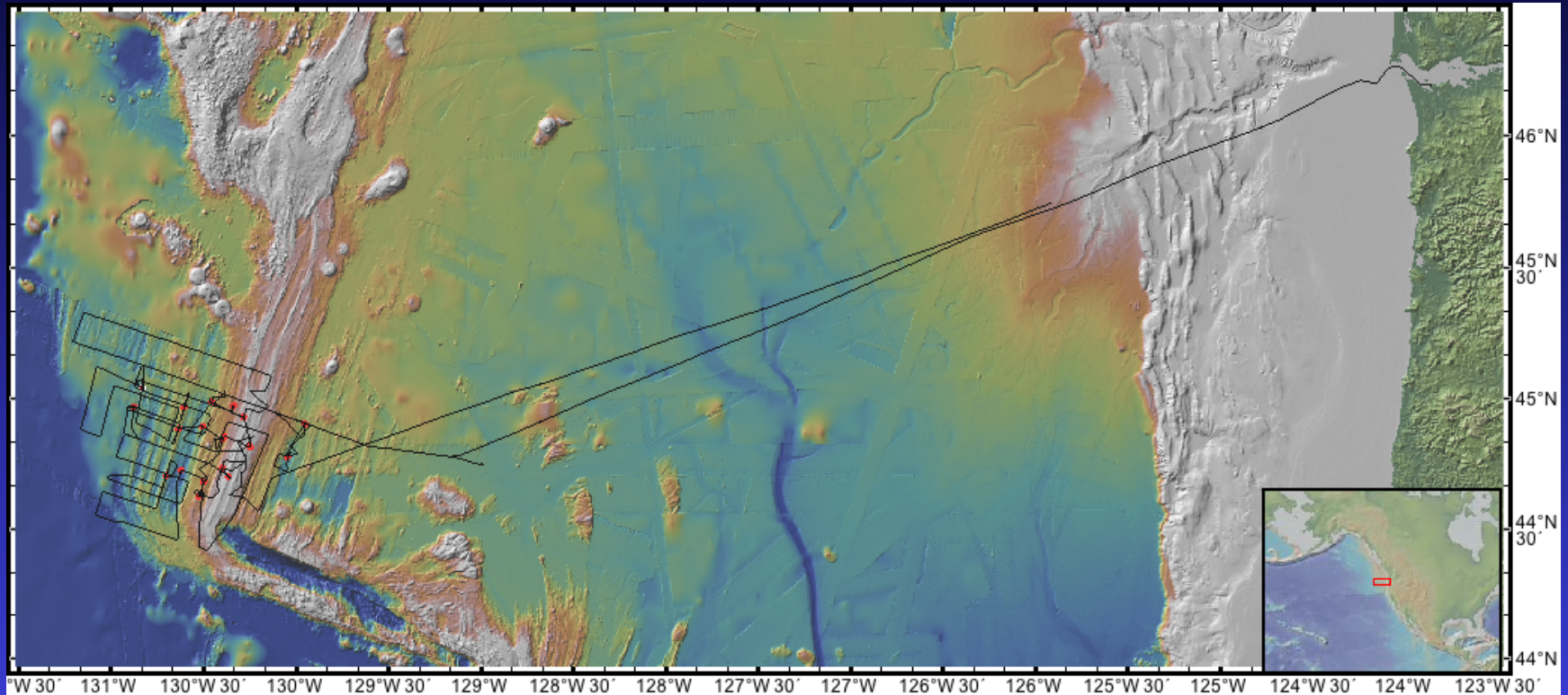
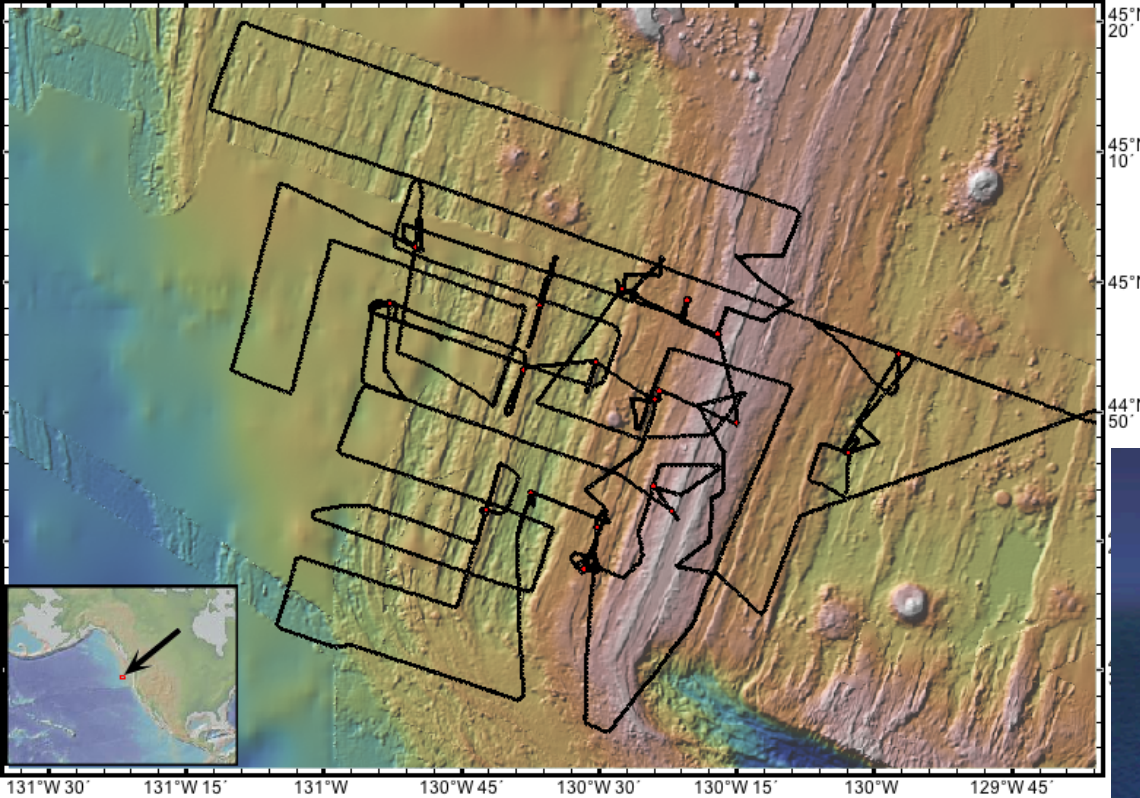


# SeaVOICE sonar mapping of abyssal hills on the flanks of the Juan de Fuca Ridge

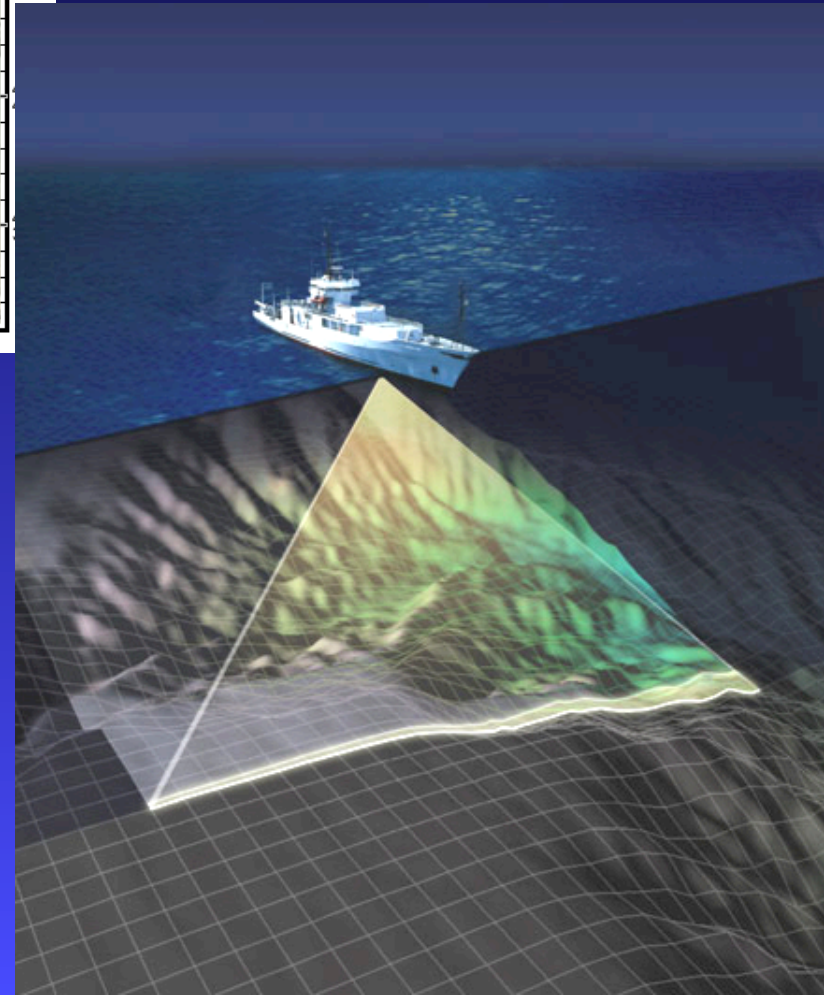


Swath Sonar Mapping Team: Bridgit Boulahanis,  
James Gibson



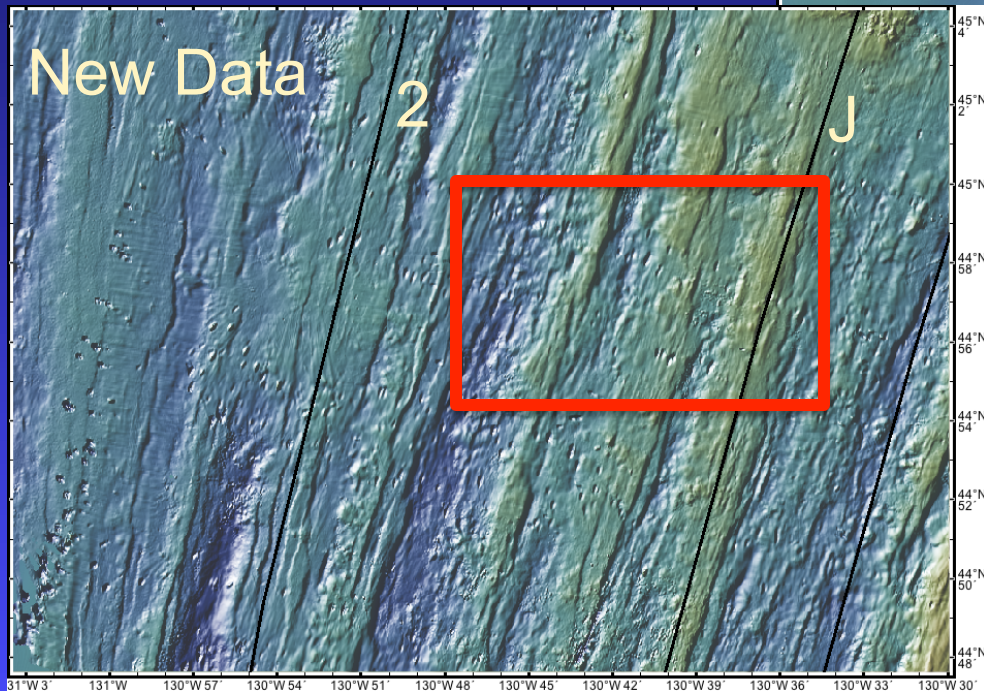
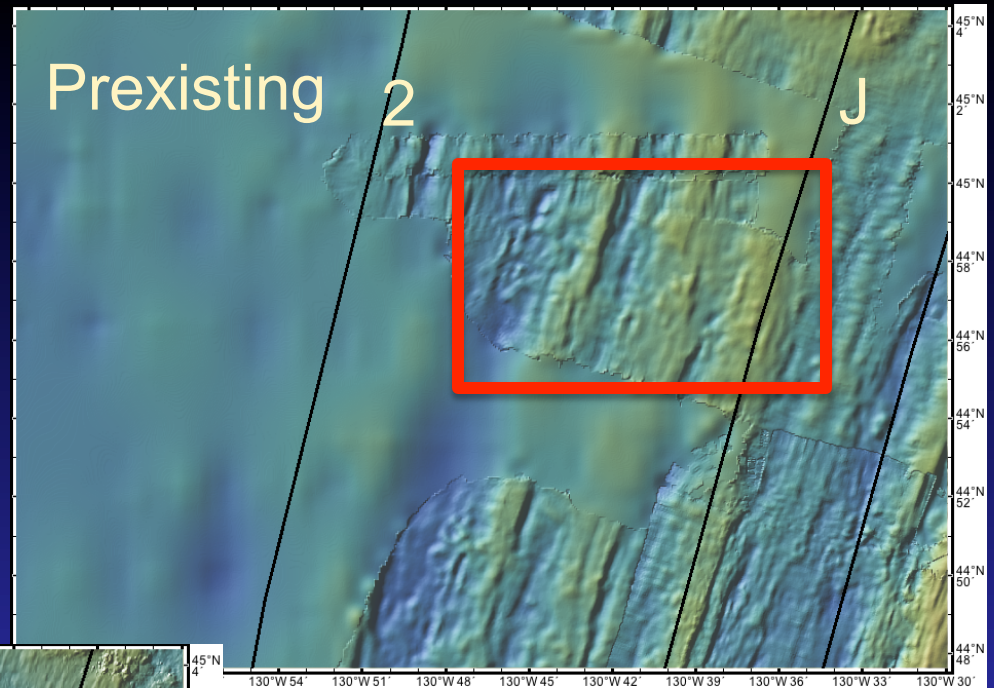
EM122 Simrad sonar  
150 ° angular coverage  
432 soundings/ping  
dual ping mode

West flank to ~ 2.6 Ma





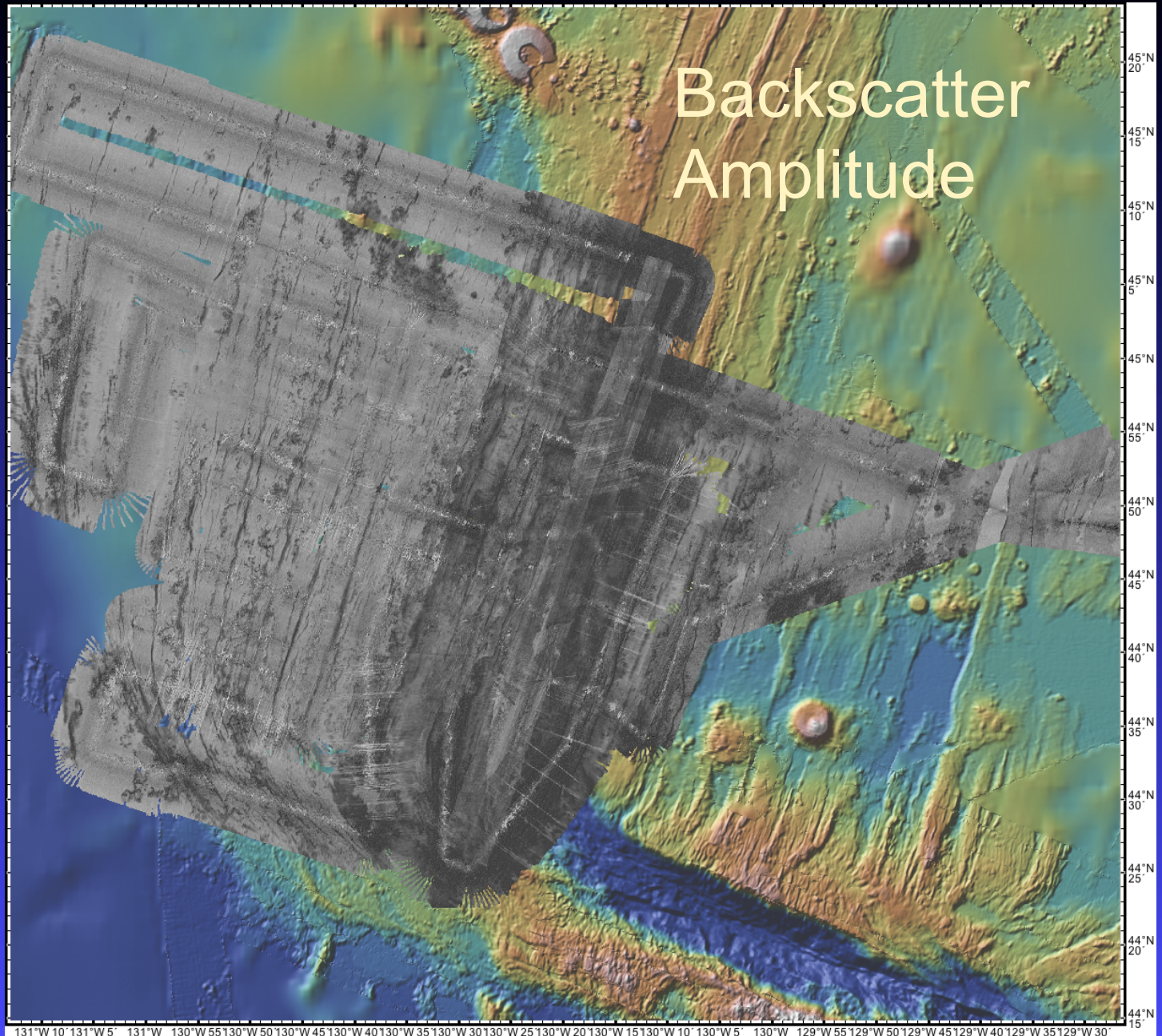
# New Coverage & Higher resolution



Complete beyond 2  
Ma with consistent  
acquisition  
parameters

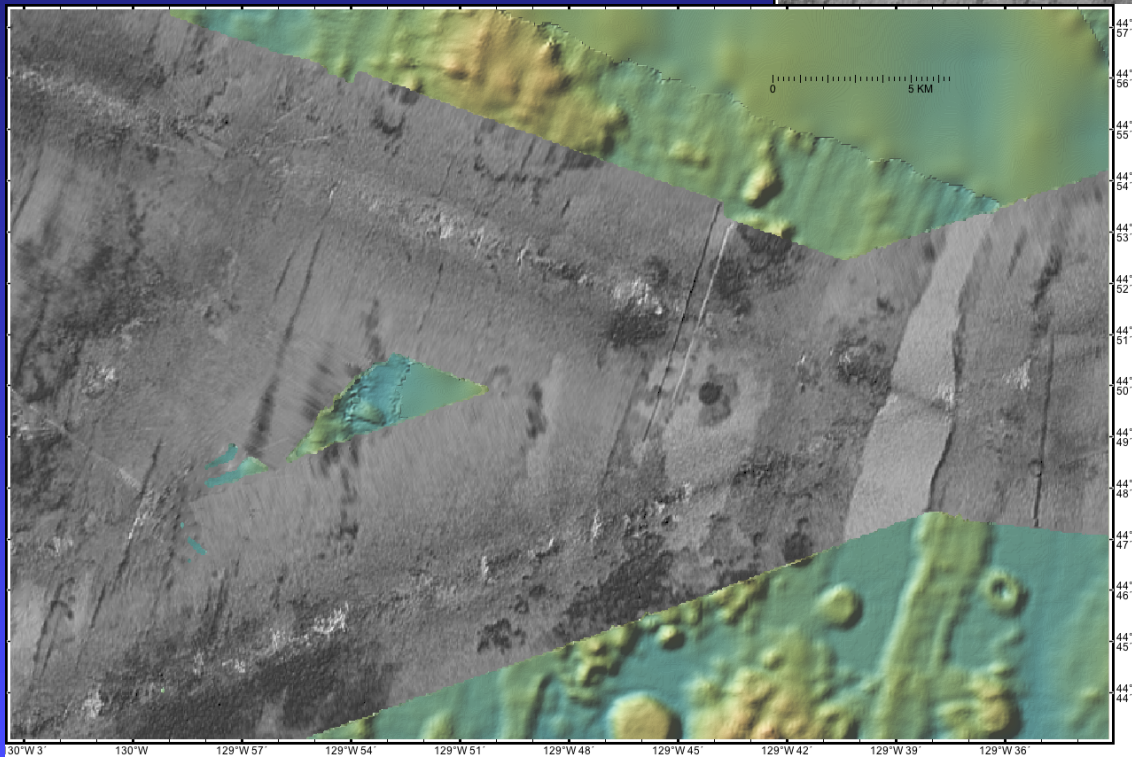


# Backscatter Amplitude





- Sediment cover
- Faults
- Volcanic flow fronts

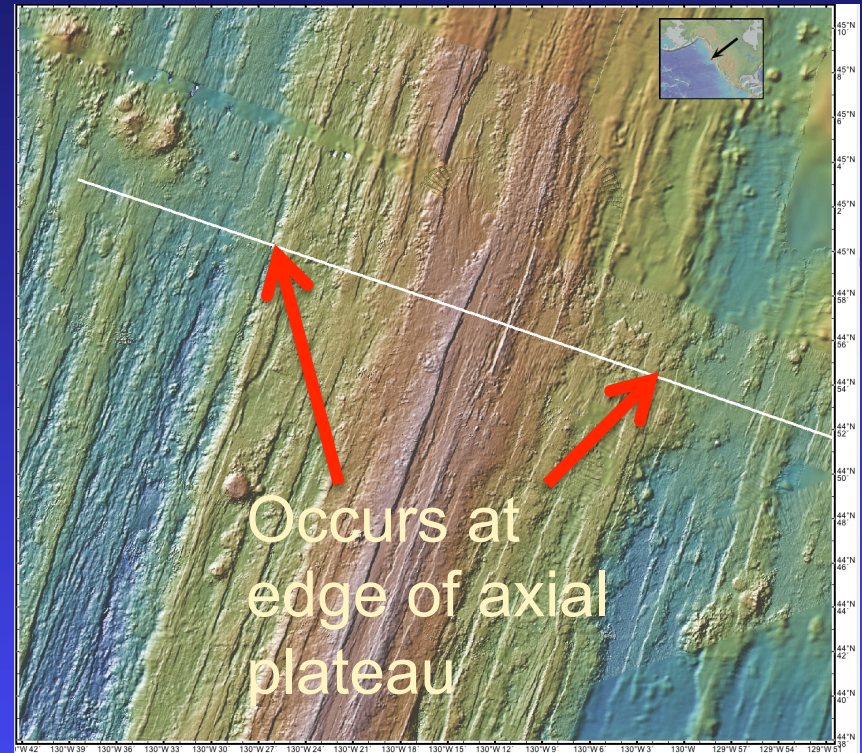
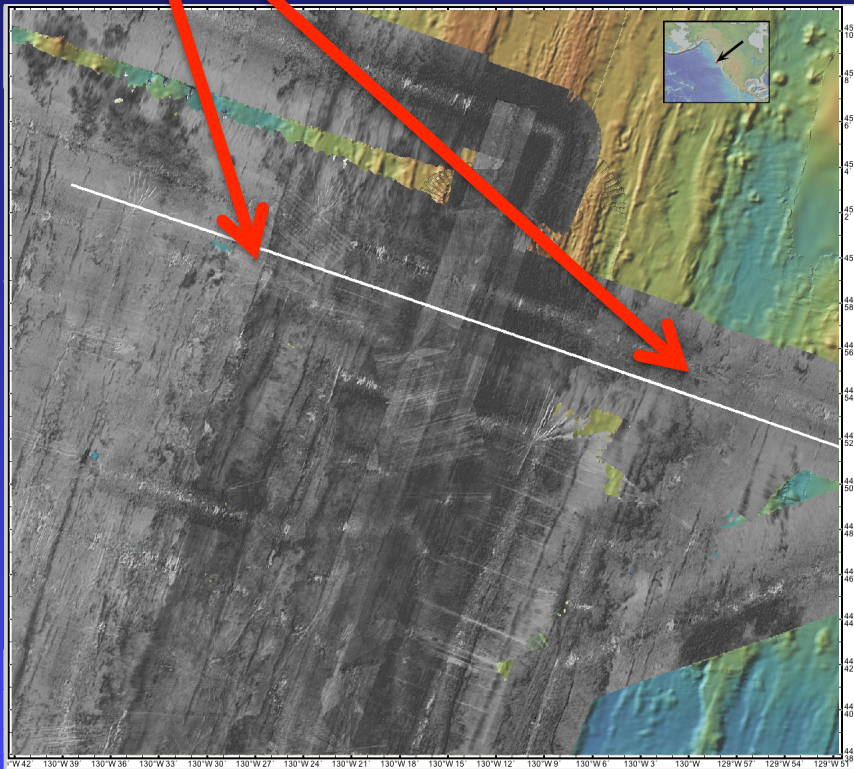
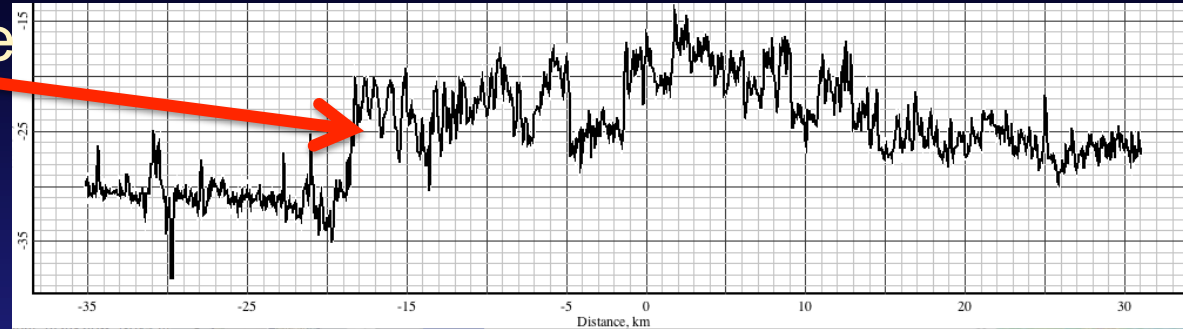


- Sediment ponds
- Off-axis volcanism



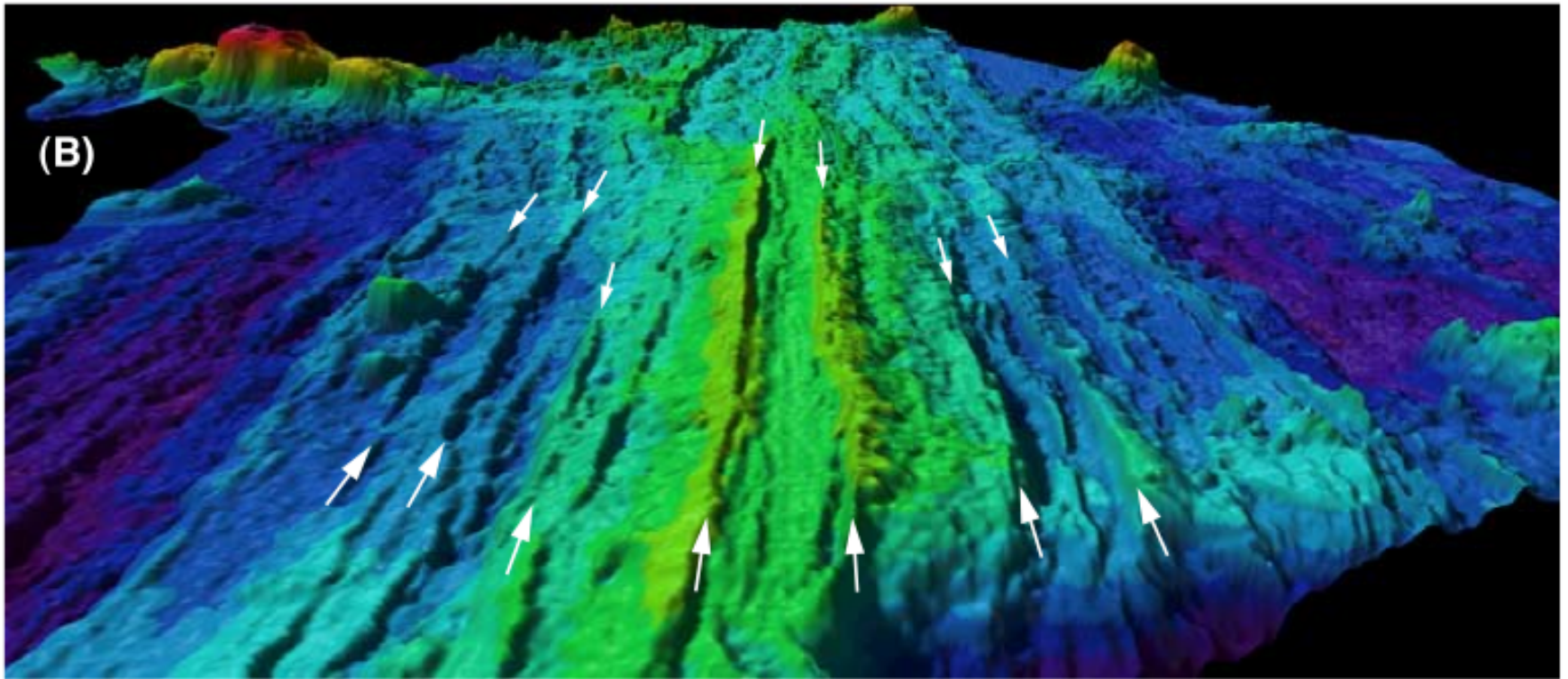
# Ridge Axis

Abrupt change  
in amplitude/  
sediment  
cover

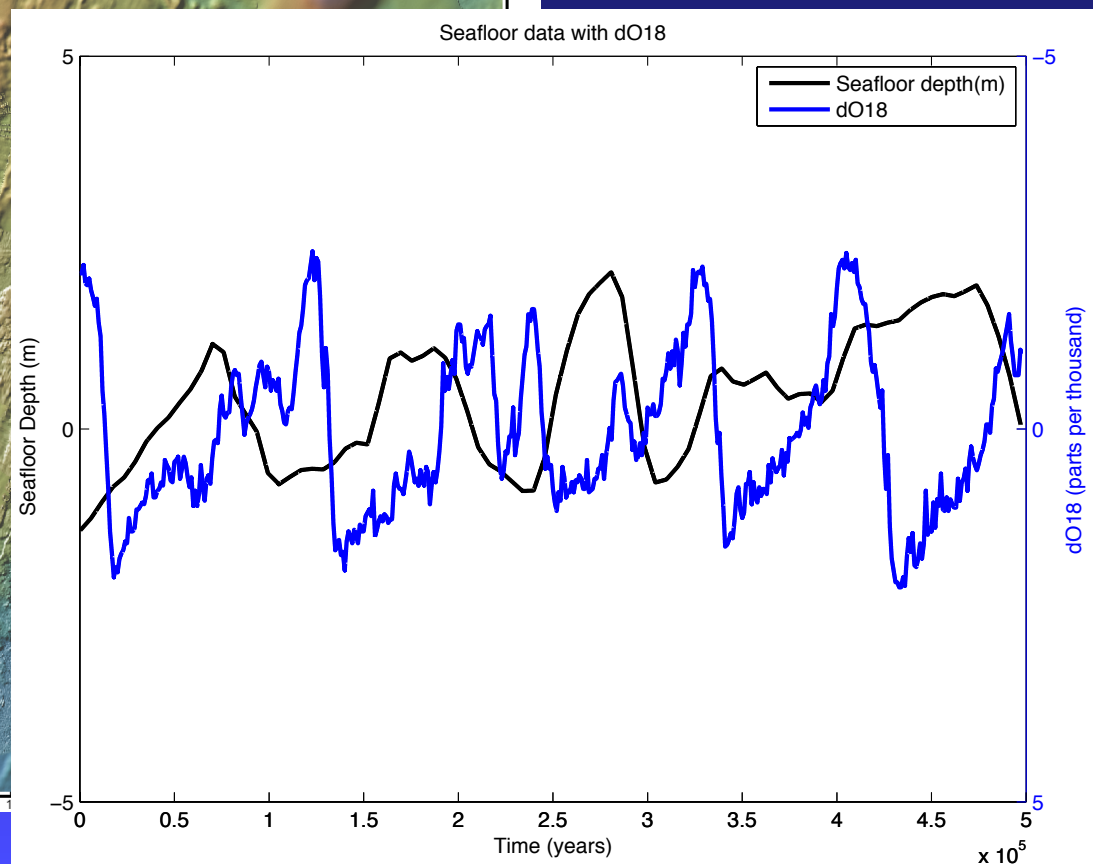
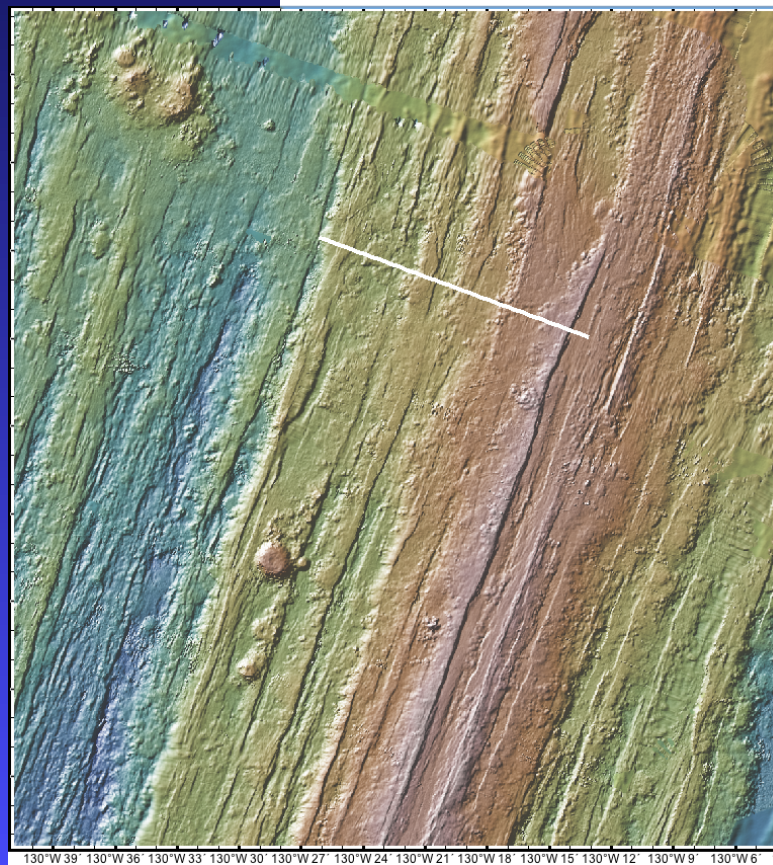
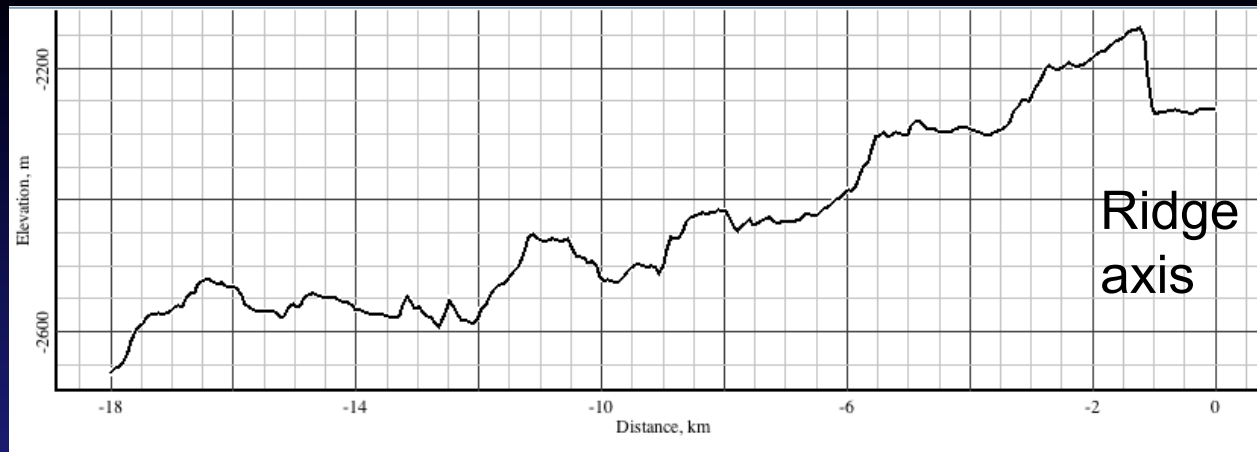




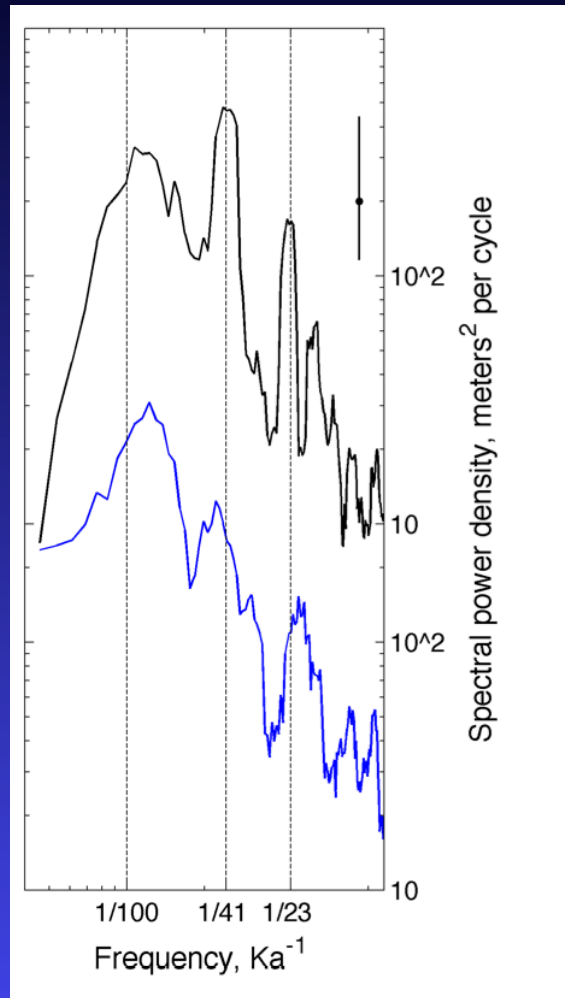
## Abyssal Hill Relief- Linked to Sealevel Change?



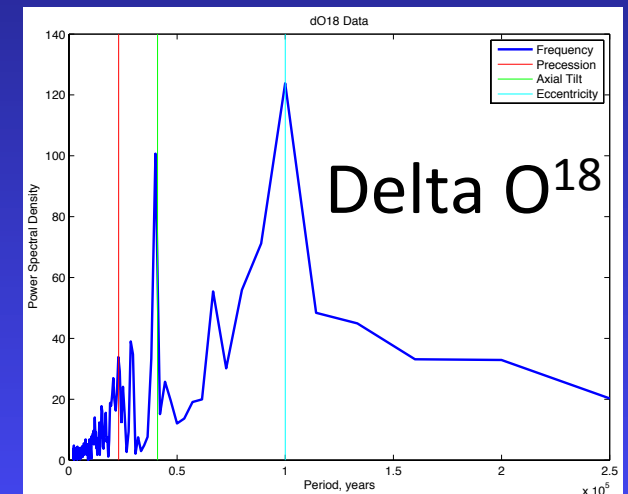
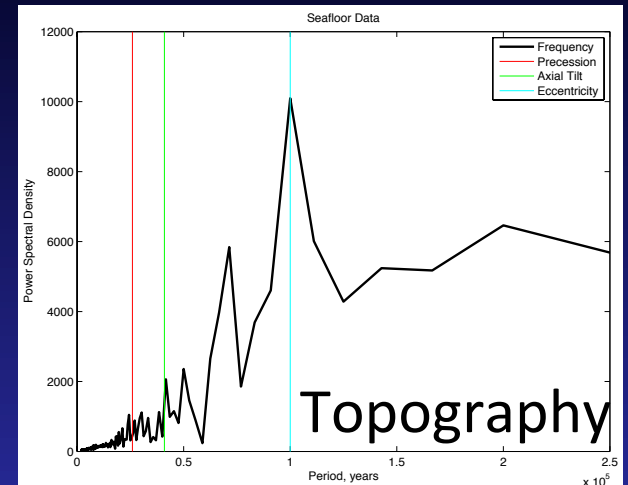




# Australian-Antarctic Ridge

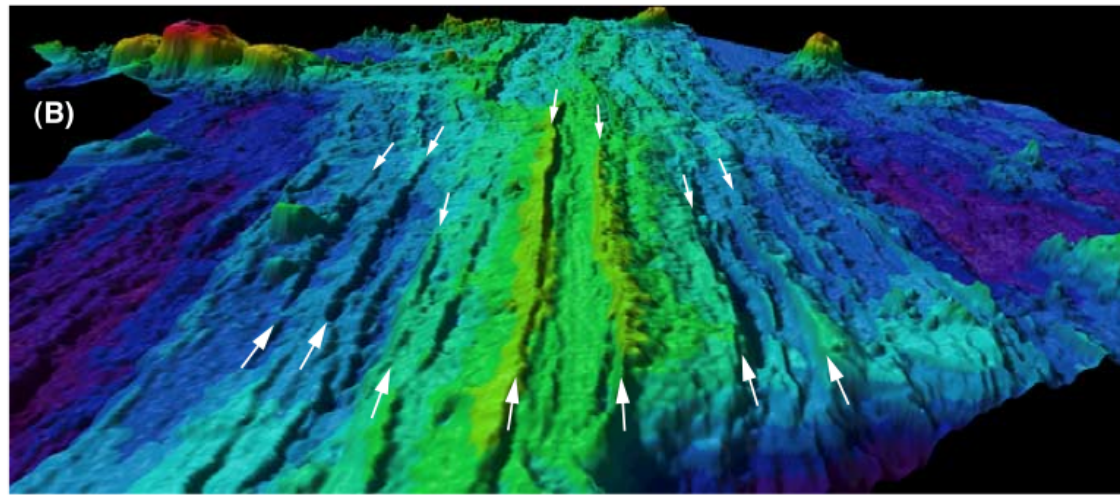


# Juan de Fuca Ridge



Crowley et al. Science

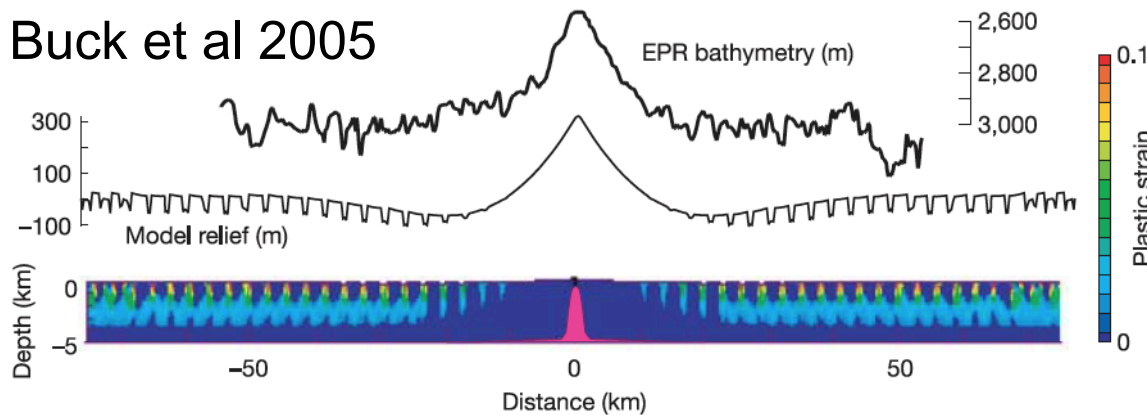




# Abyssal Hills – Fault bounded

Primarily volcanic or tectonic  
in origin?

Buck et al 2005



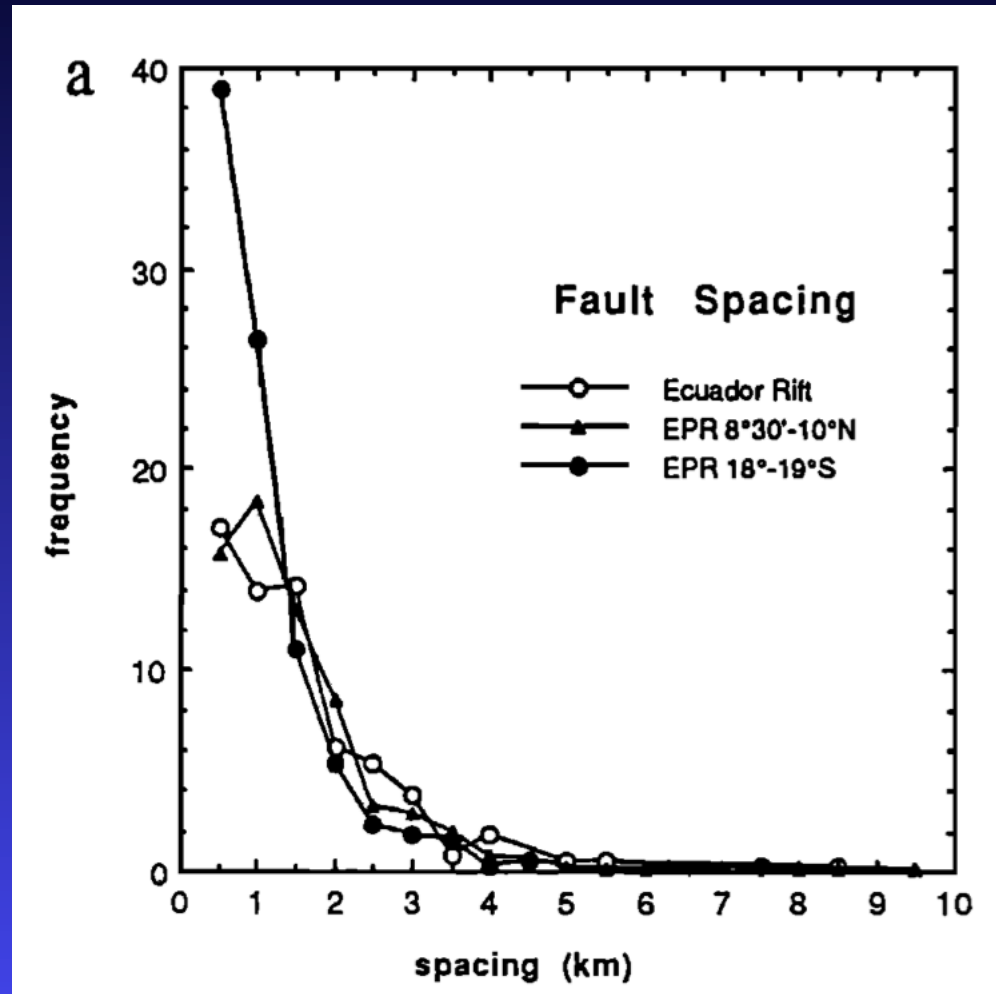
- ← Spreading Direction →
- ~200m  
~2 km
- Planar or listric normal faults
- a. Back-Tilted Fault Blocks
- Outward-dipping normal fault  
Inward-dipping normal fault
- b. Horst and Graben
- Flow fronts, elongate pillows
- c. Whole Volcanoes
- Flow fronts  
Tensional fracture
- d. Split Volcanoes
- Flow fronts or undraped outward-dipping normal faults  
Normal fault  
Volcanic growth faults
- e. Horsts bounded by inward dipping normal faults and outward dipping volcanic growth faults

Macdonald 1998

# Contribution of faulting to AH relief

## Glacial Periodicities

- 23ka = 644 m
- 41 ka = 1.2 km
- 100 ka = 2.8 km

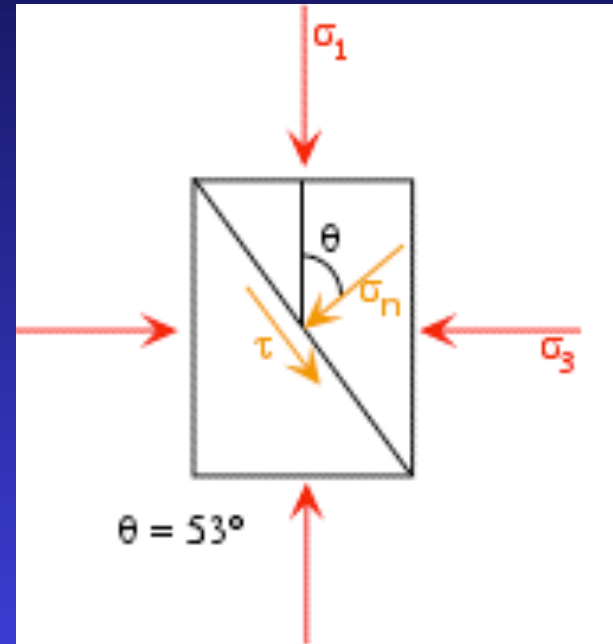


Carbotte et al., 1994

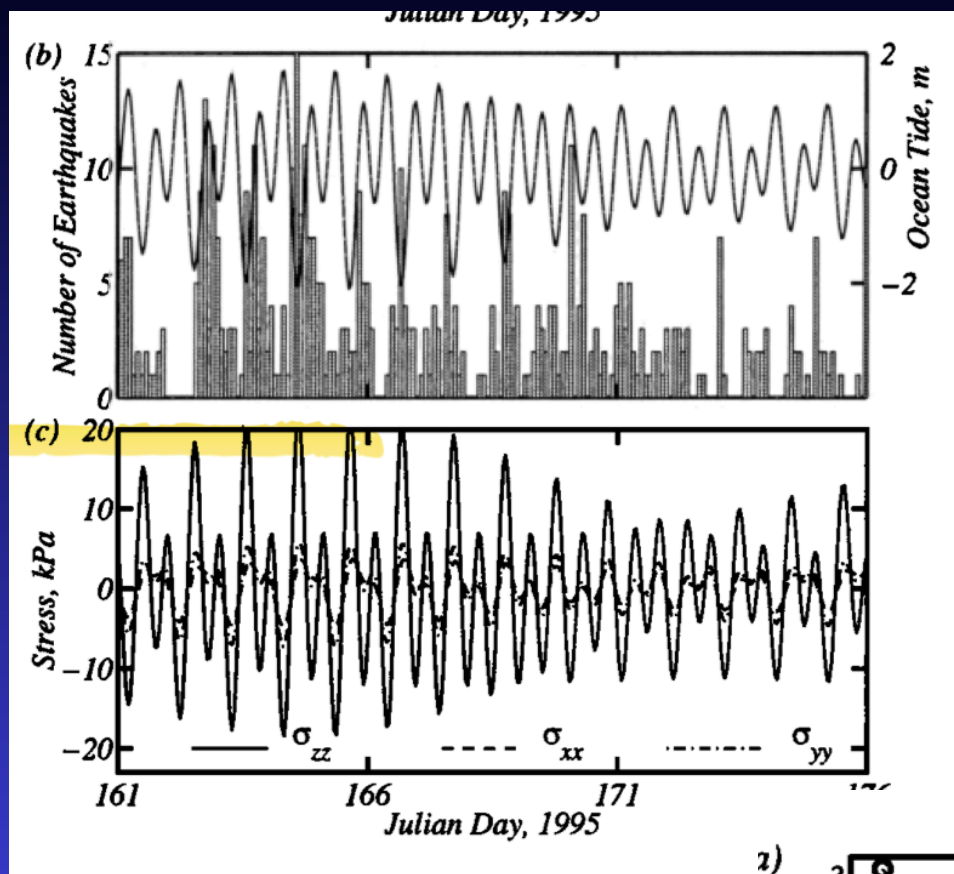


# Faulting linked to sealevel changes?

- Enhanced faulting during periods of lower sea level (reduced  $s_1$ )?



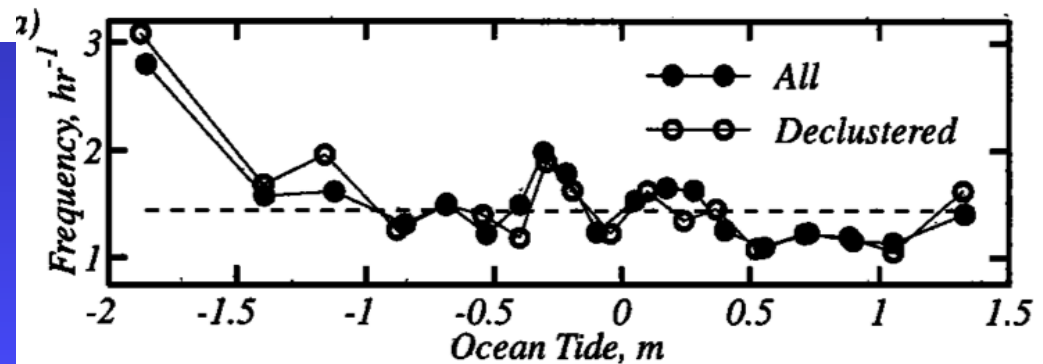
# Tidal triggering of ridge axis earthquakes



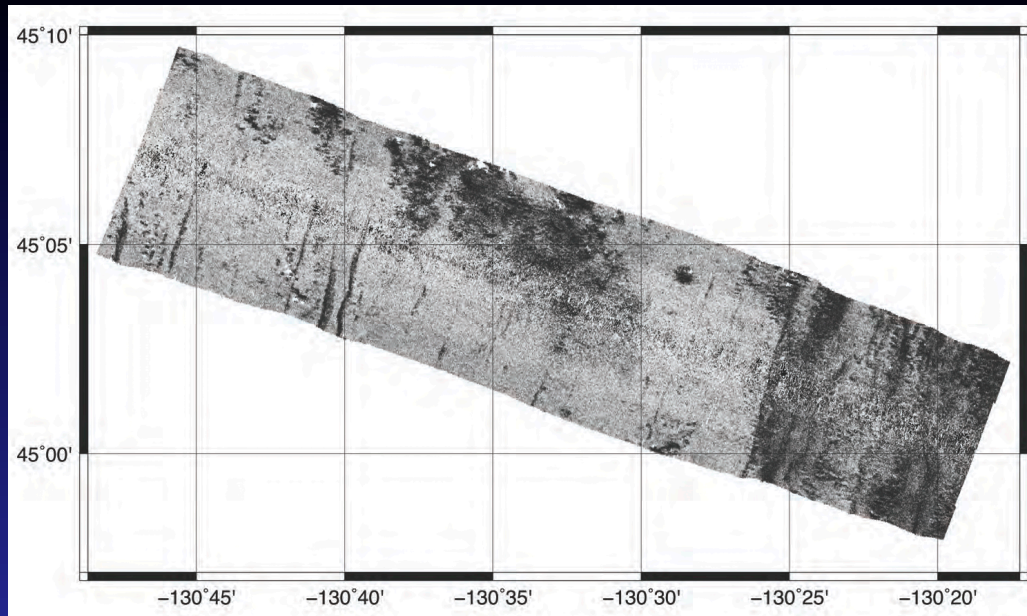
Increased Earthquake frequency during low tides

Change in mid crust normal stresses of  $\pm 20$  kPa (.2 bars)

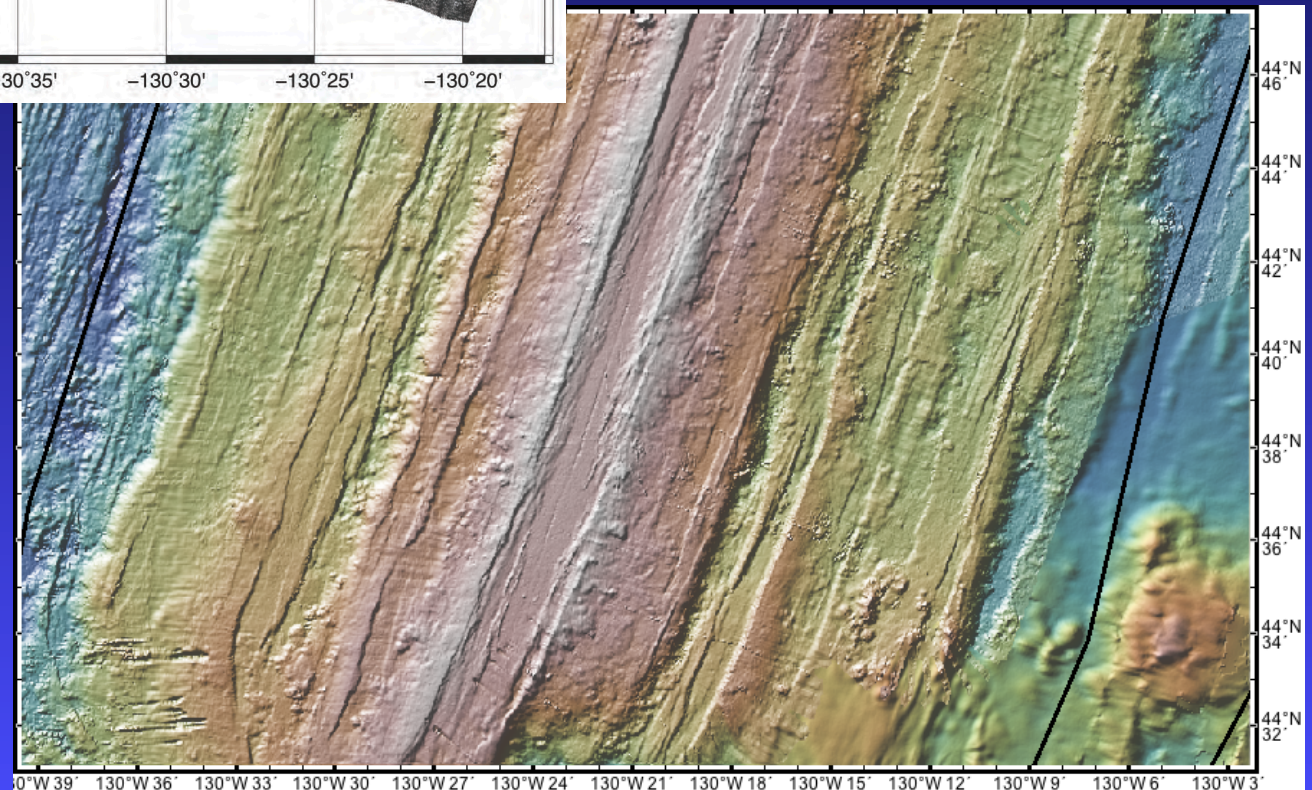
Wilcock 2001







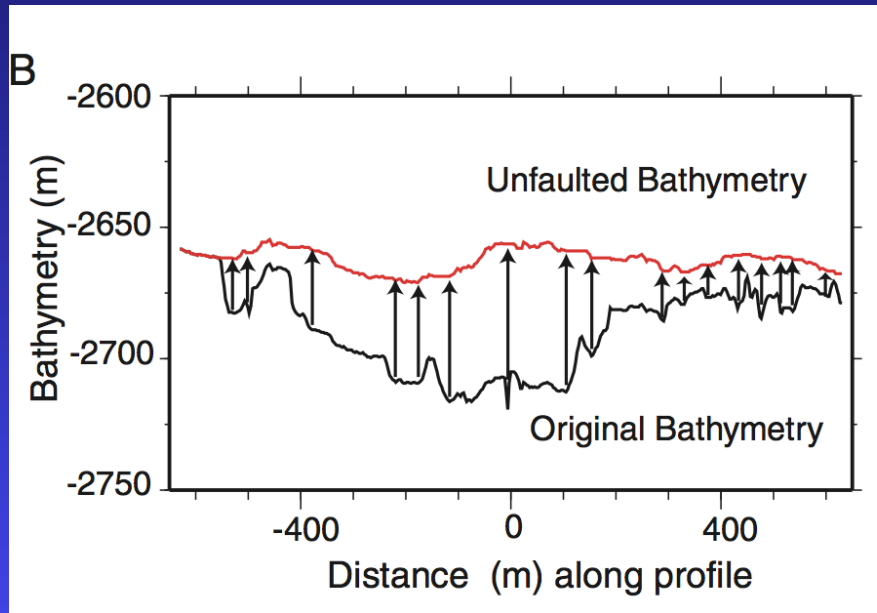
**Next steps**  
Characterize the fault  
deformation field - fault  
spacings, displacement,  
length



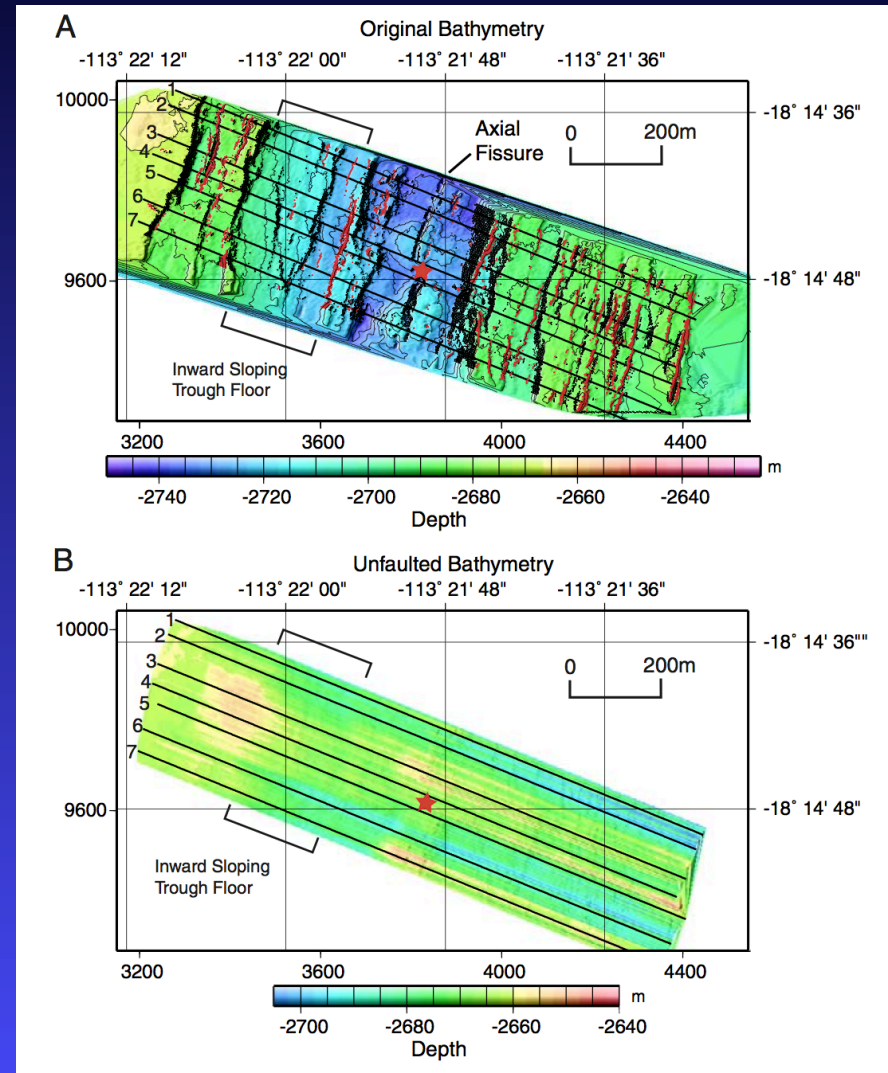
# Remove deformation field

Examine volcanic only  
topography?

18°S EPR

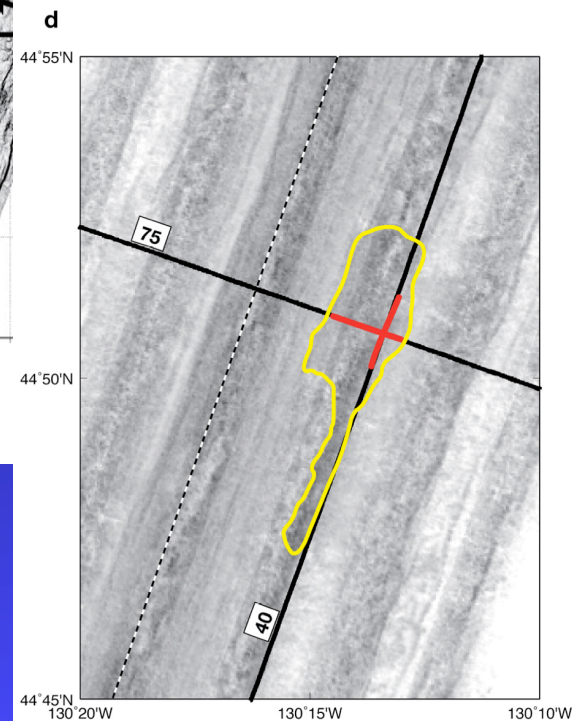
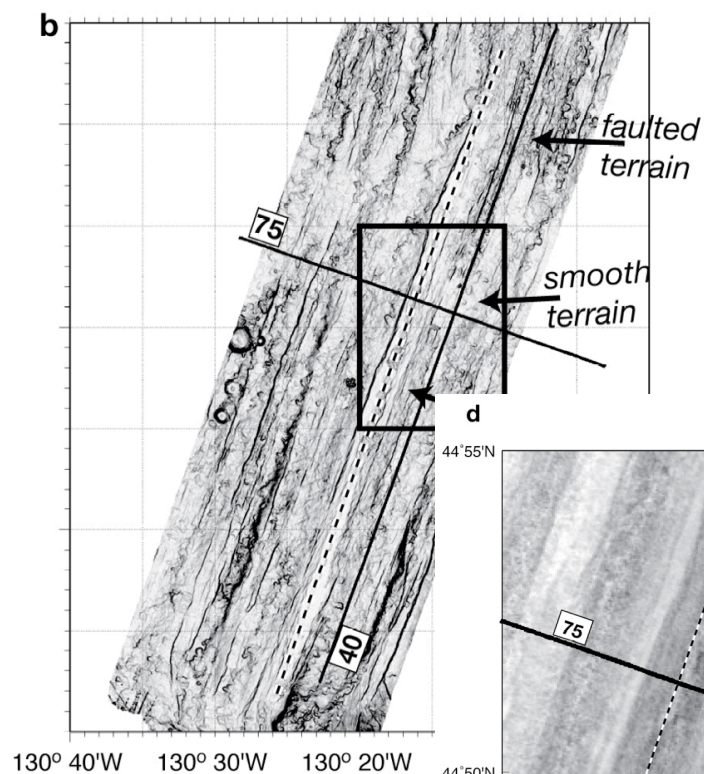
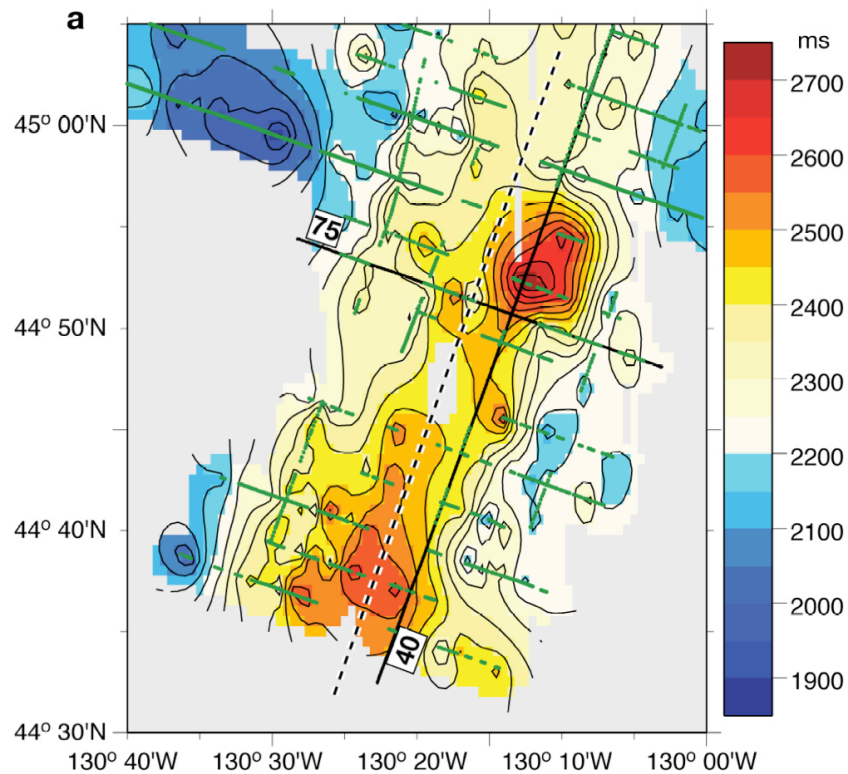


Carbotte et al., 2003









Off-axis crustal magma body  
(Canales et al, 2010)