USING SEISMOLOGY TO EXPLORE THE INTERIOR OF NORTH AMERICA

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The Importance of Seismology

- Detecting and locating earthquakes
  - Earthquake forecasting
  - Increasing earthquake awareness and decreasing hazard
  - Better understanding earthquake hotspots

Briefly discuss each of these points and how they are connected to one another.
When you hear the word “seismology”, what do you think of? Most people probably think of earthquake forecasting, but imaging is another important aspect of seismology.
The “OIlNK” Experiment
(Ozarks, Illinois, INdiana, Kentucky)

- Questions OIlNK is aiming to answer:
  1. What geologic structures characterize the mid-continent?
  2. How do these structures contribute to recent earthquakes in the region?
  3. What do these geologic structures suggest about the assembly and evolution of North America?

(Picture: The arrangement of the recording instruments across eastern Missouri and southern Illinois. Will eventually expand into western Kentucky.)

500 million years ago, this region looked like the western U.S.! We are trying to learn more about the evolution of the continental interior.
The stick interacts with the water waves causing a disturbance in the smoothly flowing water. Therefore, you can infer that something is blocking the flow of water and causing a sort of “shadow”. In a similar way, structures in the earth’s interior cause a disturbance in the traveling seismic waves. This is similar to how a CT scan works. The earthquakes we detect are from all over the world!
We must first dig a hole about 3 feet deep for the sensor. Then we install a solar panel for power, hardware for recording the earthquakes, and an antenna to retrieve the data in real-time.
It takes about an hour and a half to dig the hole and another 2-3 hours per install. There are ~70 of these stations spanning Illinois, Indiana, and Kentucky!
This is a cross section through eastern Missouri and southern Illinois. On the bottom right is the estimated crustal thickness through the region. The crust appears to thin out beneath the Illinois Basin.
Exploring the Illinois Basin

- What is the importance of crustal thickness?
  - Thinning crust beneath southern Illinois may suggest how the basin formed there.

- Additional findings
  - The basin has collected layers of sediment over the years. These layers add complexity that effect the estimates of crustal thickness.
  - The deep parts of the basin "ring" like a bell making it difficult to accurately identify the bottom of the crust.
  - Must compensate for these extra layers!
Further OIINK Investigations

- Crustal thinning
  - Now that we know the crust is changing thickness in the region, what can we learn about geologic processes caused the crust to become thin beneath the Illinois Basin?

- Imaging below the crust
  - What are the deeper properties and how do they contribute to the measured crustal properties?

- Characterizing the Wabash Valley seismic zone
  - What are the characteristics of earthquake prone regions in the mid-continent?
QUESTIONS?