TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

POLAR TREC

Polar Professional Development
ED 593: Applied Physical Science Concepts for Educators

Seismic Investigations of the Transantarctic Mountains, Antarctica

Dr. Samantha Hansen

University of Alabama

16 April 2013

Blackboard collaborate

Slides will be shown here

Exit the presentation

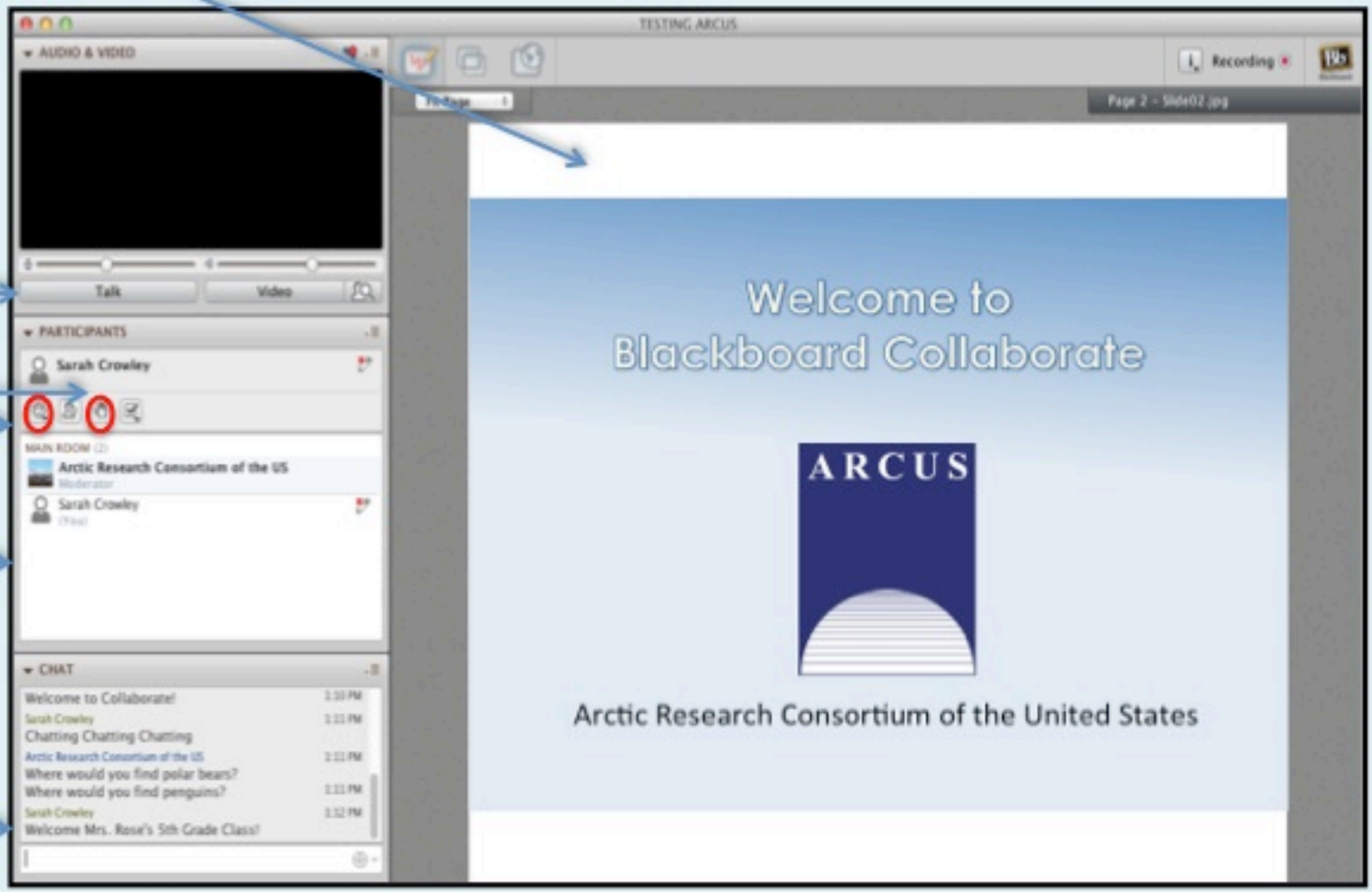
Click to Talk, **Unclick** to finish talking

Raise your hand to ask a question

Share with emoticons

List of all participants

Chat with one person or the entire group



Please Note:

- Participants using the telephone can mute/unmute by **pressing *6** on the phone.
- Today's event will be recorded and archived.

Questions

During the Presentation:

- Type your question in the text chat box

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- Raise your hand with the "hand button".
- PolarTREC staff will call on you.
- Speak loud and clear and directly into the phone to ask your question.

Click on the Talk button to speak.

Unclick when you are done.

Participant Introductions

When called, please state your:

- ✓Name
- ✓School / Institution
- ✓The number of adults participating with you in the same location

What is PolarTREC?

PolarTREC is a professional development experience in which K-12 teachers are paired with researchers for 2-6 week research experiences in the polar regions.

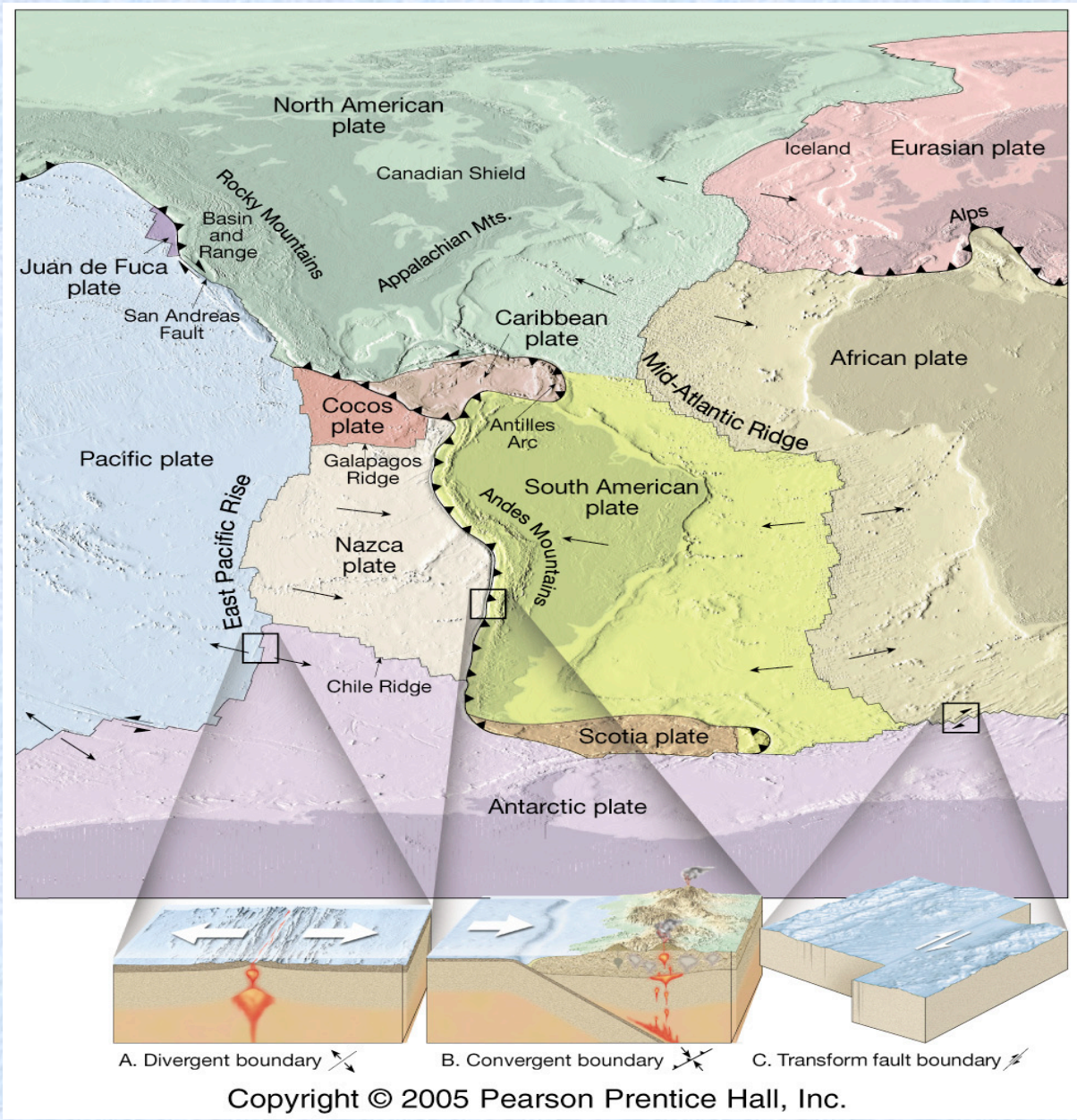
From 2010-2013, nearly 50 teachers from around the United States will join scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.

Overview

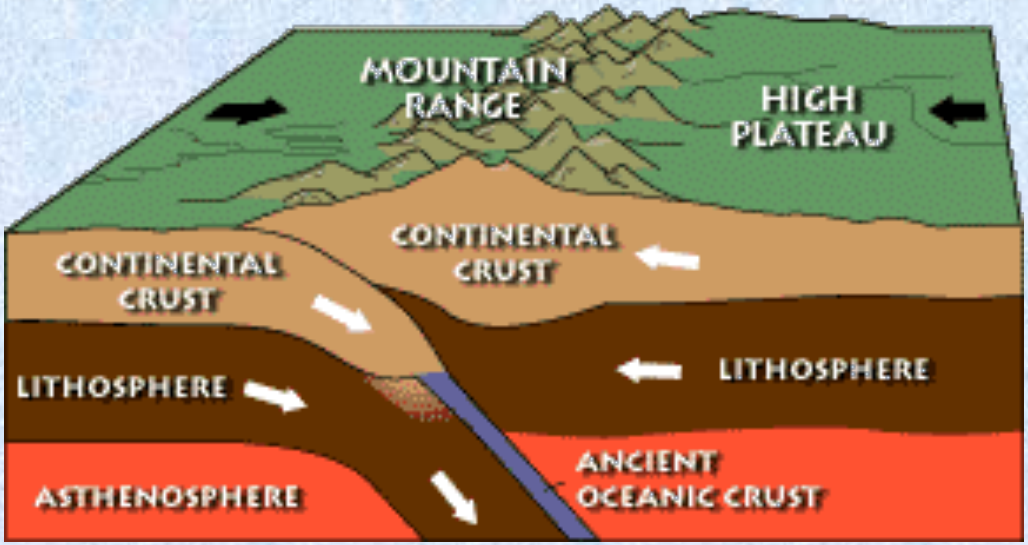
- Background on plate tectonics and mountain building
- Antarctica and the Transantarctic Mountains – why are they different?
- Seismic deployments in Antarctica
- Analysis examples
- Conclusions
- Discussion and Questions

Plate Tectonics

- Oceanic plates: dense/heavy; can sink back into mantle (subduction)
- Continental plates: less dense; do not subduct



Mountain Building



- Most mountain ranges formed by the collision of two plates (i.e. compression)

Himalaya Mtns.

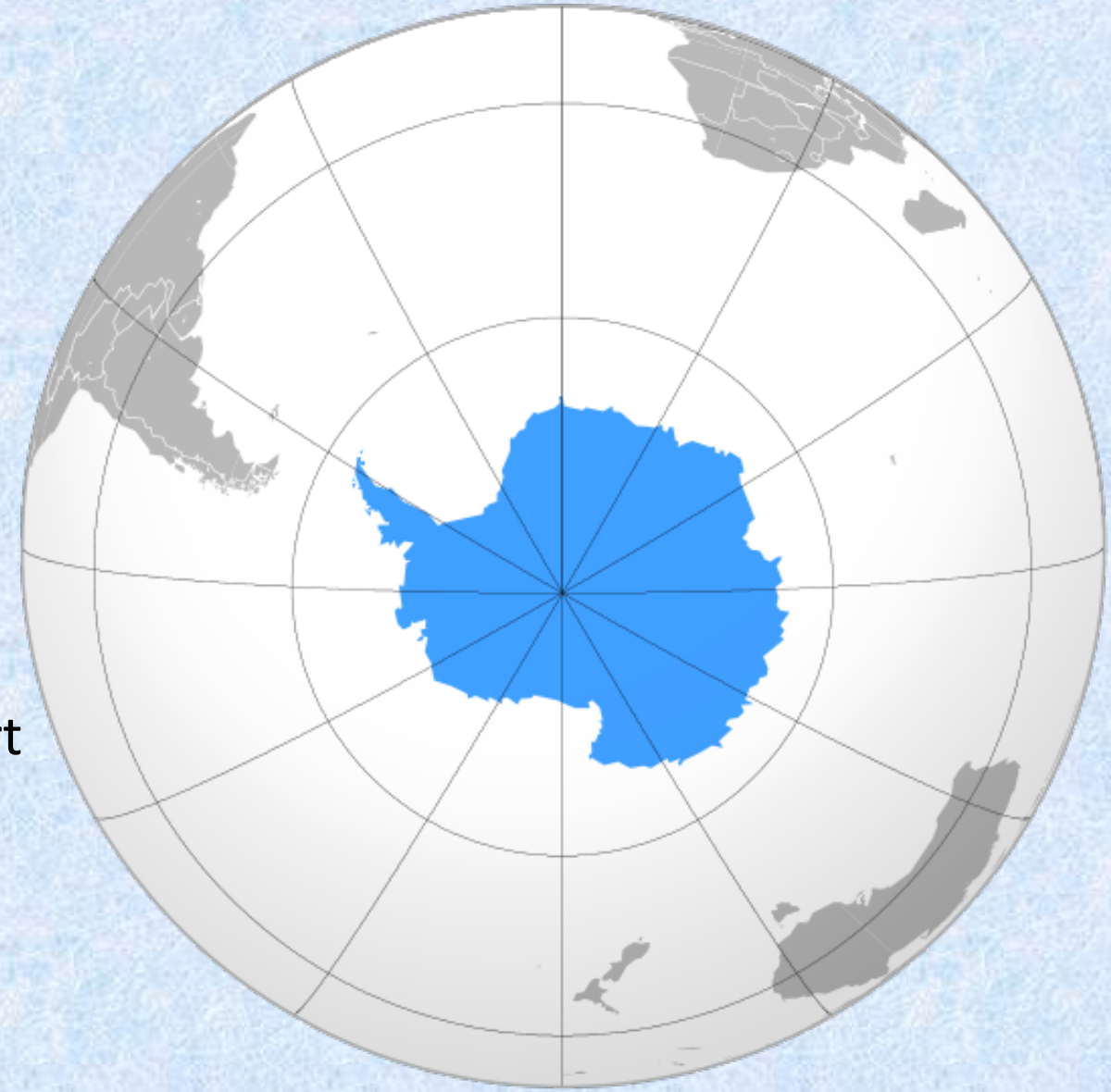
Appalachian Mtns.

Antarctica:
Fun Facts

- 5th largest land mass; 1.5 times the size of the U.S.

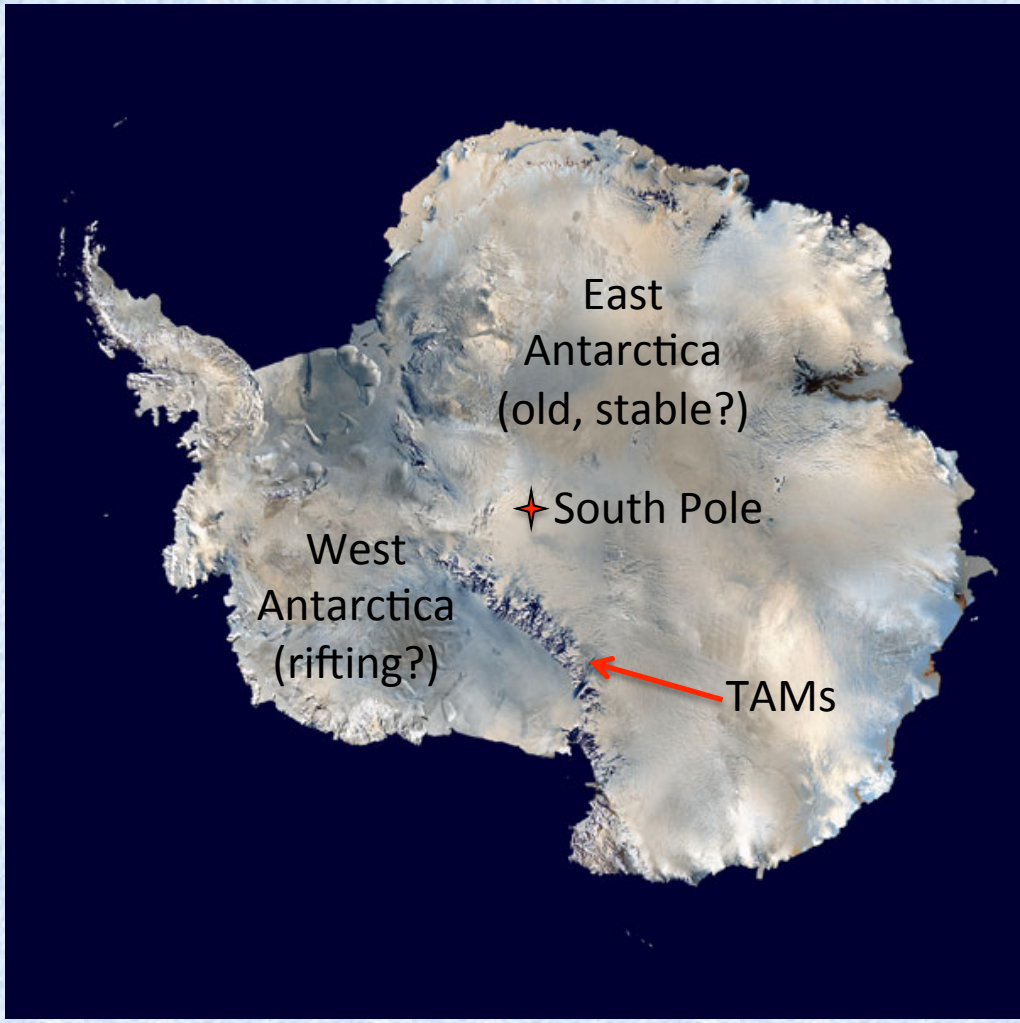
- Coldest, windiest, driest, highest, quietest, most remote, and least understood continent on Earth
    - World's largest desert
    - Record cold: -129°F

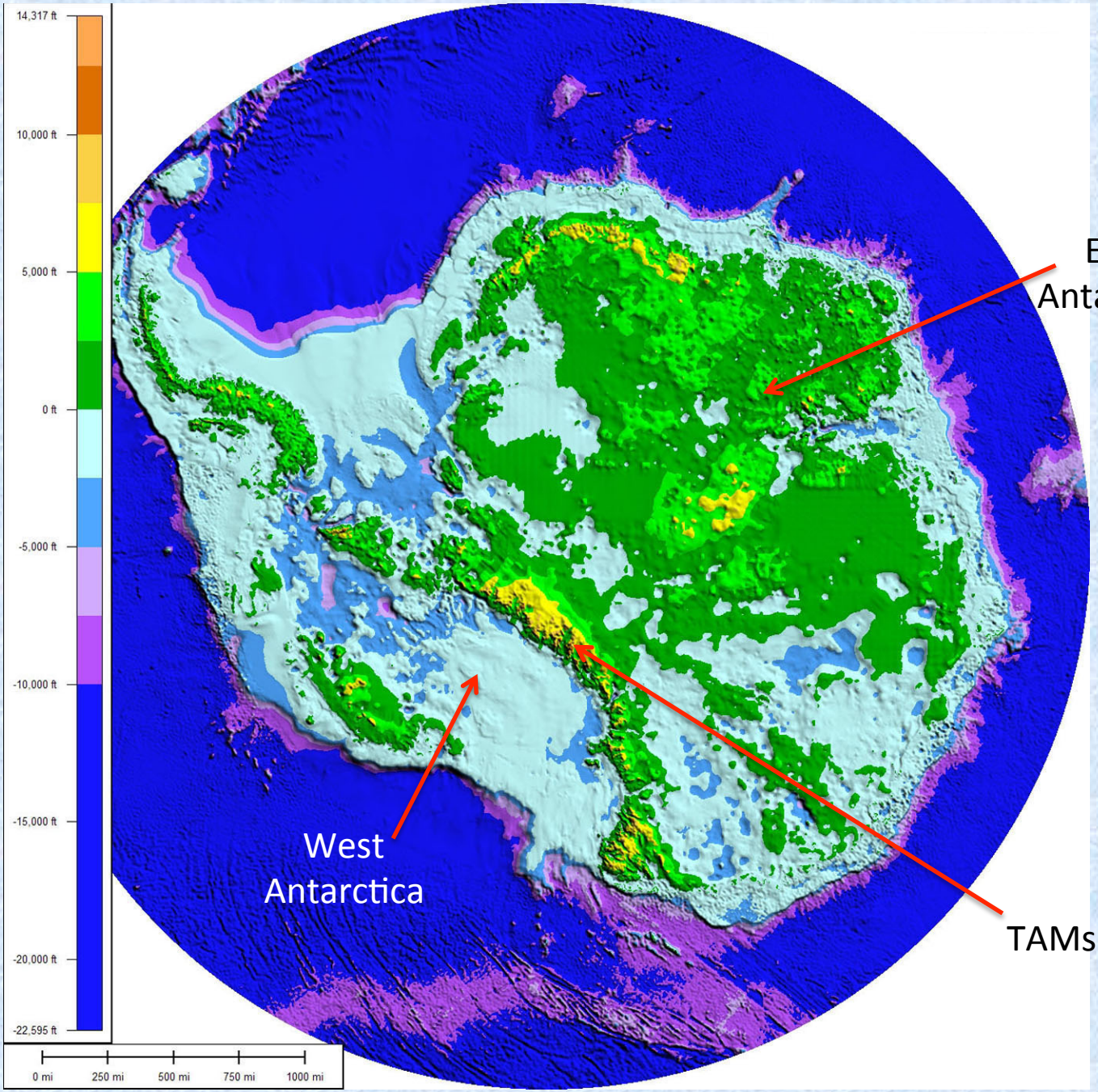
- 99.6% covered by ice
    -Difficult to make surface observations



Transantarctic Mountains (TAMs)

- Separate East and West Antarctica; ~4000 km long and ~4500 m high
- Uplift began ~55 Ma
- No evidence for a compressional origin



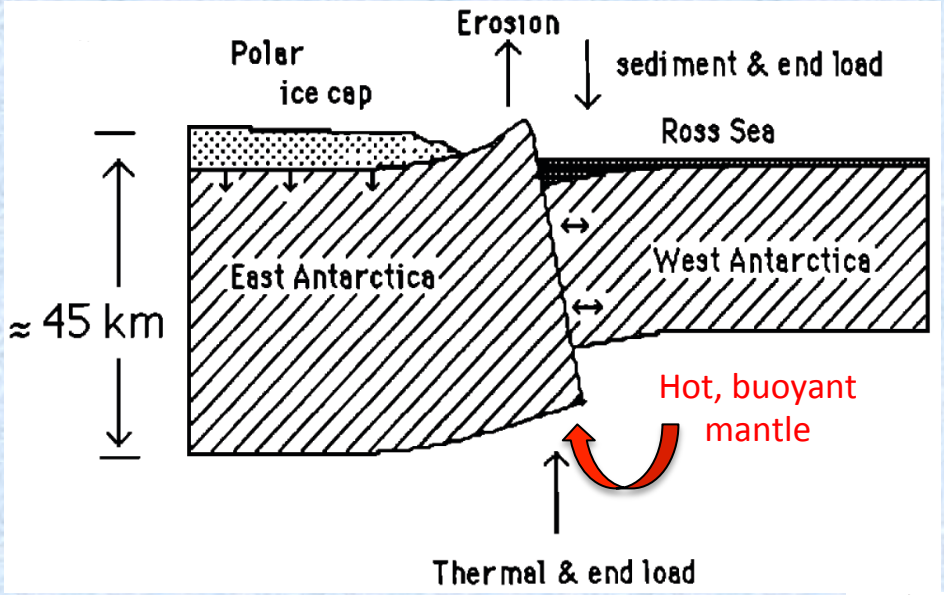


Lythe et al. (2001)

TAMs: Important Questions

- How (by what method) did the TAMs form?
- How does the formation of the TAMs relate to the overall tectonic history of Antarctica?
- What role did the TAMs play in the glaciation of the continent?

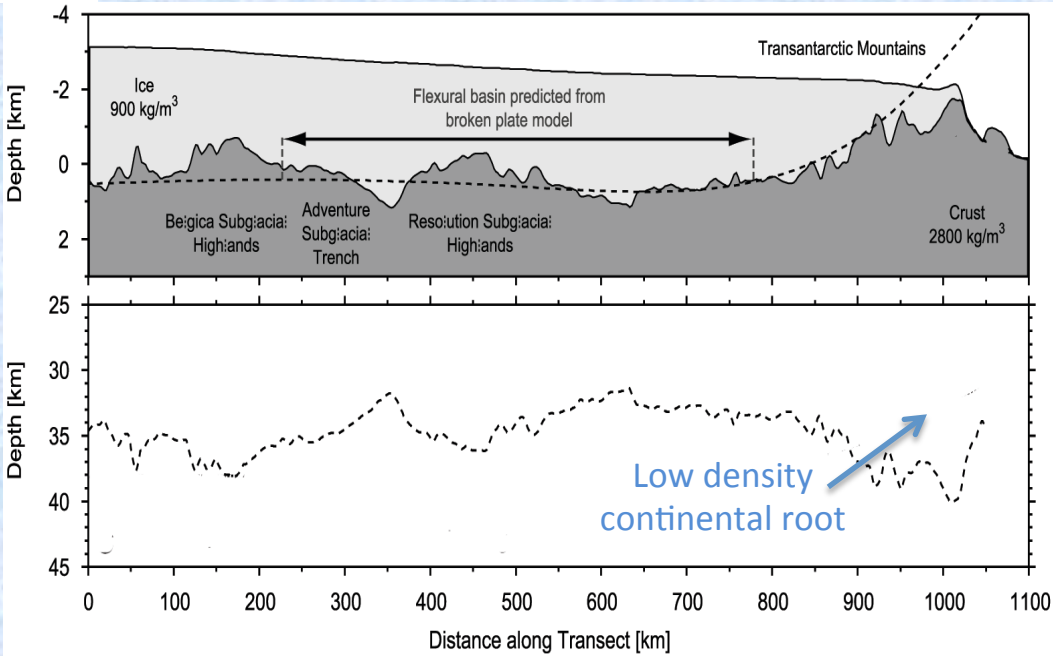
TAMs: Some Suggested Uplift Models



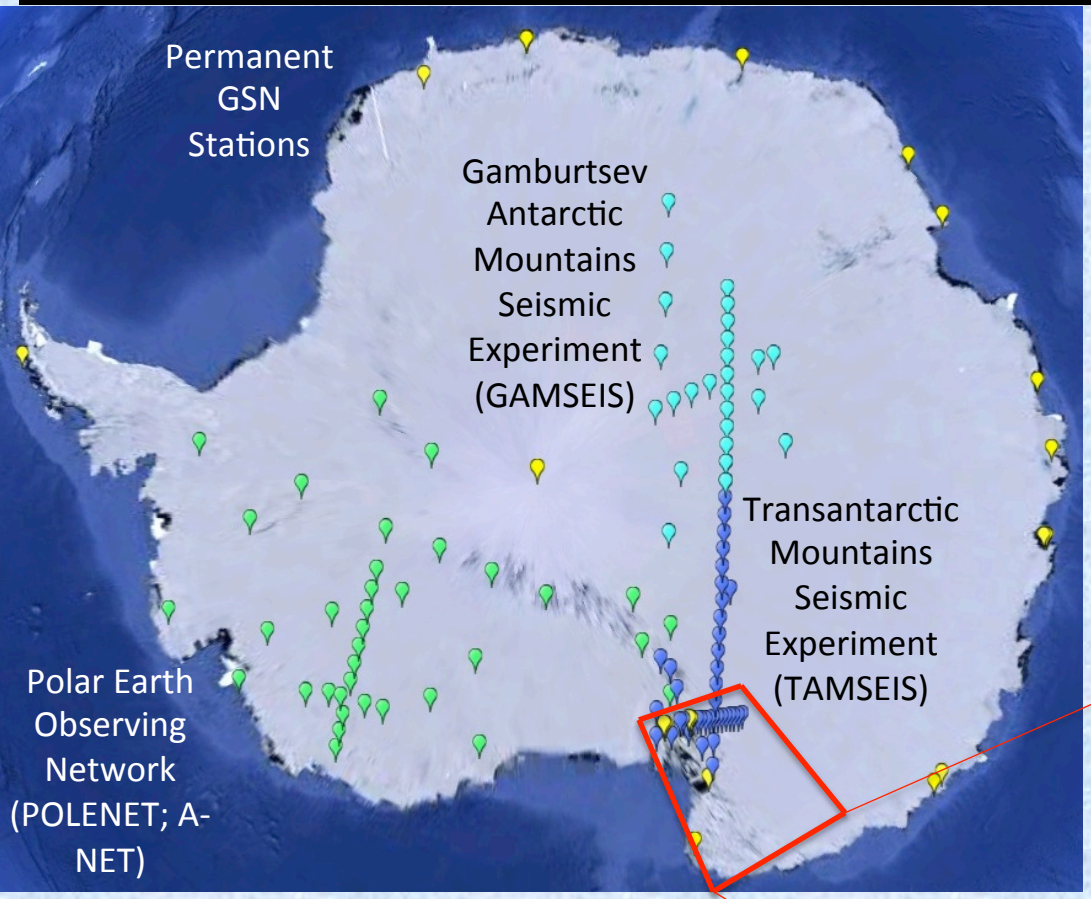
Flexure and thermal loading
Stern and ten Brink (1989)

Crustal buoyancy
Studinger et al. (2004)

- Details about the crustal and upper mantle structure could help us determine which model(s) seem most viable

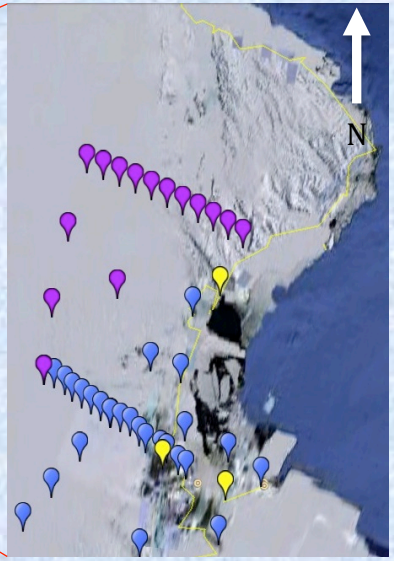


Expansion of Seismic Networks



- Use seismic data from long-range earthquakes to "see" the subsurface structure

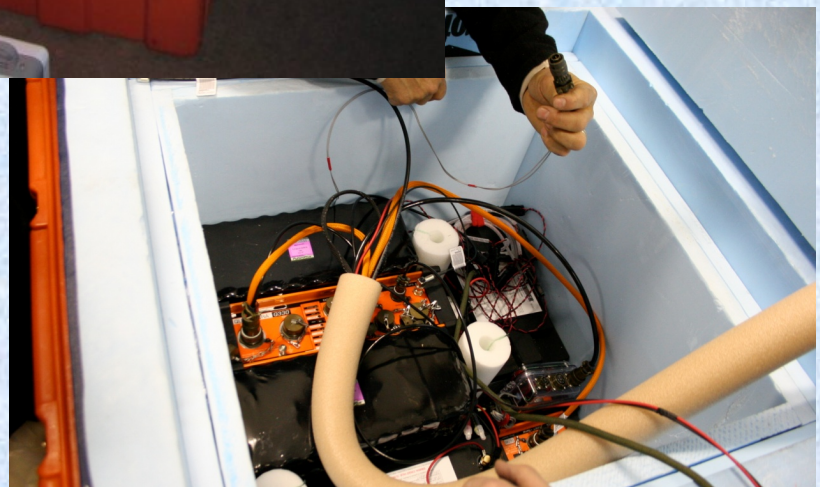
Transantarctic Mountains Northern Network (TAMNNET)



Antarctic Seismic Fieldwork

Twin Otter

Batteries, electronics



A-star Helicopter

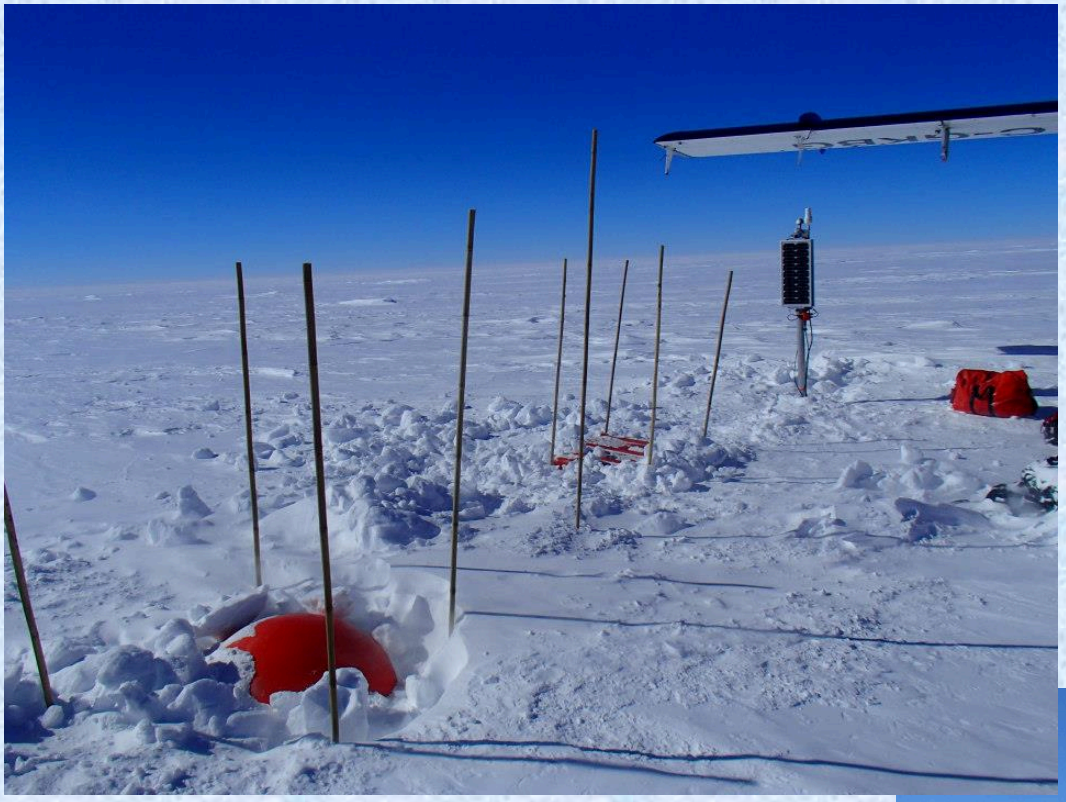
Dig
three big holes
(so much digging…)

Lower
electronics
box into
hole

Setup/connect polar-rated seismometer

Setup/connect solar panel

Full system setup



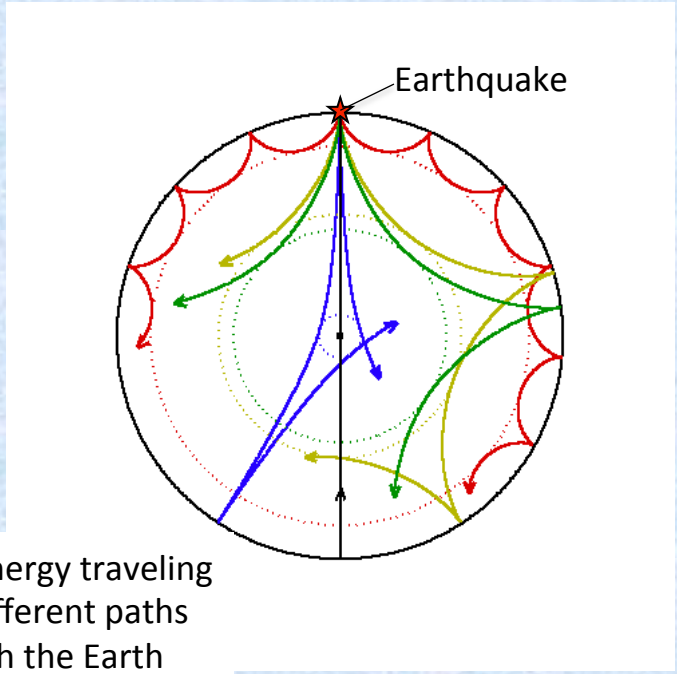
Cover seismometer with dome;
bury equipment and mark with poles

Congratulate selves
for being awesome!

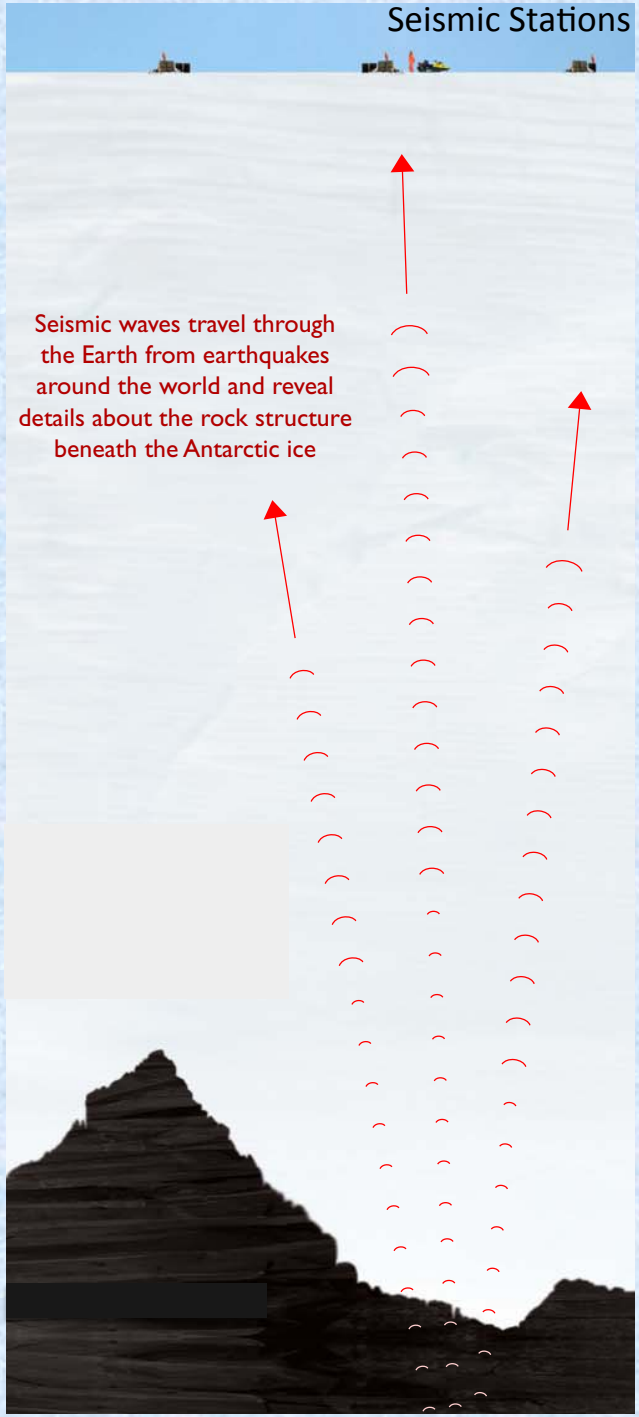
Seismic Analysis

- Our stations record seismic data from earthquakes around the world

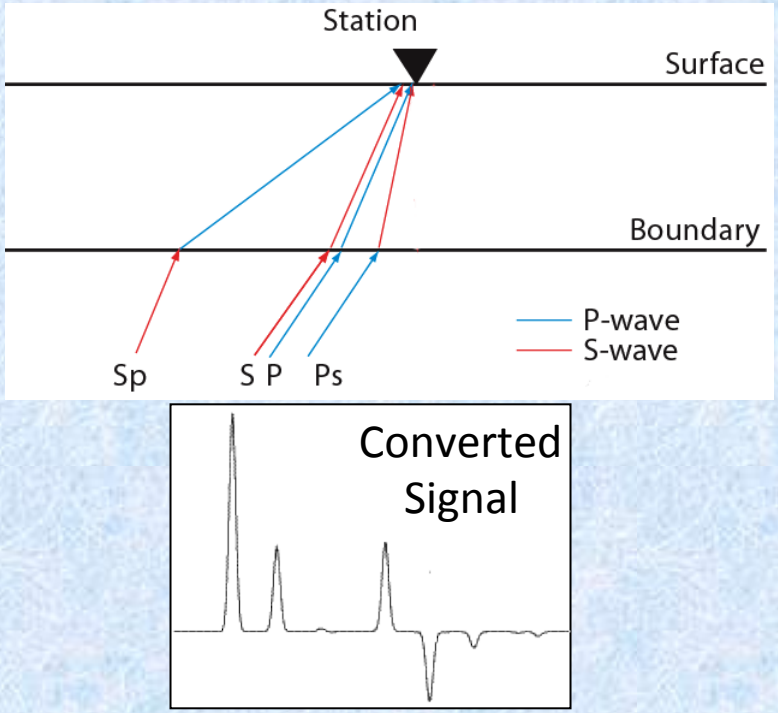
- We can model the timing, amplitude, etc. of these signals to infer Earth structure



Seismic energy traveling along different paths through the Earth



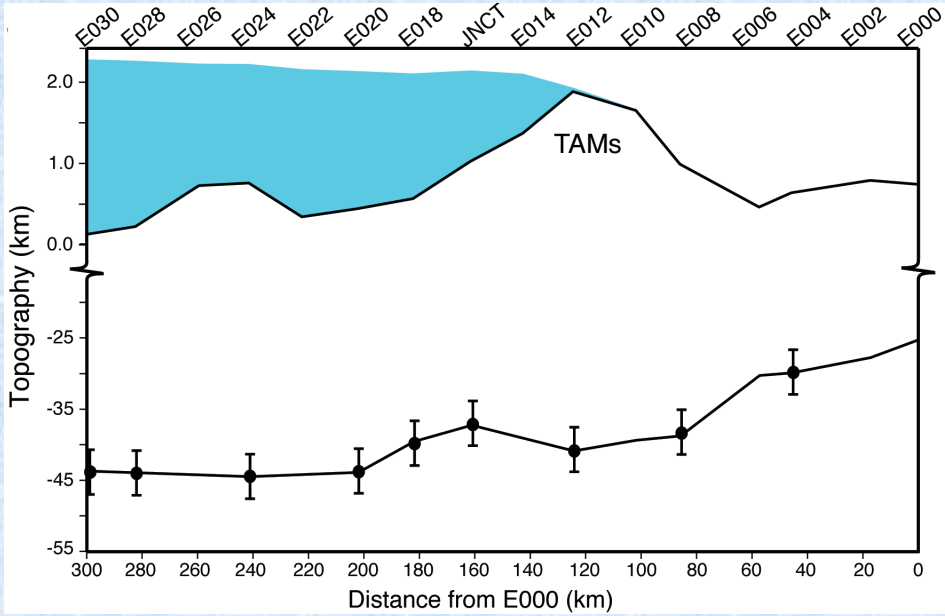
Seismic Analysis: Examples



Receiver Functions

- At boundaries in the subsurface, one type of seismic wave can convert to another

- Can model converted signal to find the associated boundary (such as the crust-mantle interface)

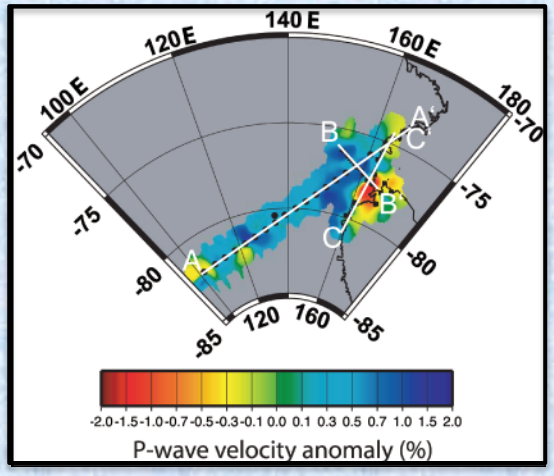


Hansen et al. (2009)

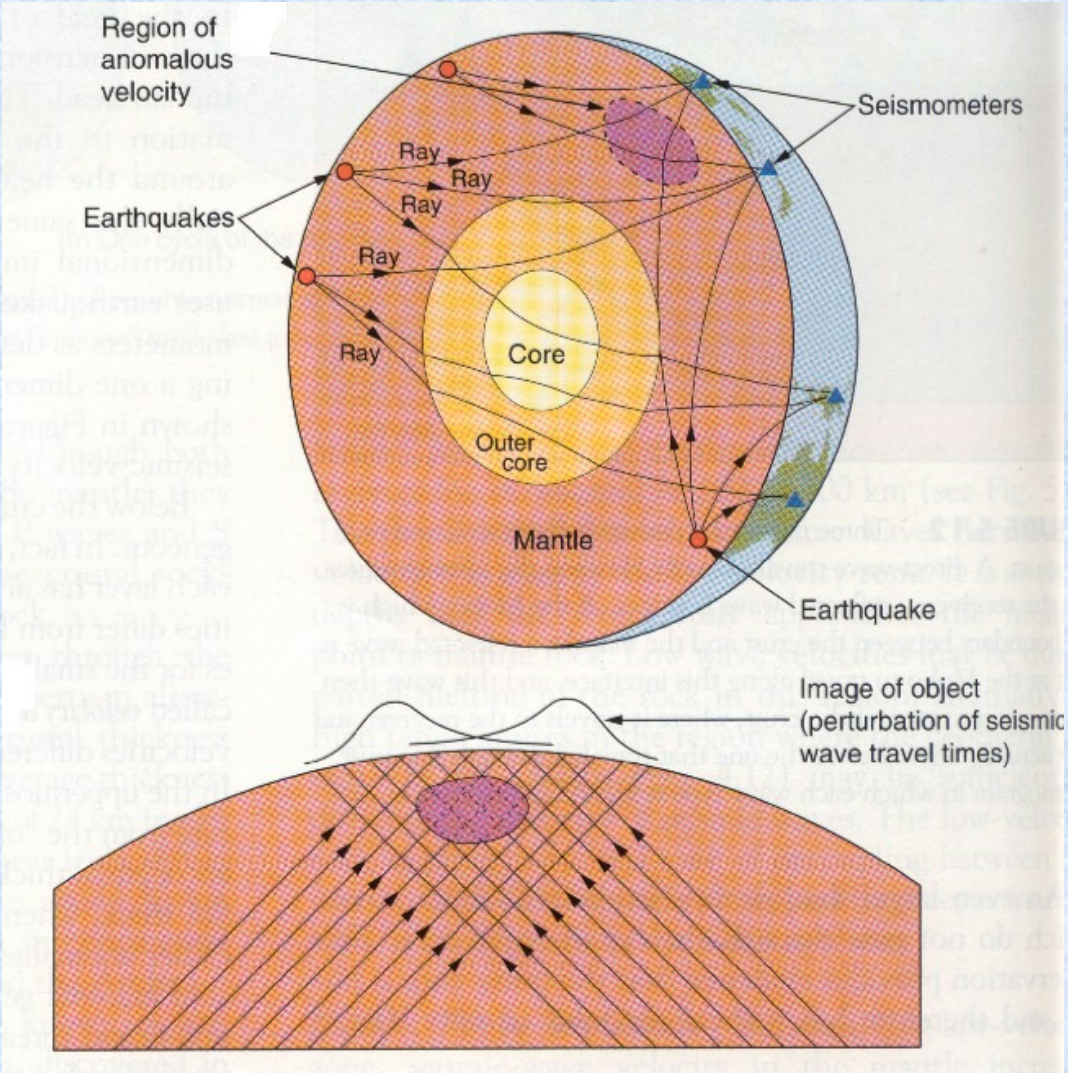
Seismic Analysis: Examples

Tomography

- "Cat scan" of the Earth to look at velocity variations
- Patterns of fast and slow areas can tell us about subsurface structure



Watson et al. (2006)



Conclusions

- The Transantarctic Mountains (TAMs) are an unusual mountain range in that they show no evidence for a compressional origin.

- To decipher how the TAMs developed, we need to look at their corresponding crustal and upper mantle structure.

- Using seismic data from long-range earthquakes, we can get images of the subsurface to investigate these details.









Thanks for your attention!

Any comments/questions?



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www.polartrec.com/about/join

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- **Become a PolarTREC Teacher!**

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Thank You!

An archive of the event will be available shortly.

http://www.polartrec.com/polar-connect/archive