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

Making Seismology Easy 1 step at a time

By: Lauren Abrahams
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 relatively unchanged and stable?

Subduction zones a lot of deformation.
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

<table>
<thead>
<tr>
<th>Undeformed</th>
<th>Deformed</th>
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<tbody>
<tr>
<td>“Isotropic”</td>
<td>“Anisotropic”</td>
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• 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