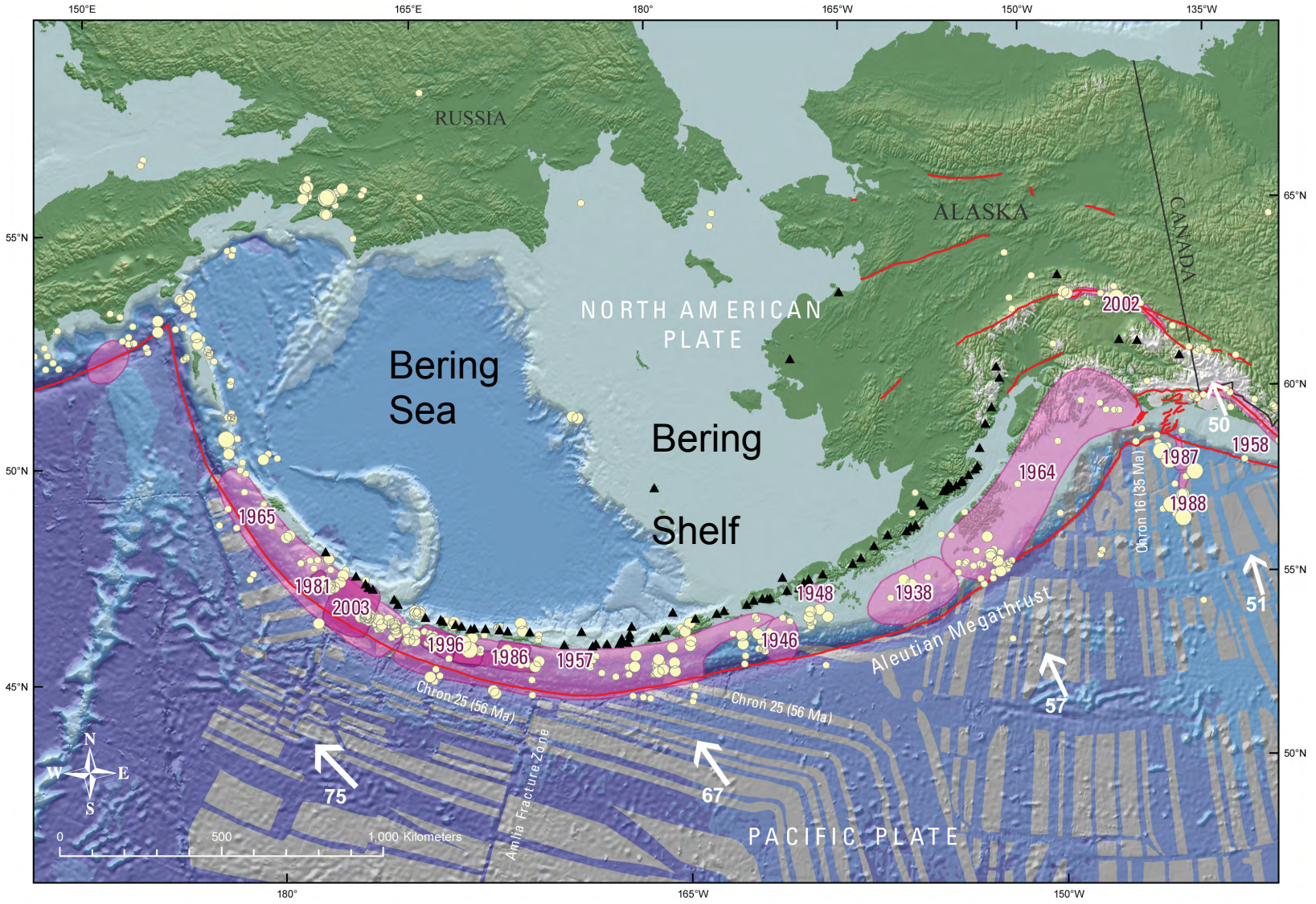
Using the drillship to understand the age and origin of the Aleutian Basin & what this tells about the early history of the Aleutian Arc



3900 km long, near-perfect arc

Peter Haeussler

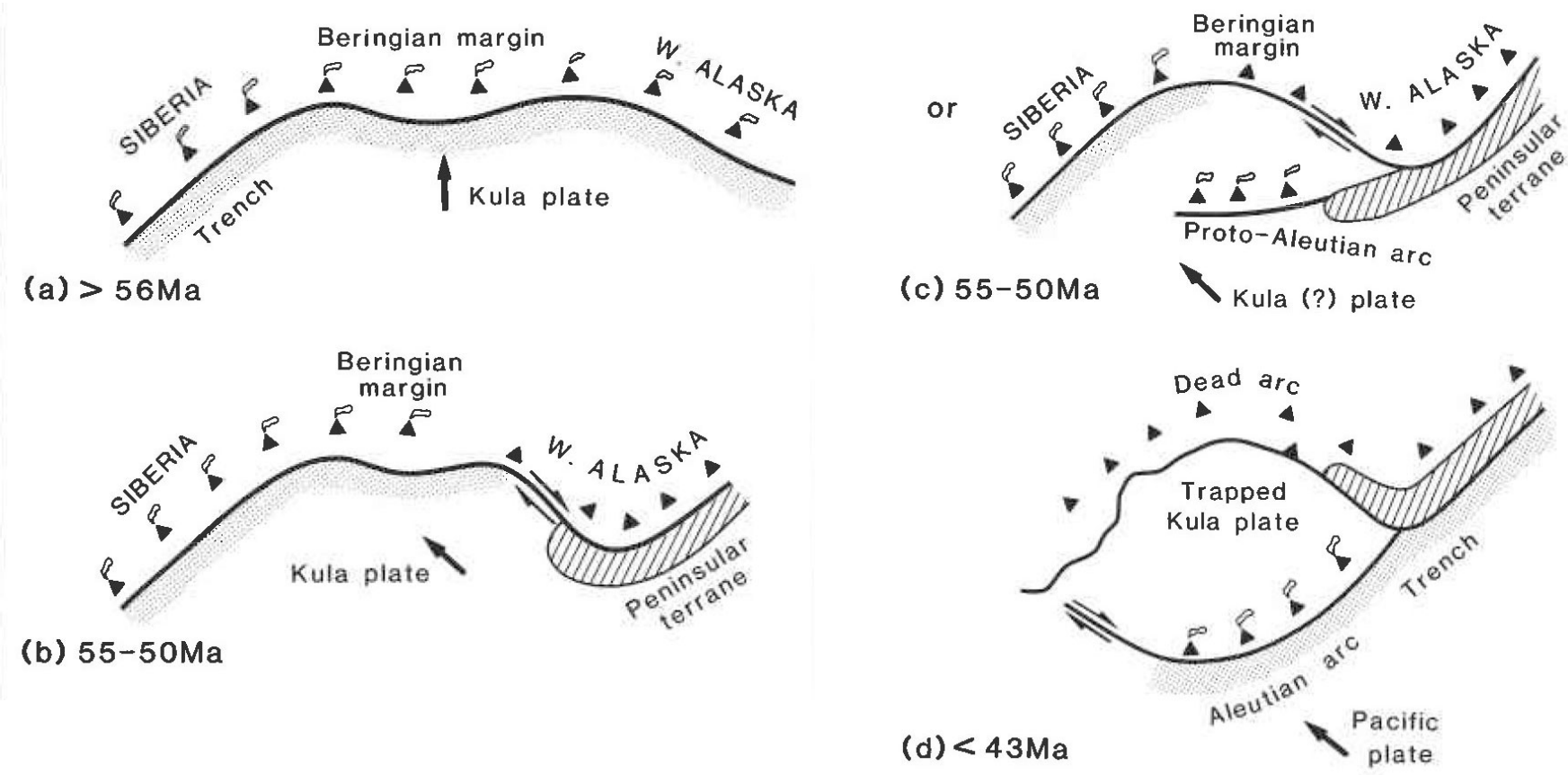
GeoPRISMS Subduction Cycles & Deformation (SCD)

- Aleutian arc is an important focus site
- **SCD science plan objective 4.6**: What are the physical and chemical conditions that control subduction zone initiation and the development of mature arc systems?
- **Strategy**: To understand how Aleutian arc formed, we must understand origin of Bering Sea deepwater basins.
  - A) trapped Mesozoic oceanic crust?
  - B) Paleogene backarc basin?

Aleutian arc crust existed by 46 Ma

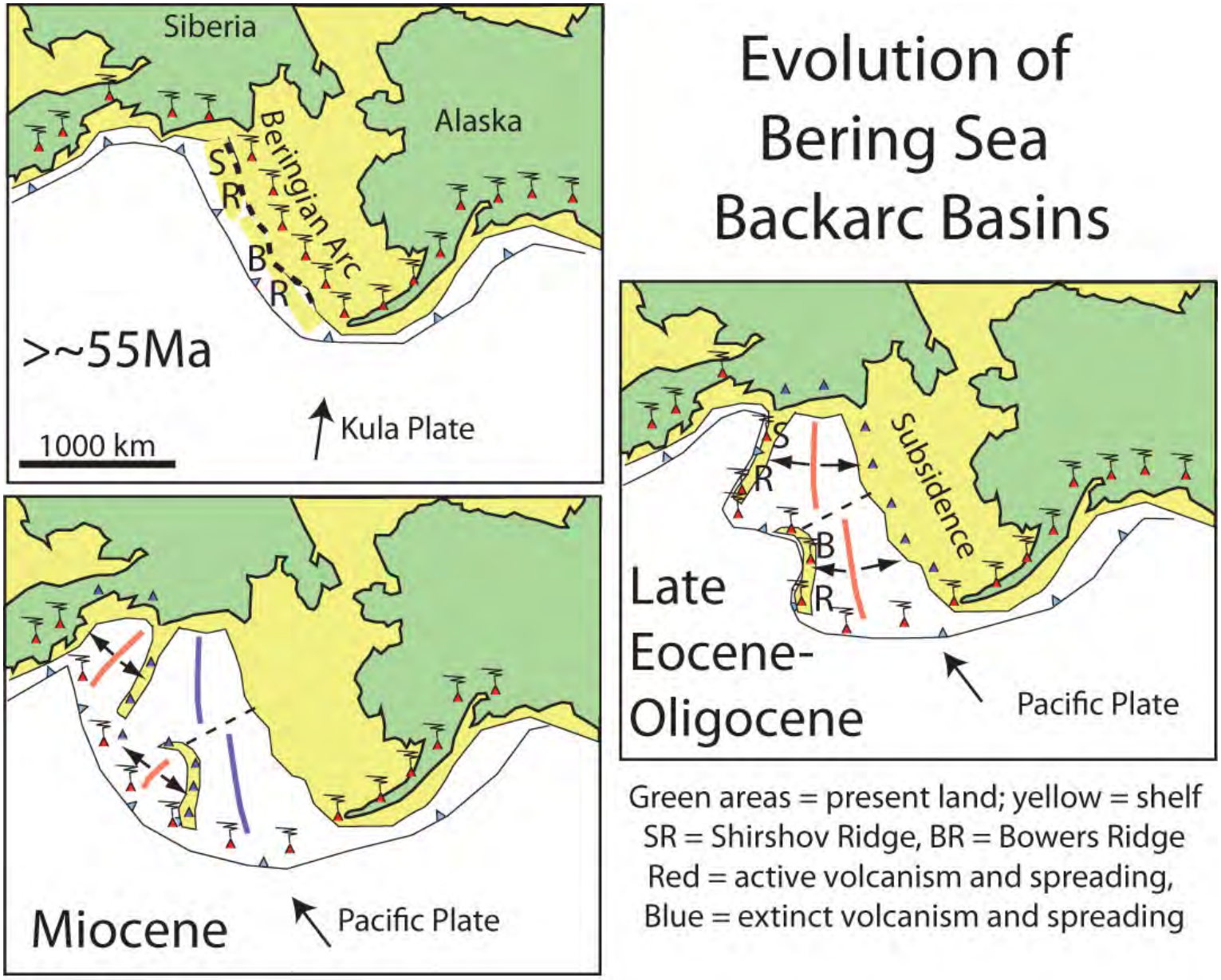
How did it come to form such a perfect 3900 km-long arc?

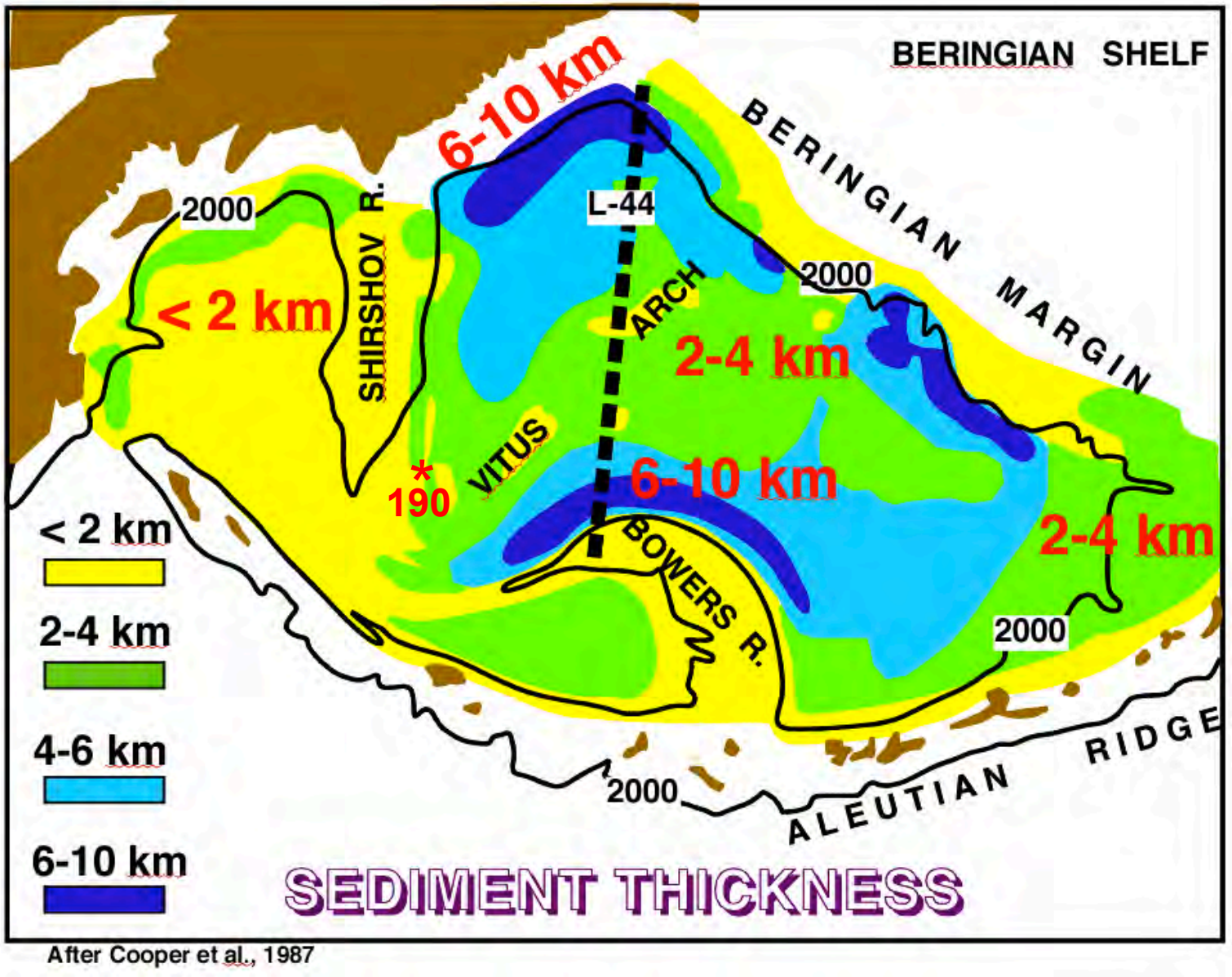
Captured Kula Hypothesis: the Aleutian Subduction Zone formed by propagating west from Alaska, **trapping Cretaceous Kula plate** crust to form the Bering Sea



Davis et al., 1989

Bering BAB Hypothesis: the Aleutian arc migrated due to Paleogene opening of Aleutian Basin as a backarc basin



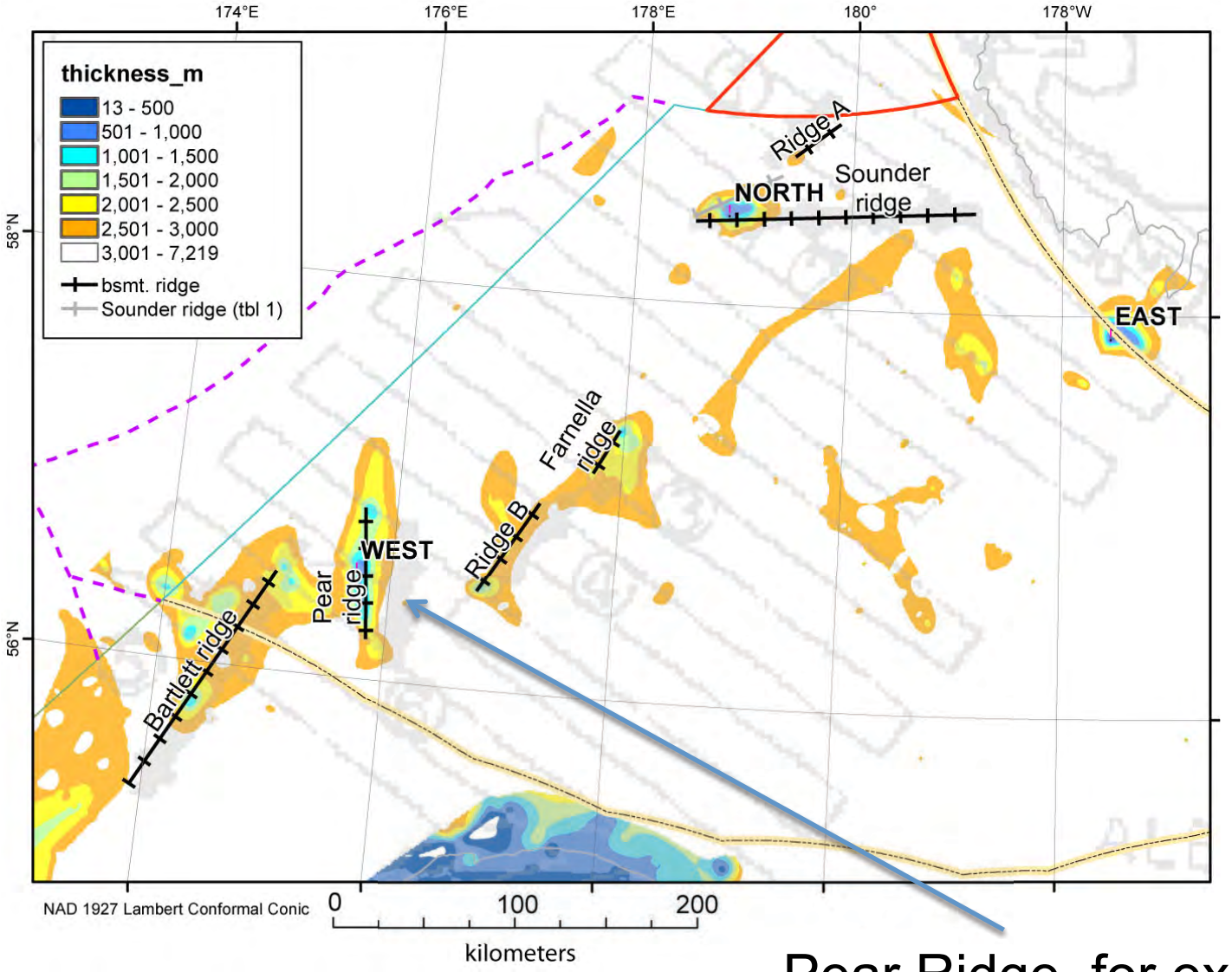


CHALLENGE: Aleutian Basin mostly has >2km thick sediments – how to sample oceanic crust?

AB sed is thinnest over Vitus Ridge

Sediment is much thicker in Aleutian Basin than in Bowers or Komandorsky basins.

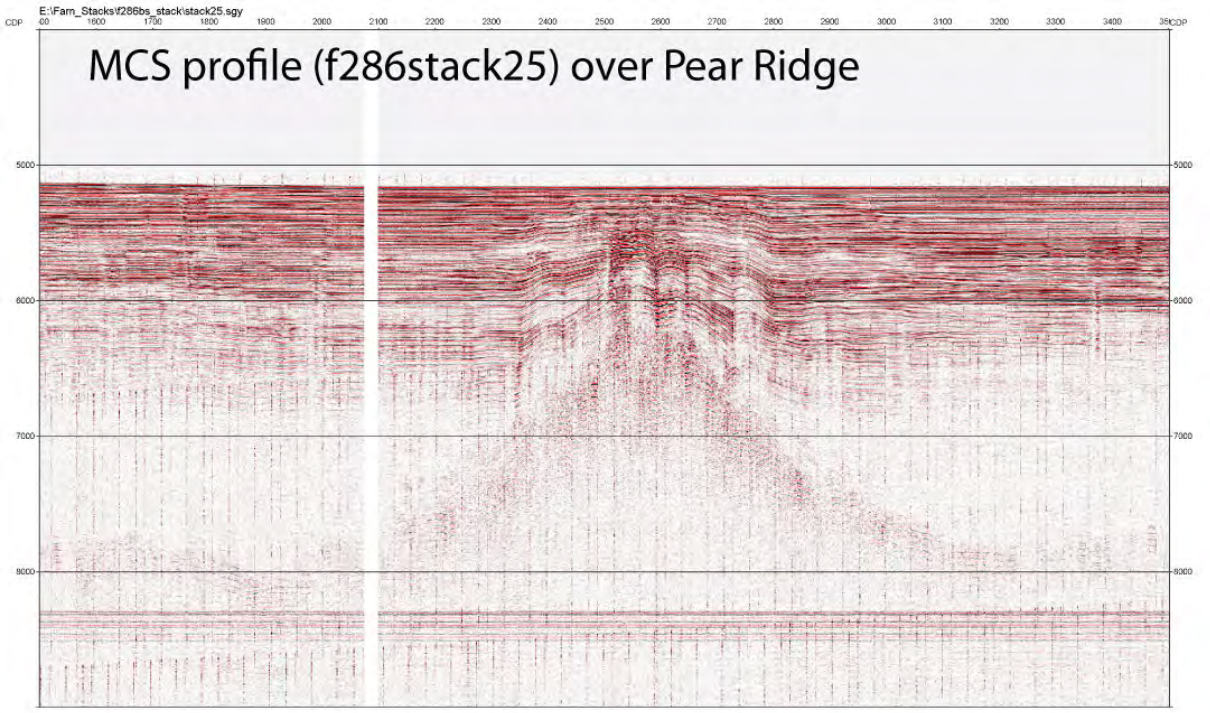
…and there are several places along the Vitus Ridge to drill through sediments into basement...

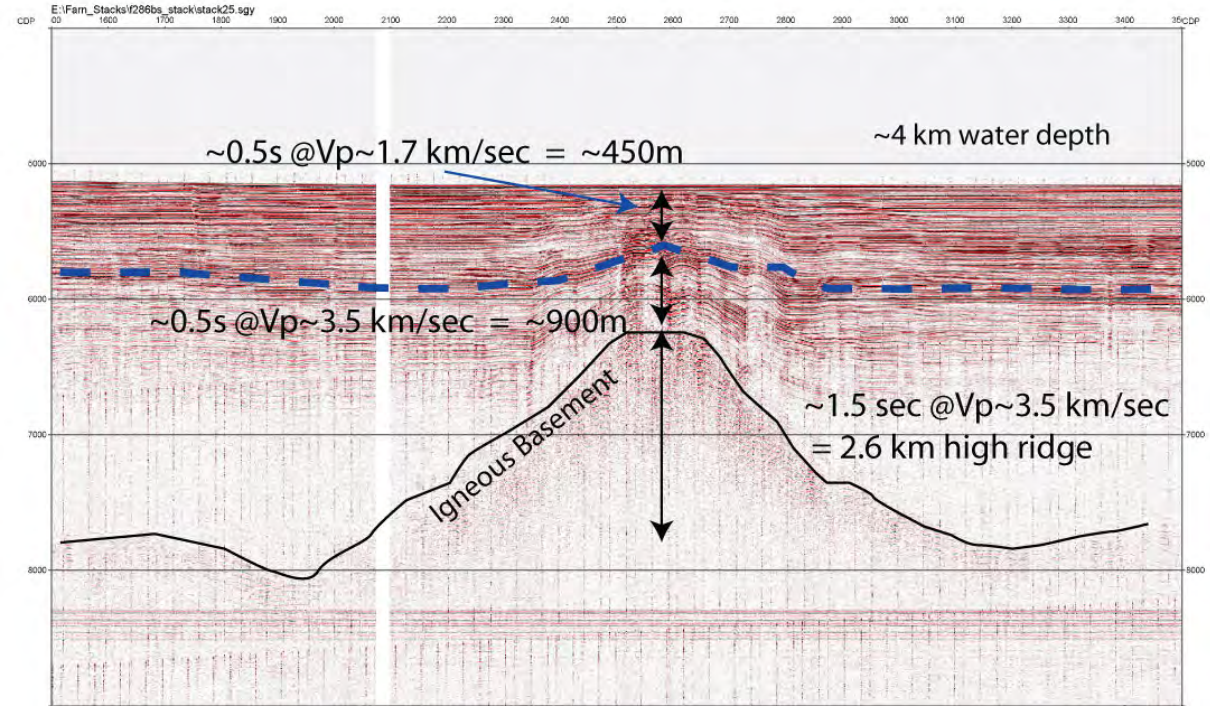


Colors indicate where Aleutian Basin sediment <3km thick

For example Pear Ridge

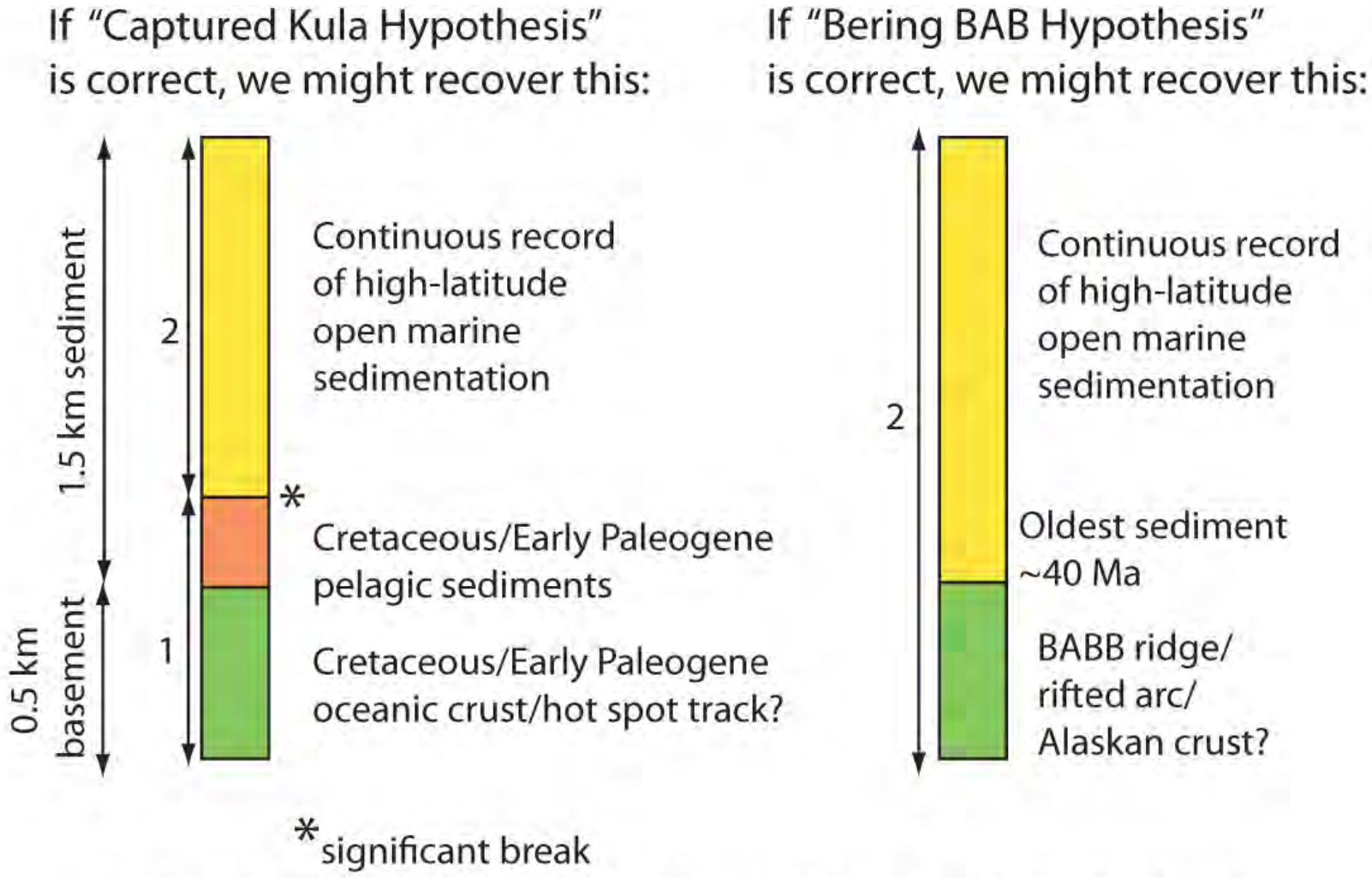
…Pear Ridge, for example.





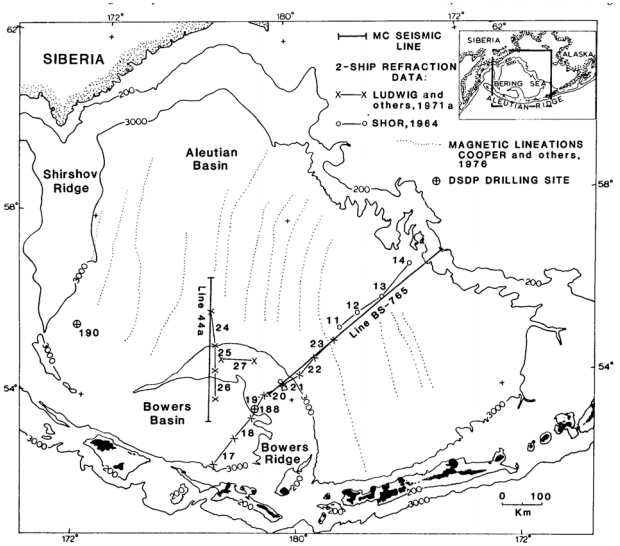
At Pear Ridge we can sample sedimentary section and reach basement in <1.5 km!

How can we resolve the controversy about the origin of the Aleutian Basin by drilling?

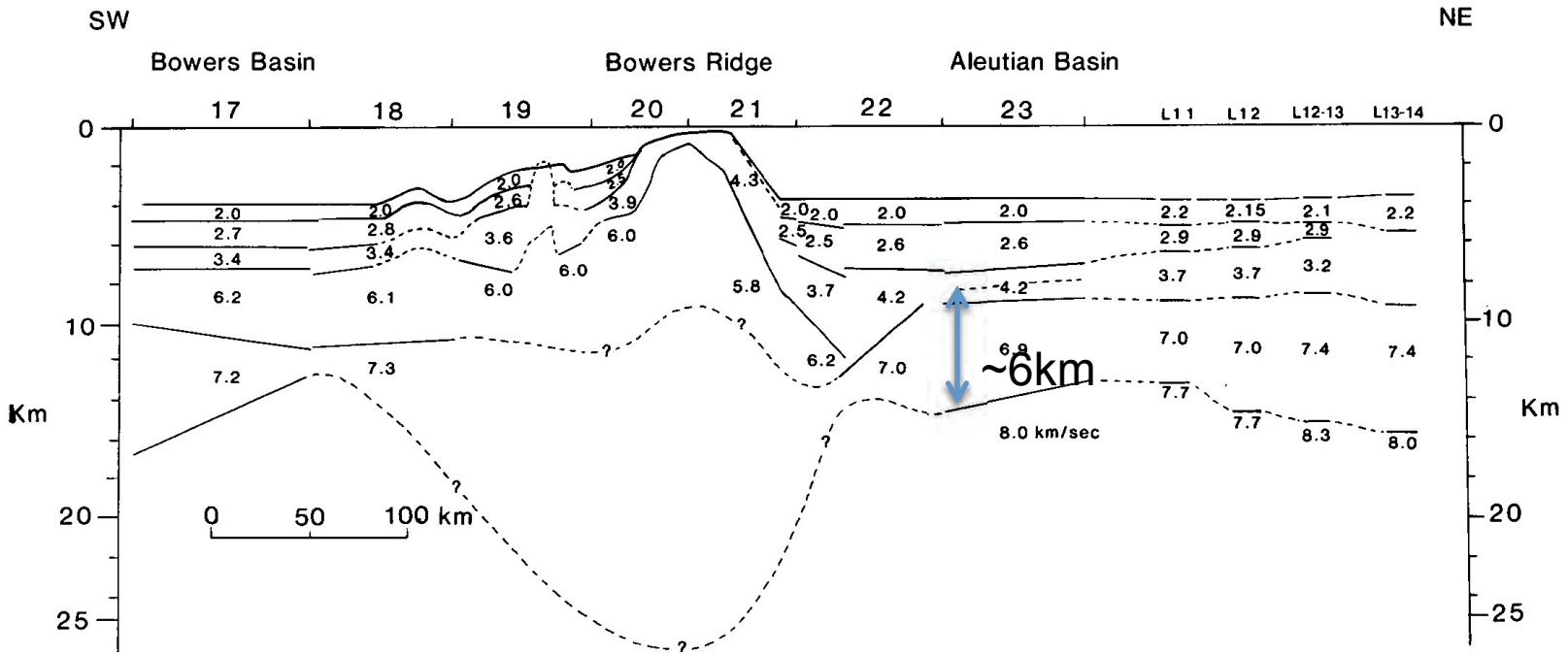


1: should show paleomagentic evidence of significant latitudinal motion
2: paleomagnetic evidence of little latitudinal motion

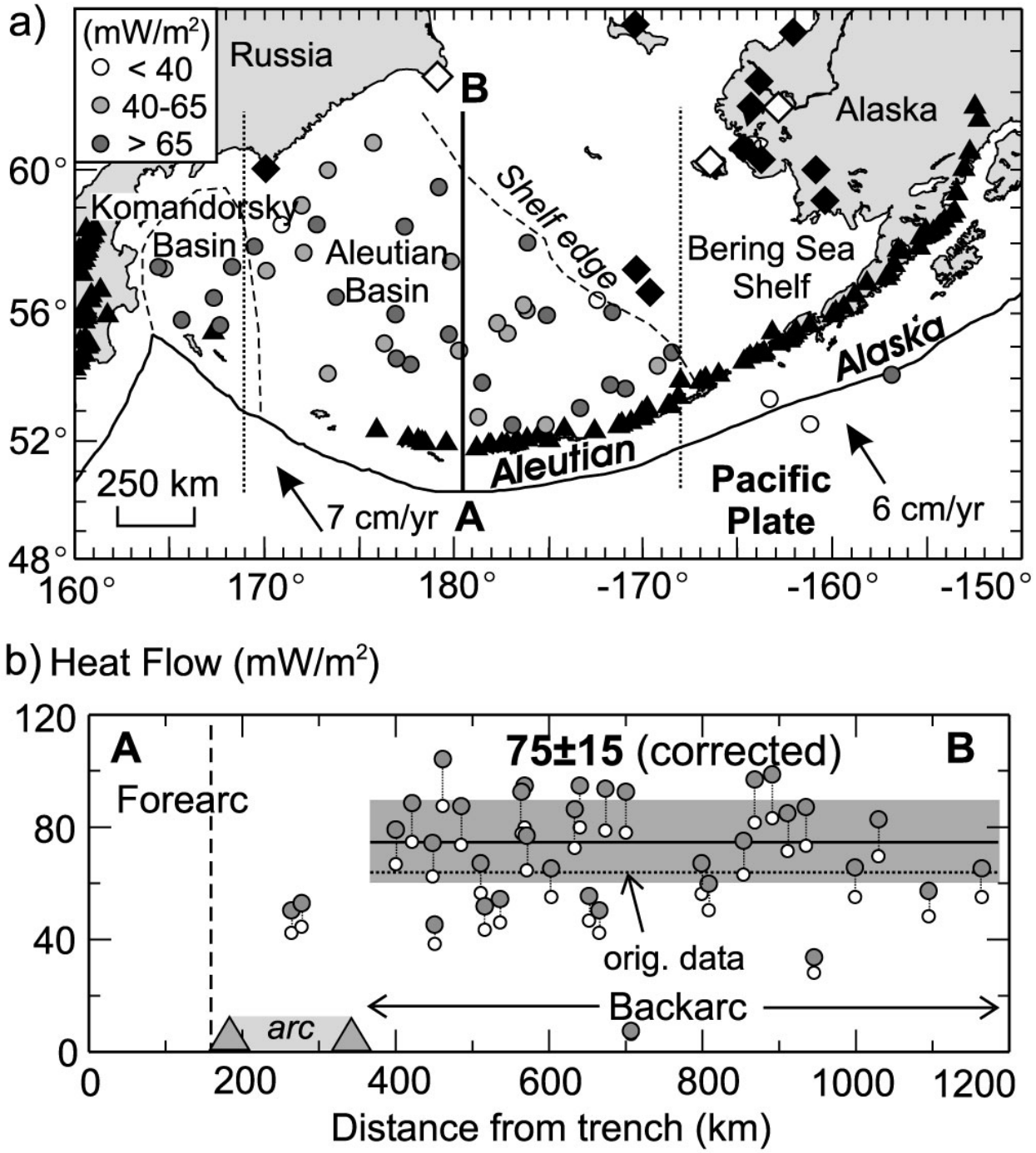
Comments? Questions?



Seismic refraction shows that the Aleutian Basin has normal oceanic crustal structure (Cooper et al. 1981)



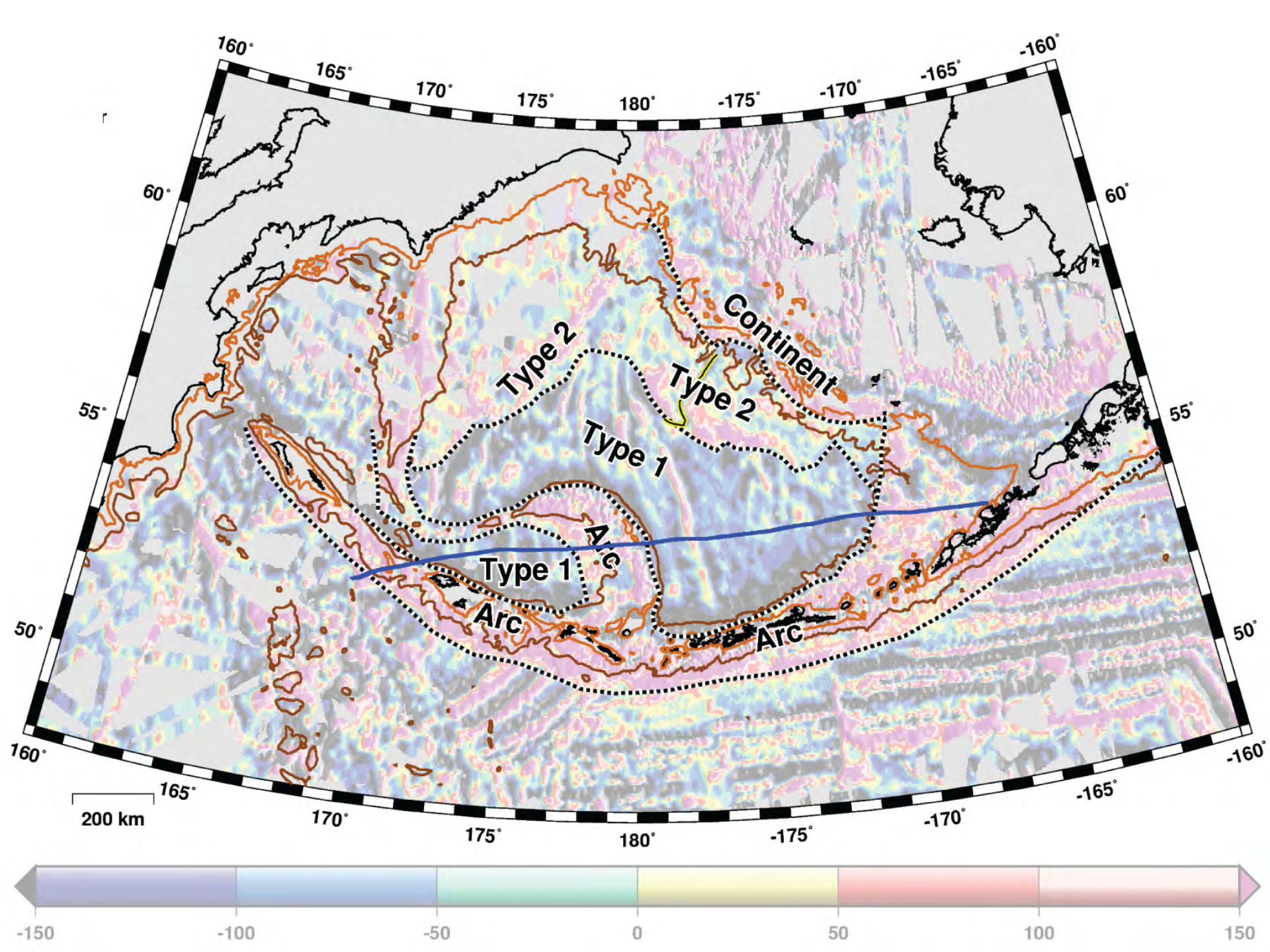
Two opposing ideas about how this oceanic crust formed

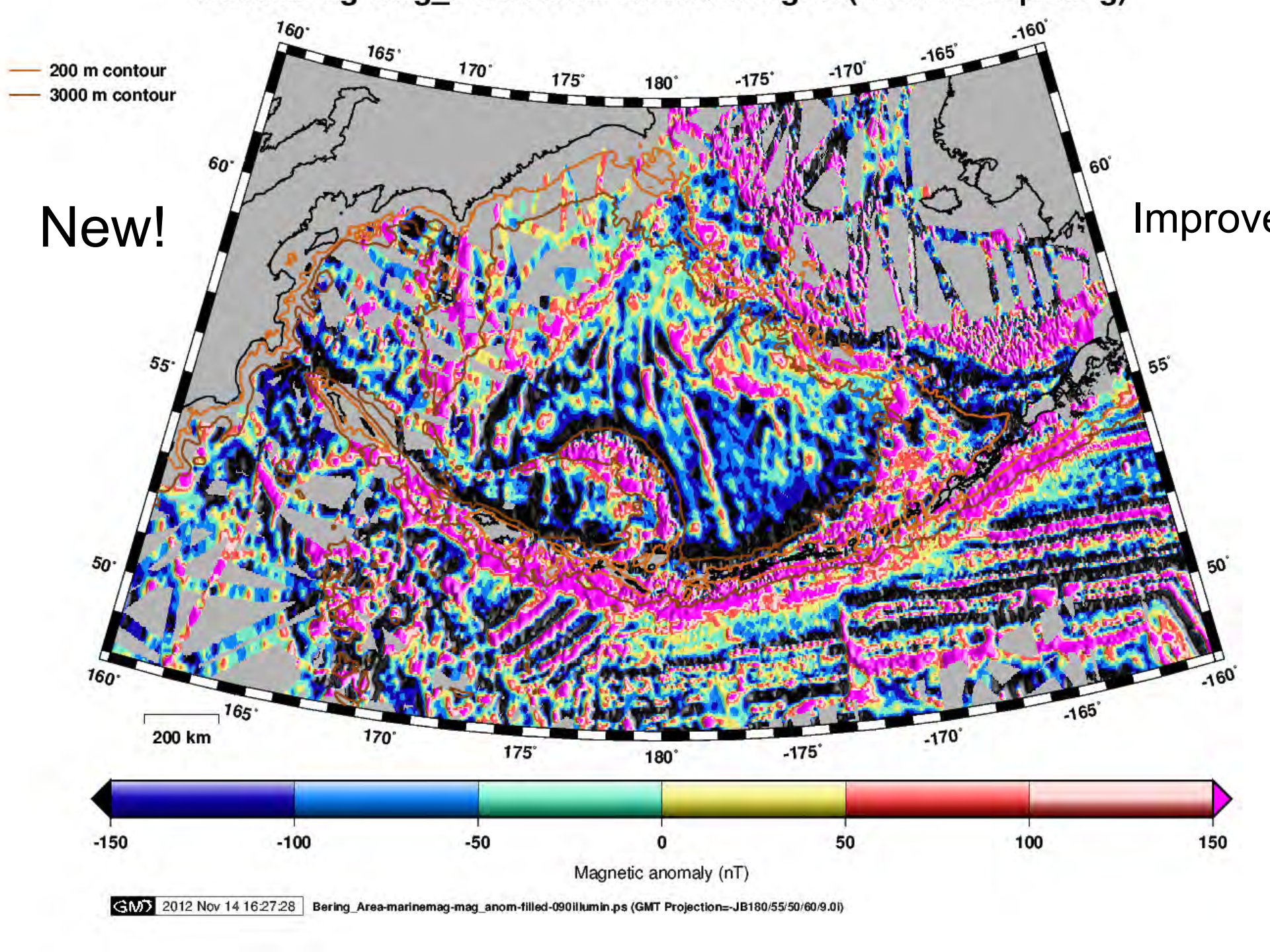


Heatlow evidence supports a Paleogene age

If the Aleutian Basin was formed by seafloor spreading processes,then the heatflow suggests an age of ~45 Ma (Langseth, 1980)

Currie & Hyndman, 2006

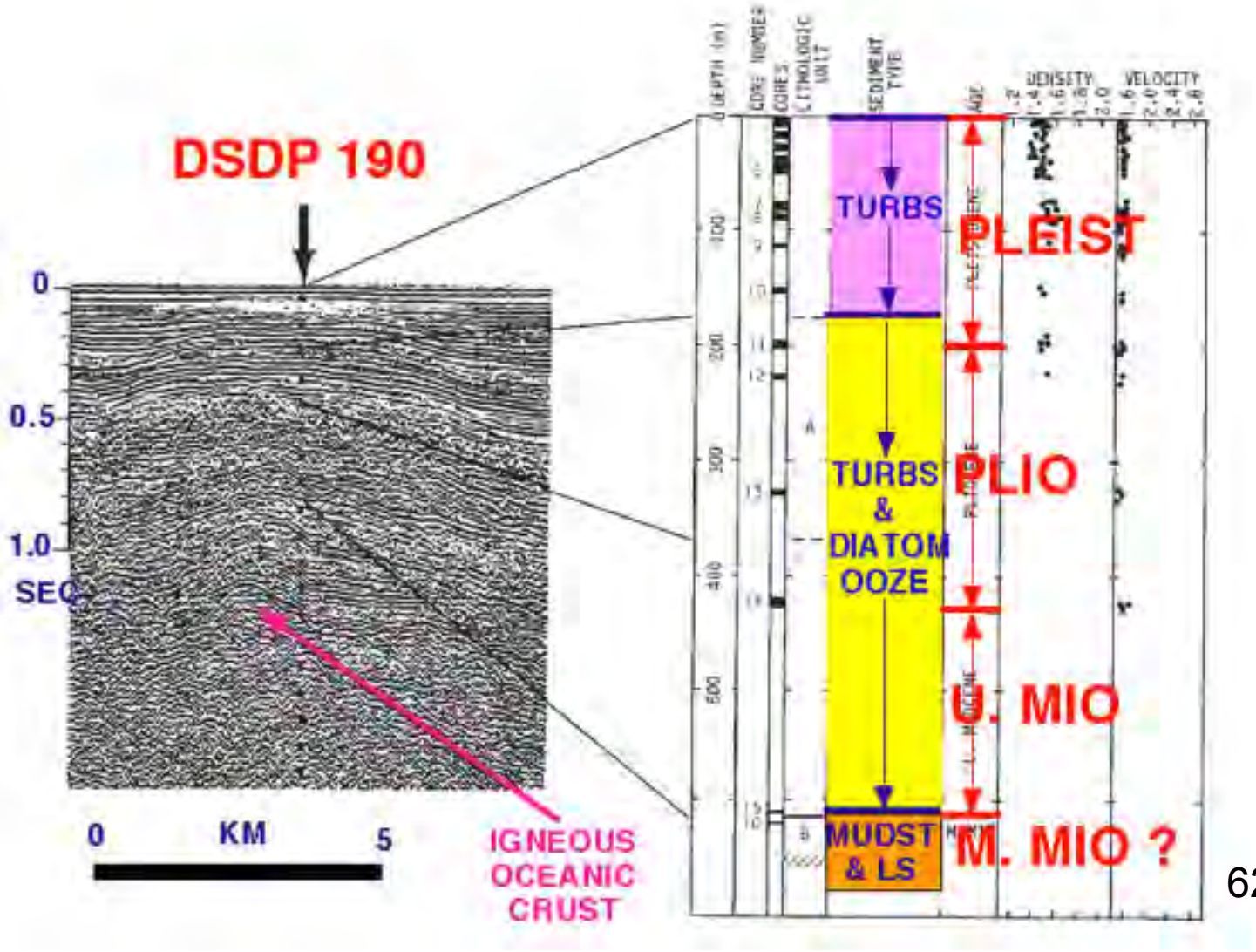

160°
165°
170°
175°
180°
-175°
-170°
-165°
-160°
60°
55°
50°
Type 2
Type 2
Continent
Type 1
Type 1
Arc
Arc
Arc
200 km
-150
-100
-50
0
50
100
150


200 m contour
3000 m contour
160°
165°
170°
175°
180°
-175°
-170°
-165°
-160°
60°
55°
50°
200 km
-150
-100
-50
0
50
100
150
Magnetic anomaly (nT)
GMT 2012 Nov 14 16:27:28
Bering_Area-marinemag-mag_anom-filled-090illumin.ps (GMT Projection=-JB180/55/50/60/9.0i)

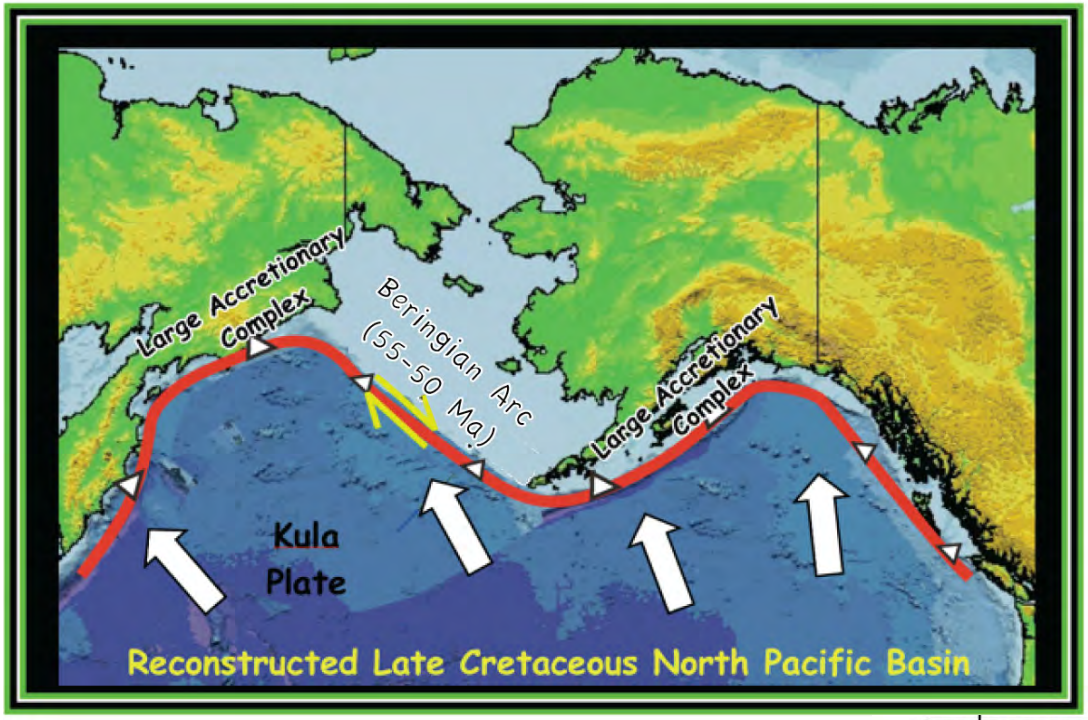
New!

Improve

We have a good idea of what the uppermost sequence is….



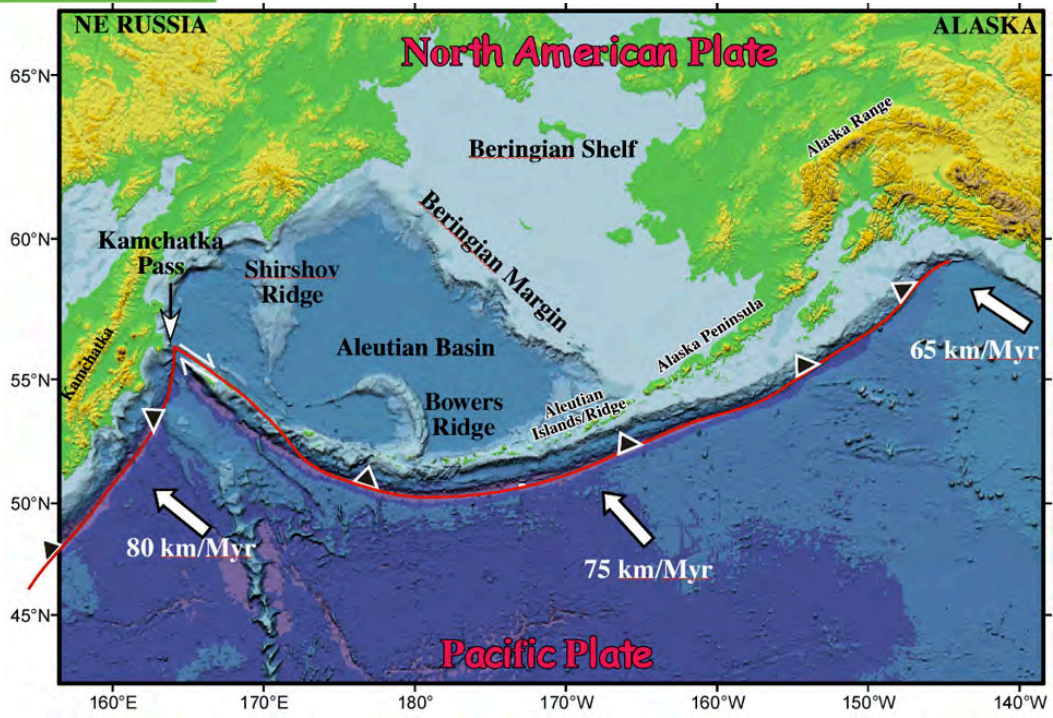
627 m total depth



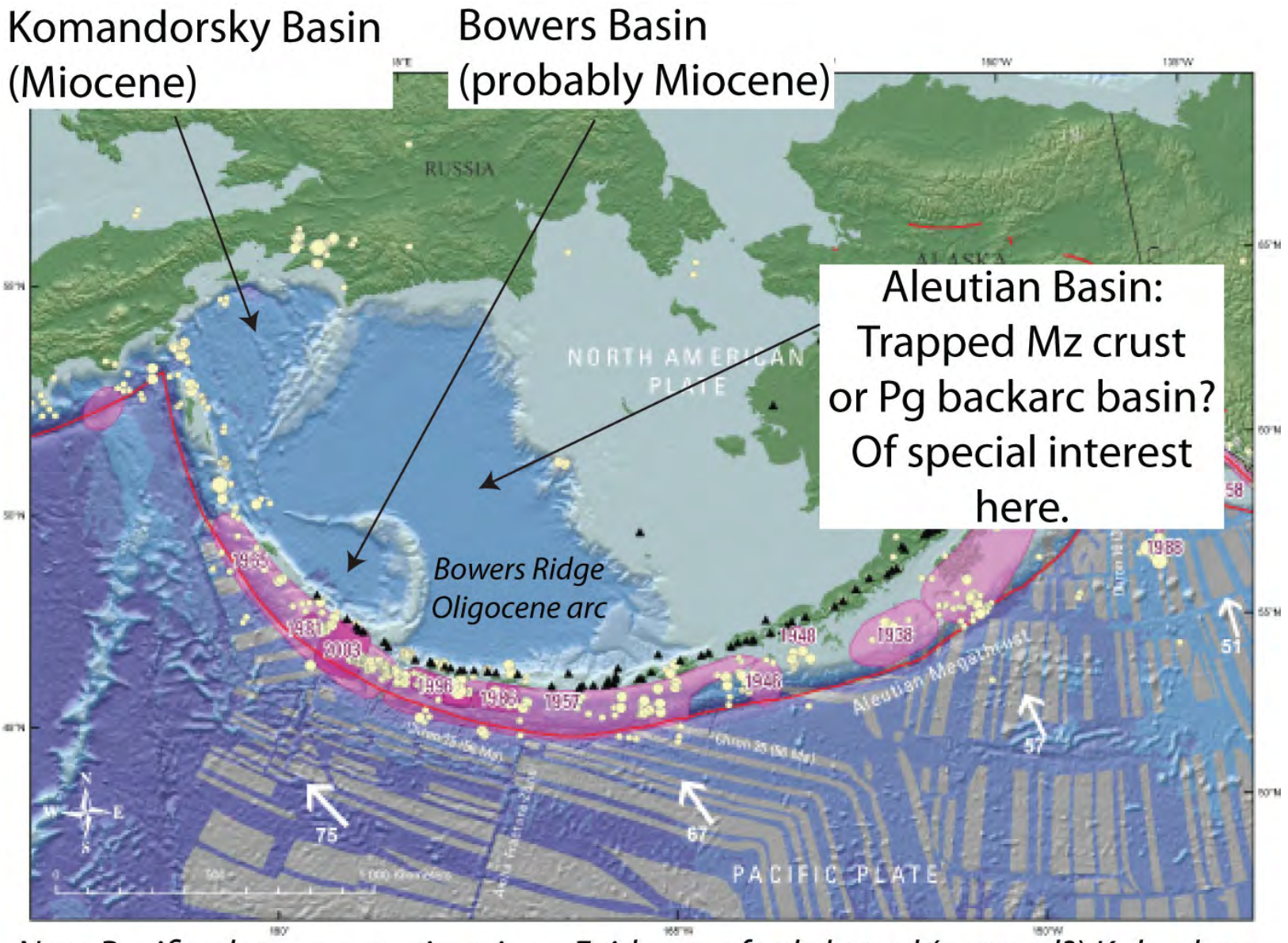
How did the Beringian margin evolve from this (~65Ma)….

…to this?

Key to understanding can be found in deepwater Bering Sea basins



The answer lies in understanding the Deepwater Basins of the Bering Sea, especially Aleutian Basin



Note Pacific plate magnetic stripes. Evidence of subducted (trapped?) Kula plate