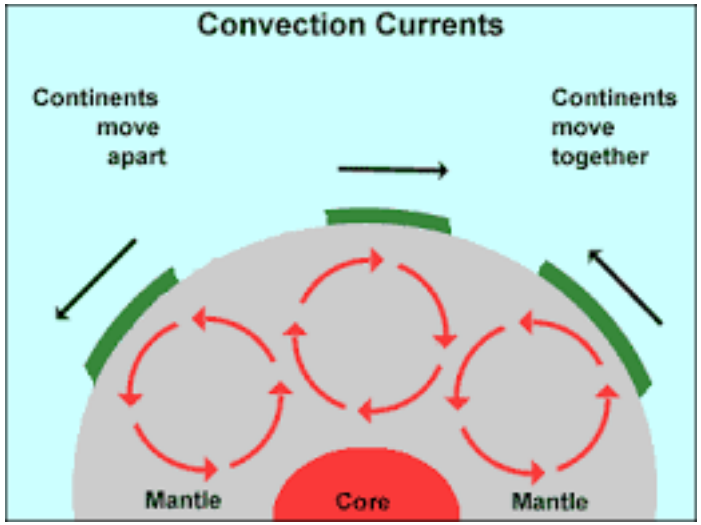
Why is this important?

- By knowing more about these regions we can make better velocity models
- Not a lot is known about the creation of continents or how they were deformed
- This research is the building blocks to help us ask more questions

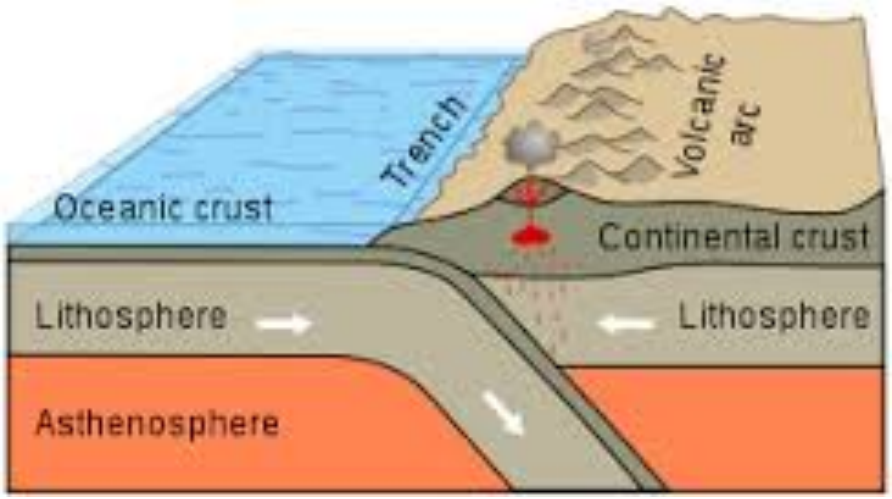
What are Plates and Plate Boundaries?





- The Earth is made up of different plates
- The plates move due to convection
- The plate move (about 2.3cm/year)!

Subduction zone

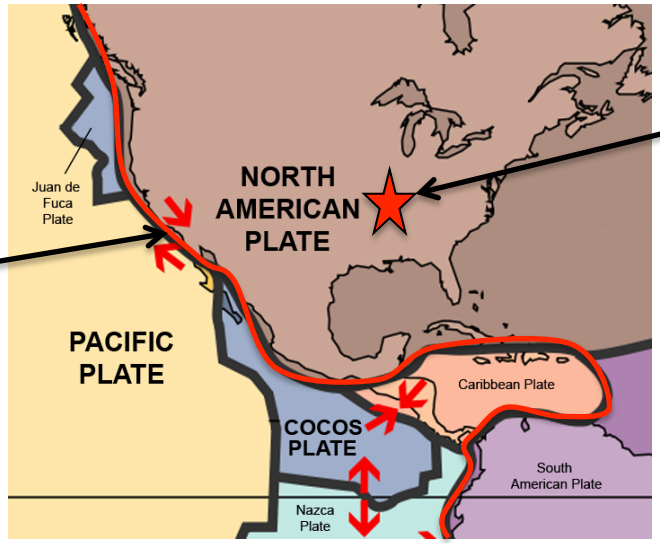


- Because plates move they grind against other
- Oceanic crust will subduct (go under) continental crust
- For example California San Andres Fault

The Center of Stability

- The edges of the plates get a lot of damage or deformation because the two plates grind against each other
- So should the middle stay relativity unchanged and stable?

Subduction zones a lot of deformation



Super unchanged and stable

Yes and No

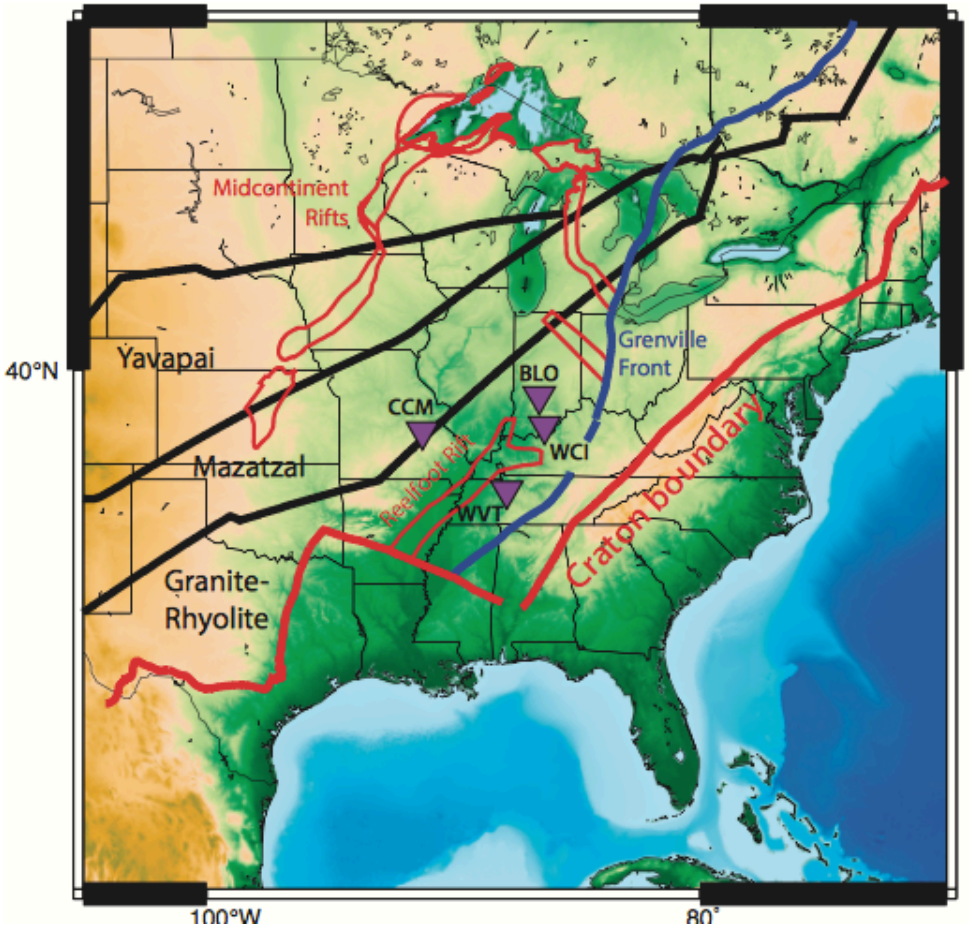
- You should be correct!
- The interior of the continental plate is very old and relativity stable
- However, its been found that there is deformation (damage)

How do we know its not uniform?

- We can measure seismic speeds (how fast energy travel through the earth as waves, for example from an earthquake)
- If the interior of the continent was not deformed and was uniform the speed in which seismic waves travel would be uniform
- A negative velocity zone has been found called the Mid-lithospheric Discontinuity in the interior of the North American Plate.

My Research Questions

- Why are the seismic waves traveling at different speeds?
- Is this velocity decrease seen on both sides of the Grenville Front?

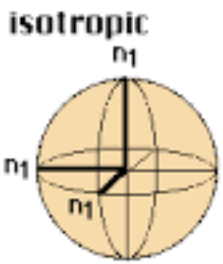


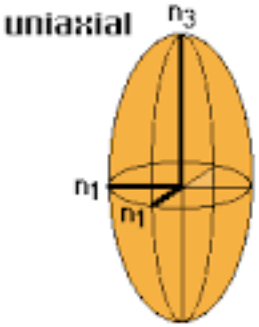
Why are the seismic waves traveling at different speeds?

- Deformed Minerals looked squished

<u>Undeformed</u>

"Isotropic"





<u>Deformed</u>

"Anisotropic"

- Wavespeed
  - Isotropic uniform speed no matter how the wave hits the minerals
  - Anisotropic
    - travel fast parallel to deformation (n1)
    - Travel slow perpendicular to deformation (n3)

Is this velocity decrease seen on both sides of the Grenville Front?

- Grenville Front: 1250- 980 Million Years old
- Would the deformation on the Grenville Front and outside of it be the same?
- If different:
  - deformation happened before it formed
- If the same:
  - deformation happened after it formed