An inverted continental Moho and serpentinization of the forearc mantle

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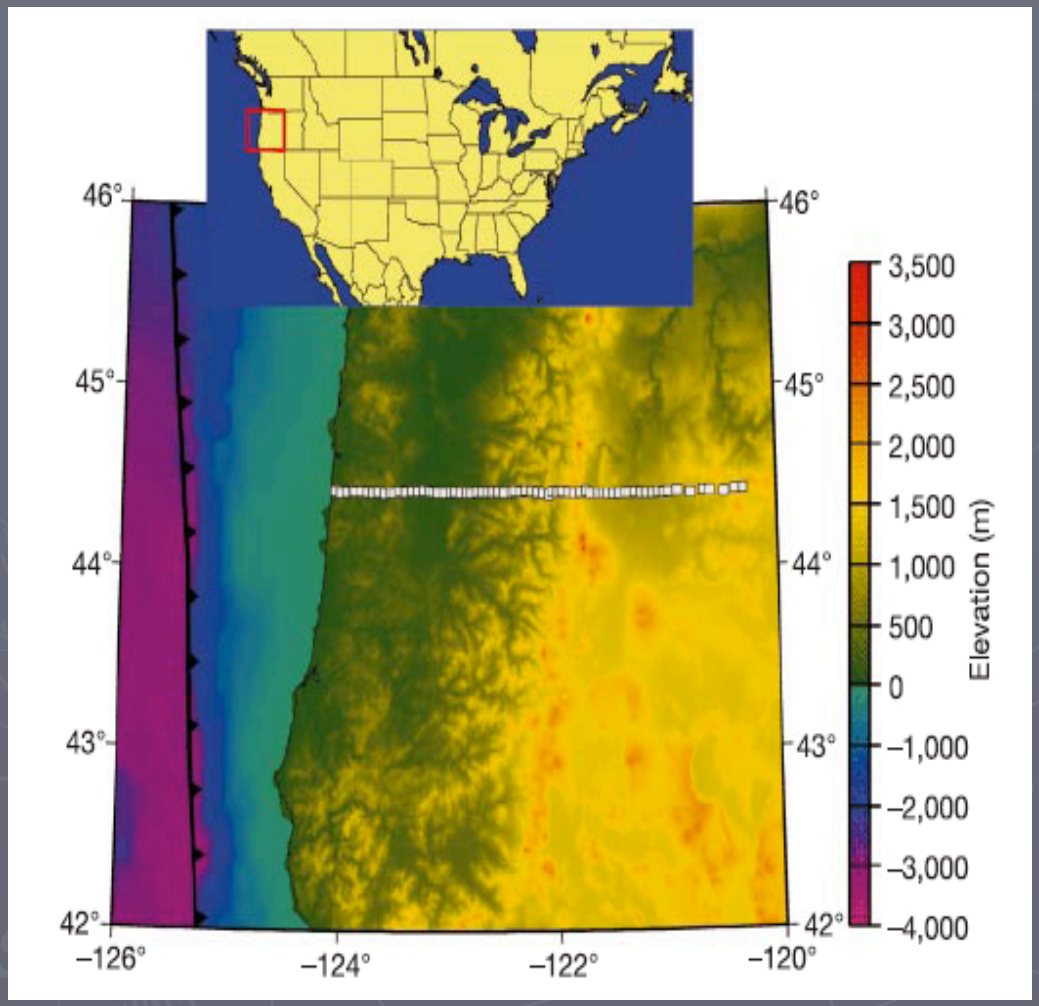
Intentions

- To explore structure of the mantle wedge in the southern Cascadia subduction zone (CSZ)
- To understand the observed variations in velocity structure in the forearc region

Data



Bostock et al., 2002

- Relief map of the CSZ
  - White squares represent broadband stations
- Collected data from a dense broadband array of 69 stations across Central Oregon
  - high-quality P-wave seismograms from 31 events

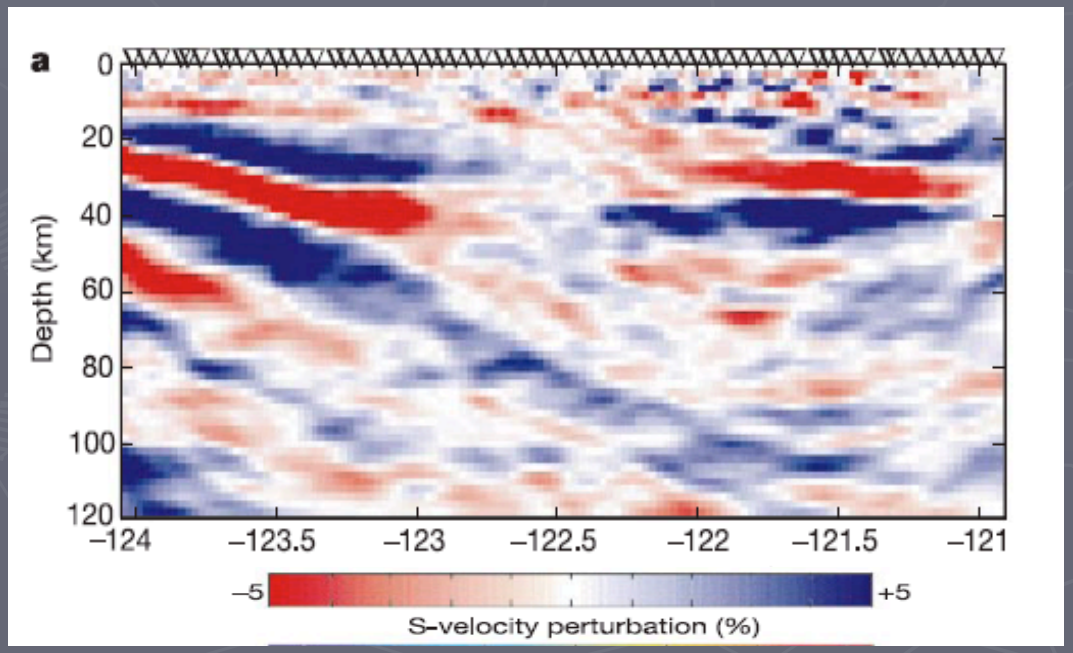
Methods

1) Applied formal, multichannel inversions of:

-forward scattered P to S wave conversions

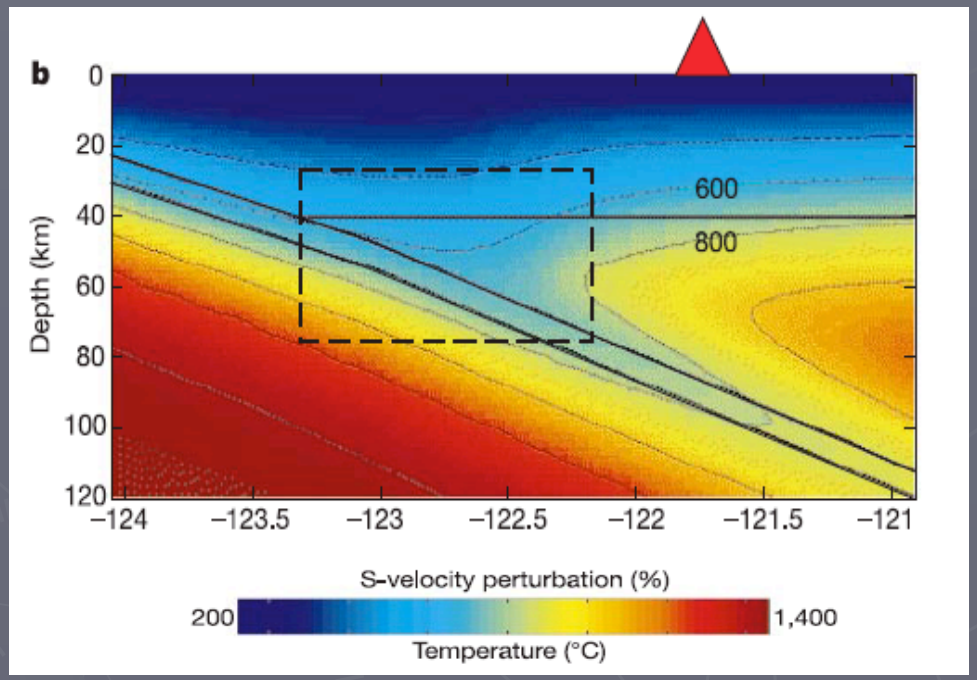
-back-scattered waves caused by free surface reflections

2) Plotted perturbations in velocity structure



Bostock et al., 2002

Methods



Bostock et al., 2002

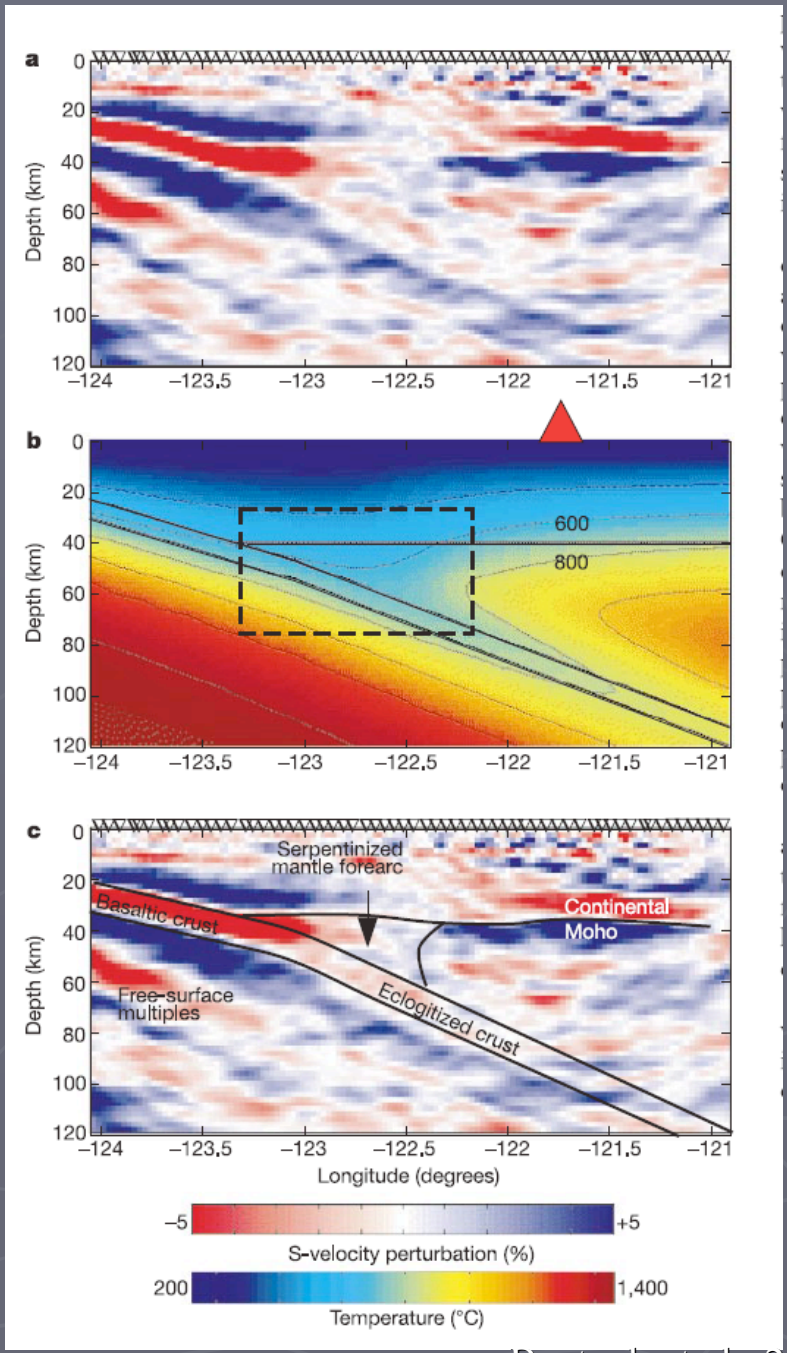
3) Plotted a thermal model for Central Oregon

-based on teleseismic profile, heat flow, and other geophysical data

- Note that the temperatures in the forearc are 400°-600° (200°-400° colder than arc temperatures)

Interpretations

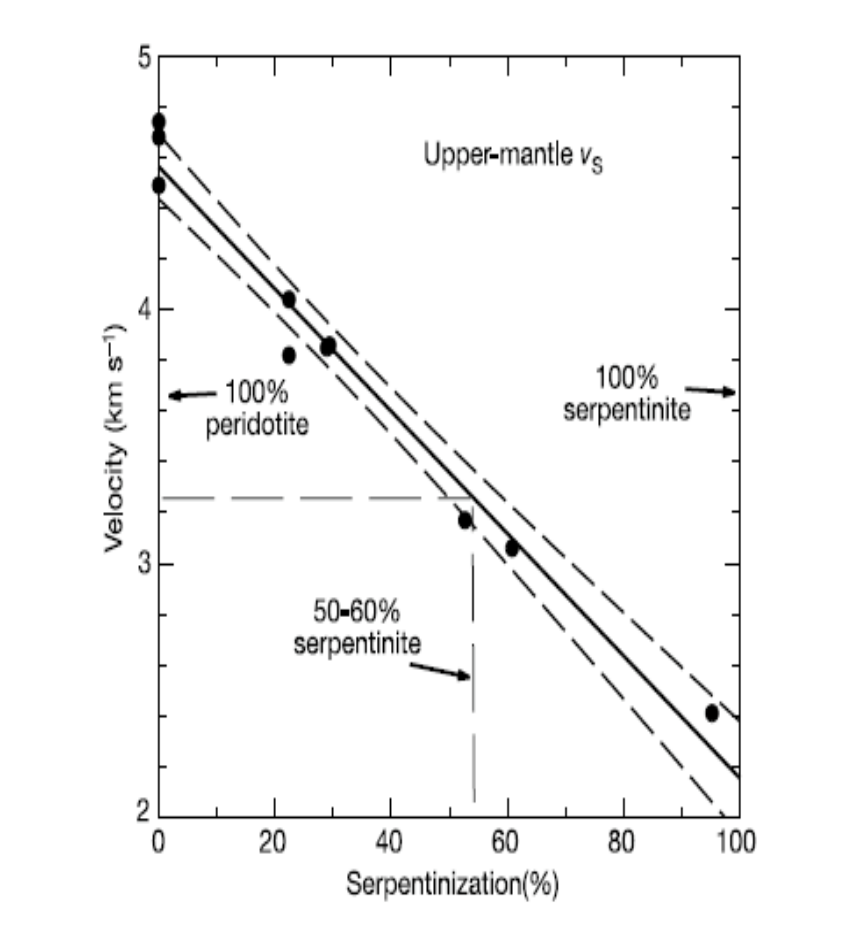
- Sharp increase in dip angle (from ~10° to ~30°) argues for eclogitization of the slab
- Eclogitization implies hydration and serpentinization of the forearc
- Thermal model temperatures are within the range that serpentine minerals are thought to be stable
- With a high enough % composition, serpentinization of the forearc would significantly reduce S-wave velocities



Bostock et al., 2002

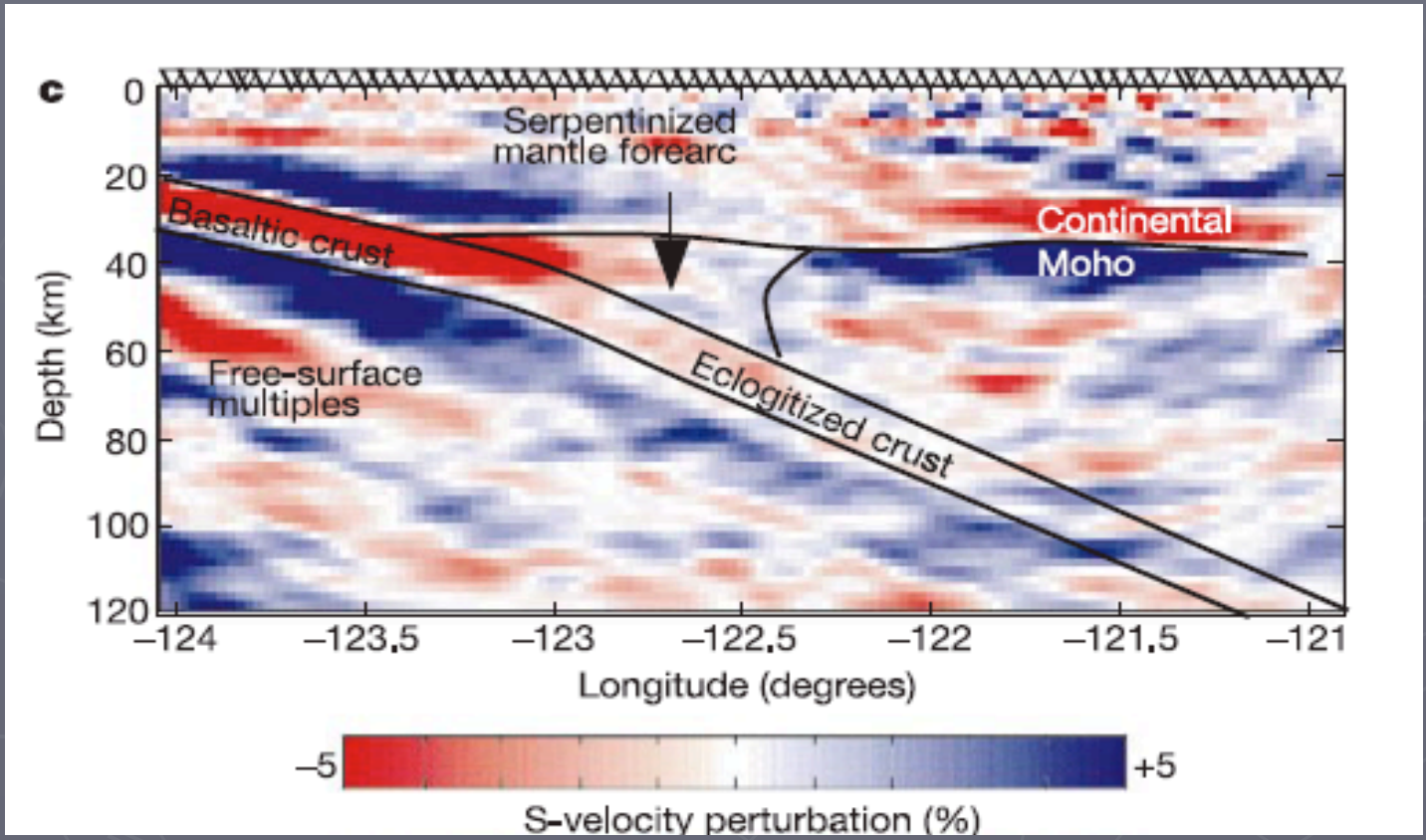
Interpretations

- As presence of serpentinite increases, S-wave velocities decrease
- Observed S-wave velocities in the forearc indicate a possible composition of serpentinite as high as 50-60%



Bostock et al., 2002

Interpretations



Bostock et al., 2002

Implications

- Serpentine and it's alteration products are though to exhibit stable sliding properties and will impede rupture into the forearc mantle
- Mantle flow into the wedge may be modified by the presence of the serpentinized forearc mantle
  - The weak rheology and positive buoyancy will cause isolation from the mantle-wedge corner flow system

Additional Thoughts...

- To what depth are the perturbation plots reliable?
- Are there other possible explanations for such a decreased velocity within the forearc?