GeoPRISMS Rift Initiation and Evolution Scientific Planning Meeting

Evolution: Observation Perspective

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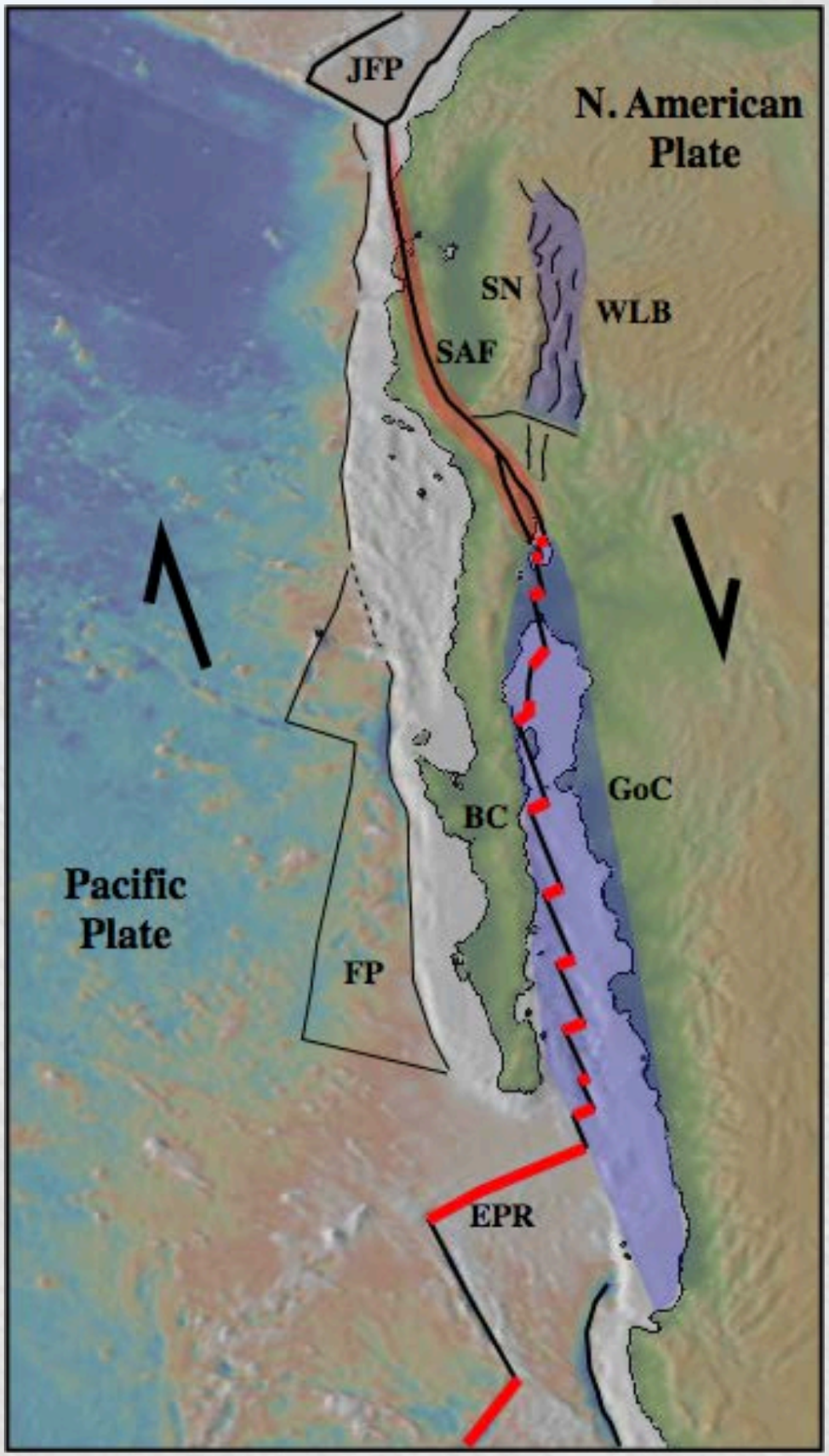
- *PESCADOR*-Dan, Paul, Gary, Steve, Antonio and John
- Students (Danny Brothers, Fiona Sutherland, Jeff Dingler, Annie Kell and Amy Eisses)

—Observations and *Lessons* from the Gulf of California, Salton Trough and Walker Lane



- *Slab Rollback*
- *Slab Detachment*
- *Microplate Capture*
- *Extension*
- *Drift*

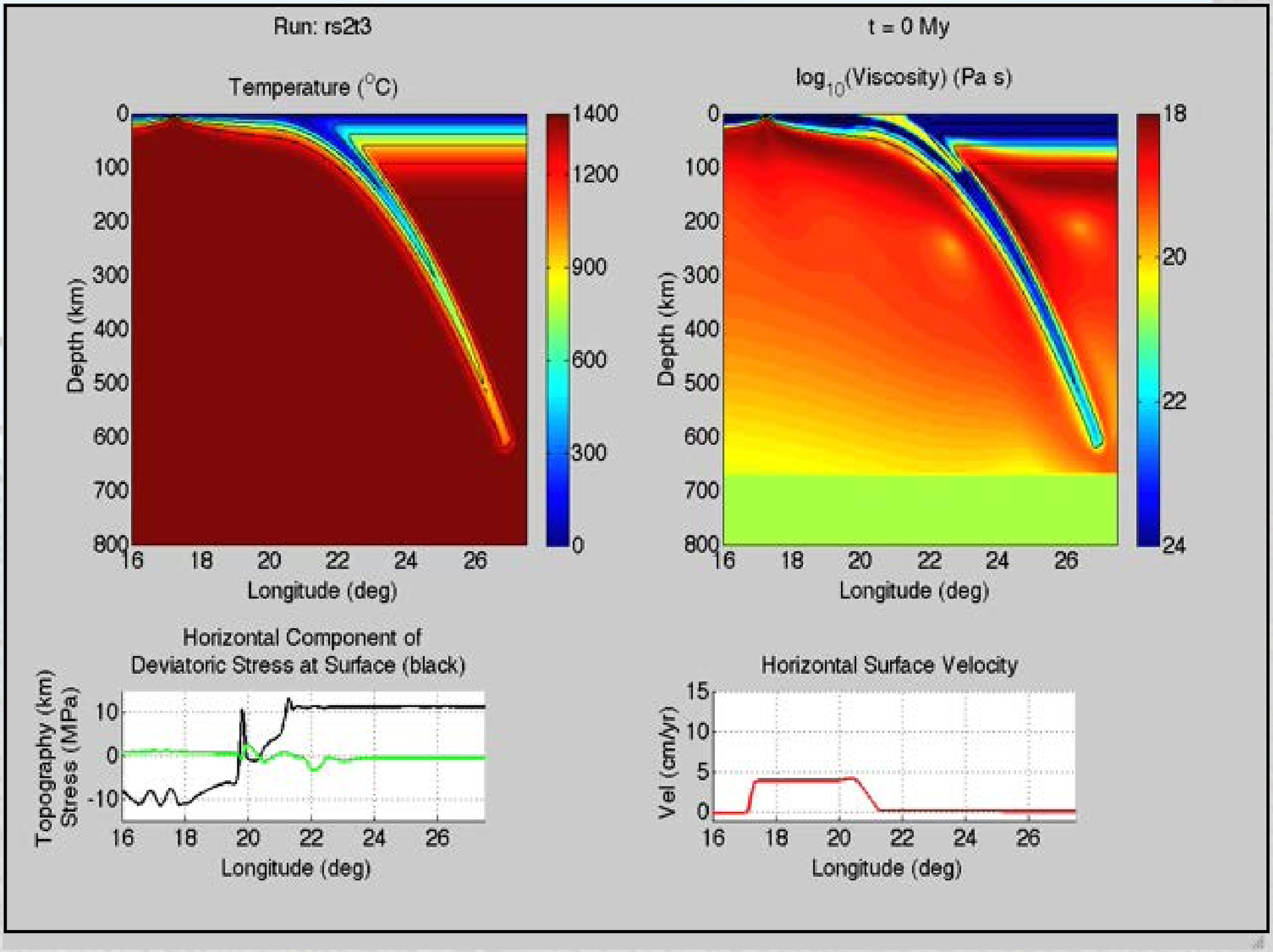
Outline
—10 Years of Margins Research—

Gulf of California, Salton Trough & Walker Lane

- The "Slab"
- Rifting
- Rift to Drift
- Sediment Influence

The “Slab”

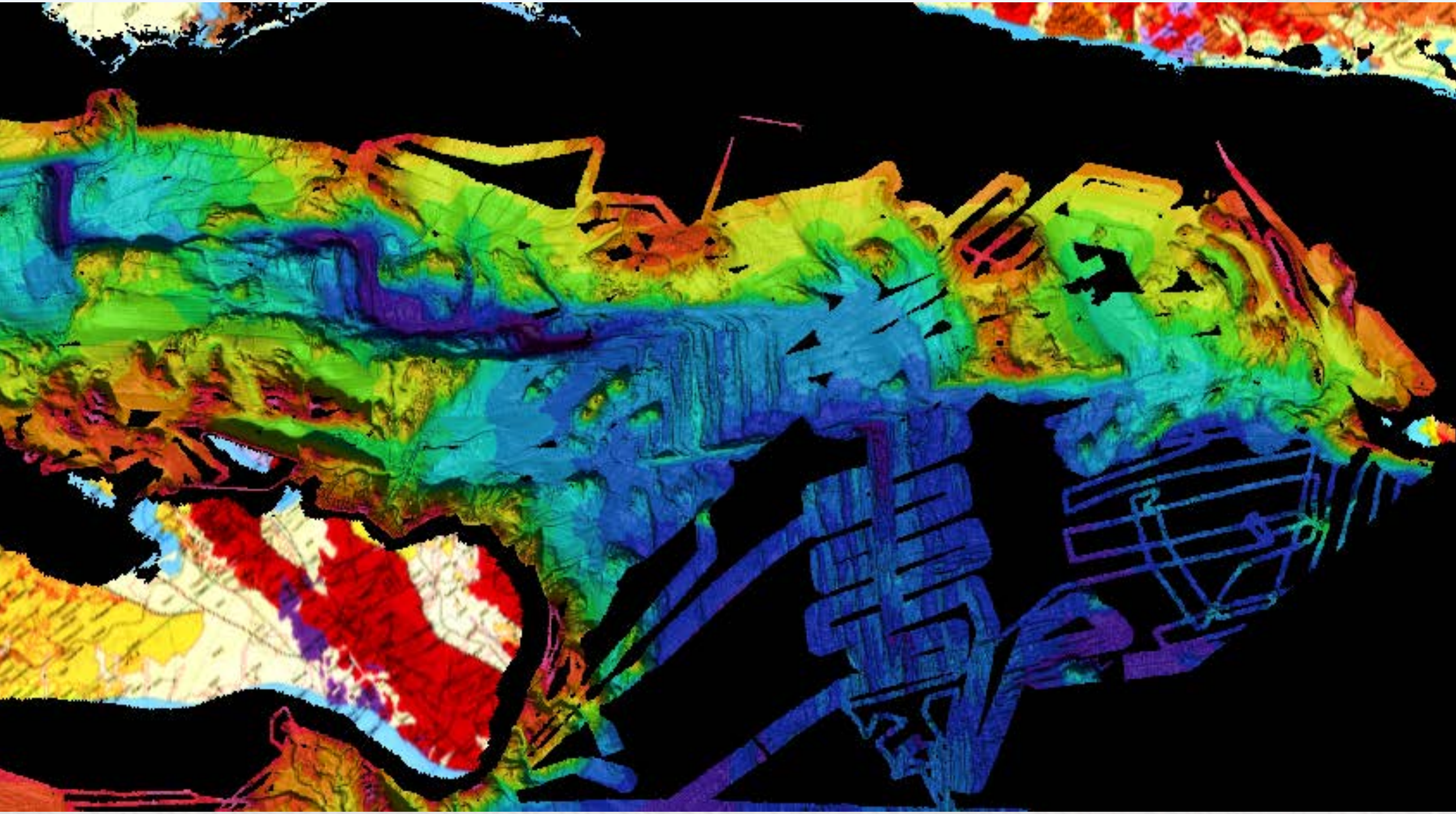
Slab Detachment



Erin Burkett, UC Davis

Oblique Rifting
— Arc Crust—

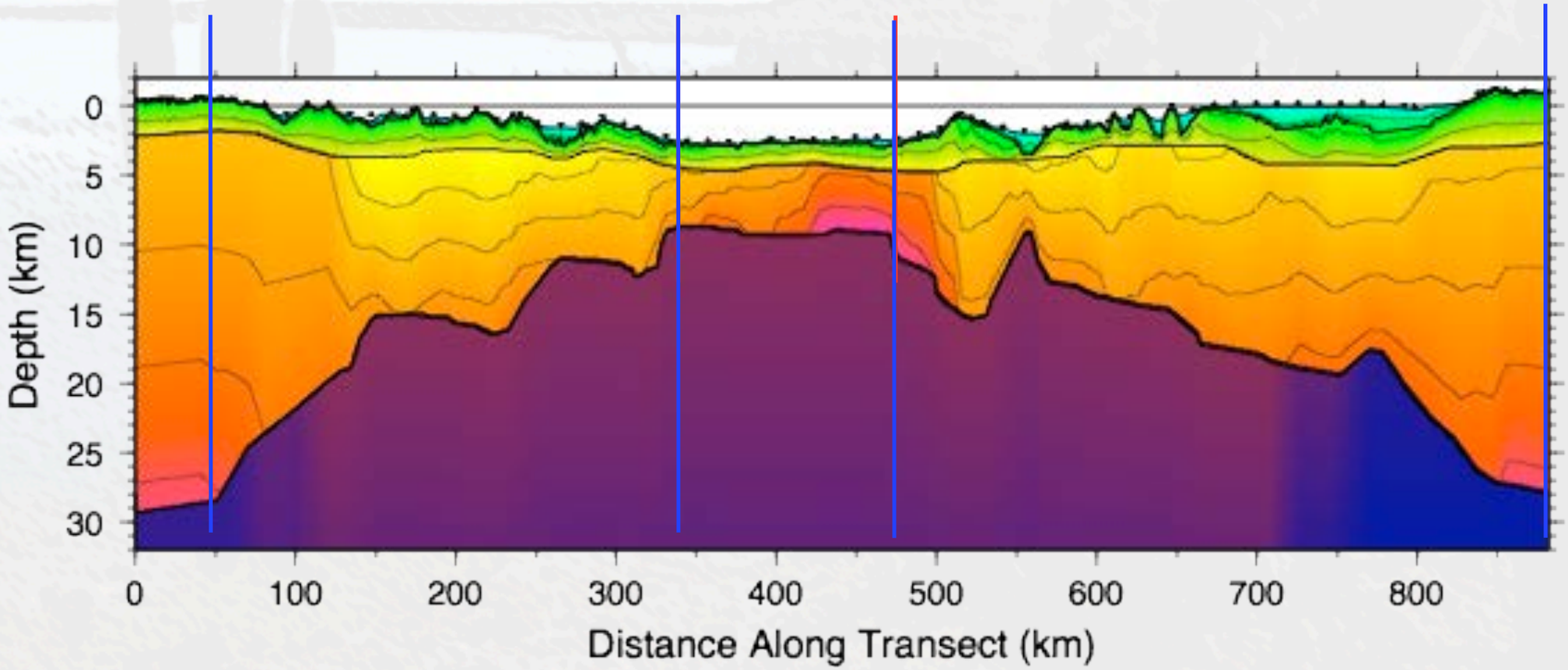
PESCADOR Line 1—Alarcón Transect



Whole Crustal Extension

<u>Northwest Margin:</u>
Current width: 285 km
Non-extended
crustal thickness: 30 km
Extension = 145 km

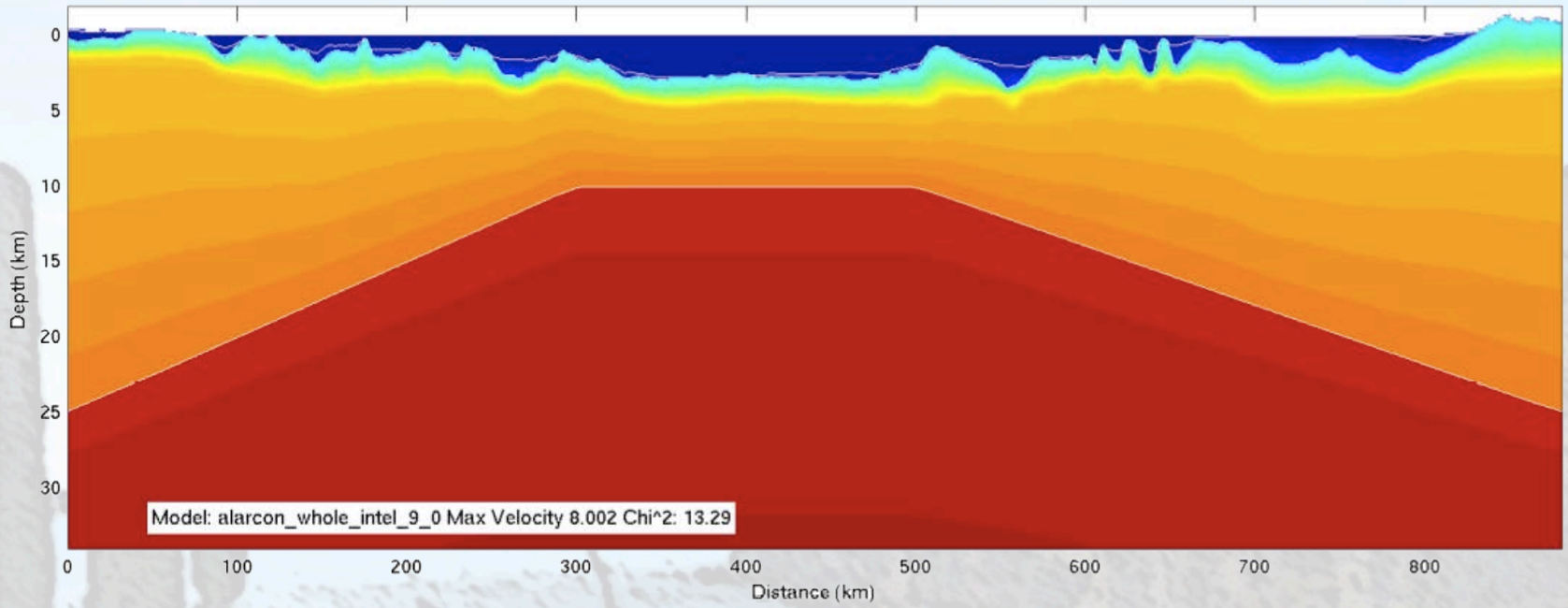
<u>Southeast Margin:</u>
Current width: 400 km
Non-extended
crustal thickness: 29 km
Extension = 170 km



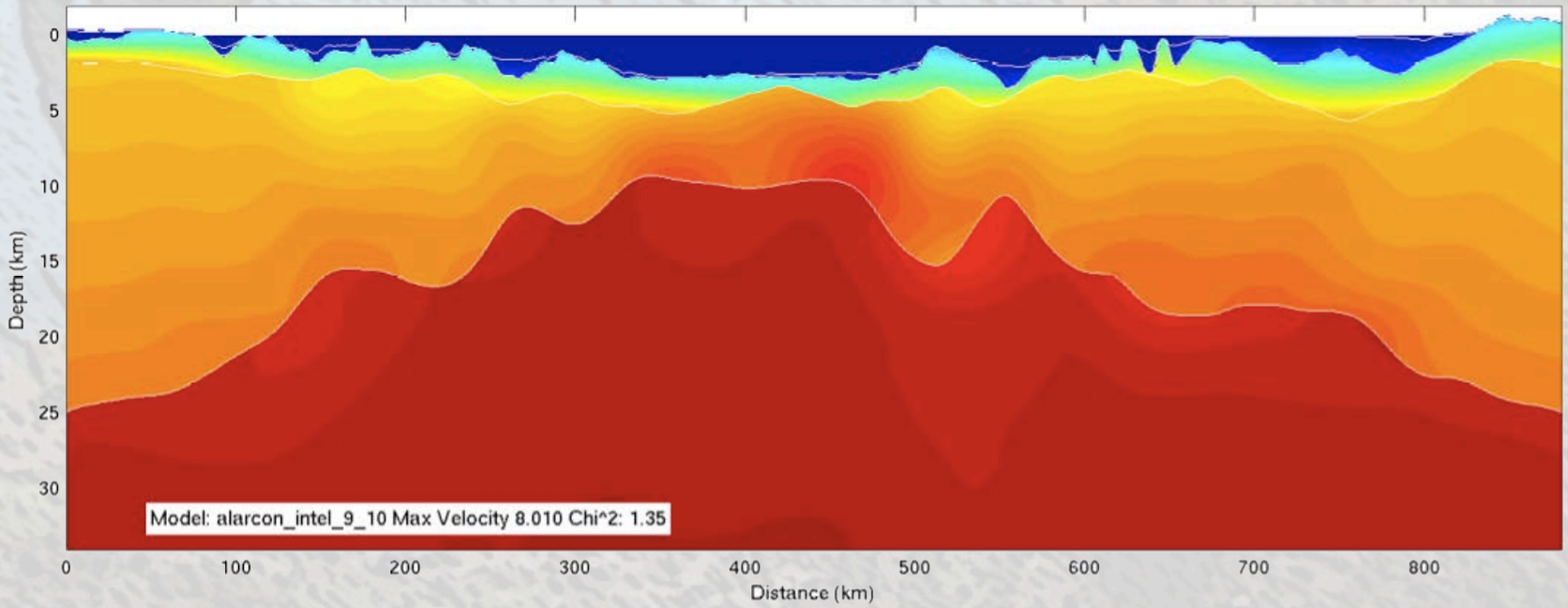
Total opening across the Alarcón transect = 450 km

Tomographic Inversions

Starting Model



Final Model



-crustal keel remains

-allowable extension: 425-477 km

MCS profiles: Timing of Extension in the Gulf

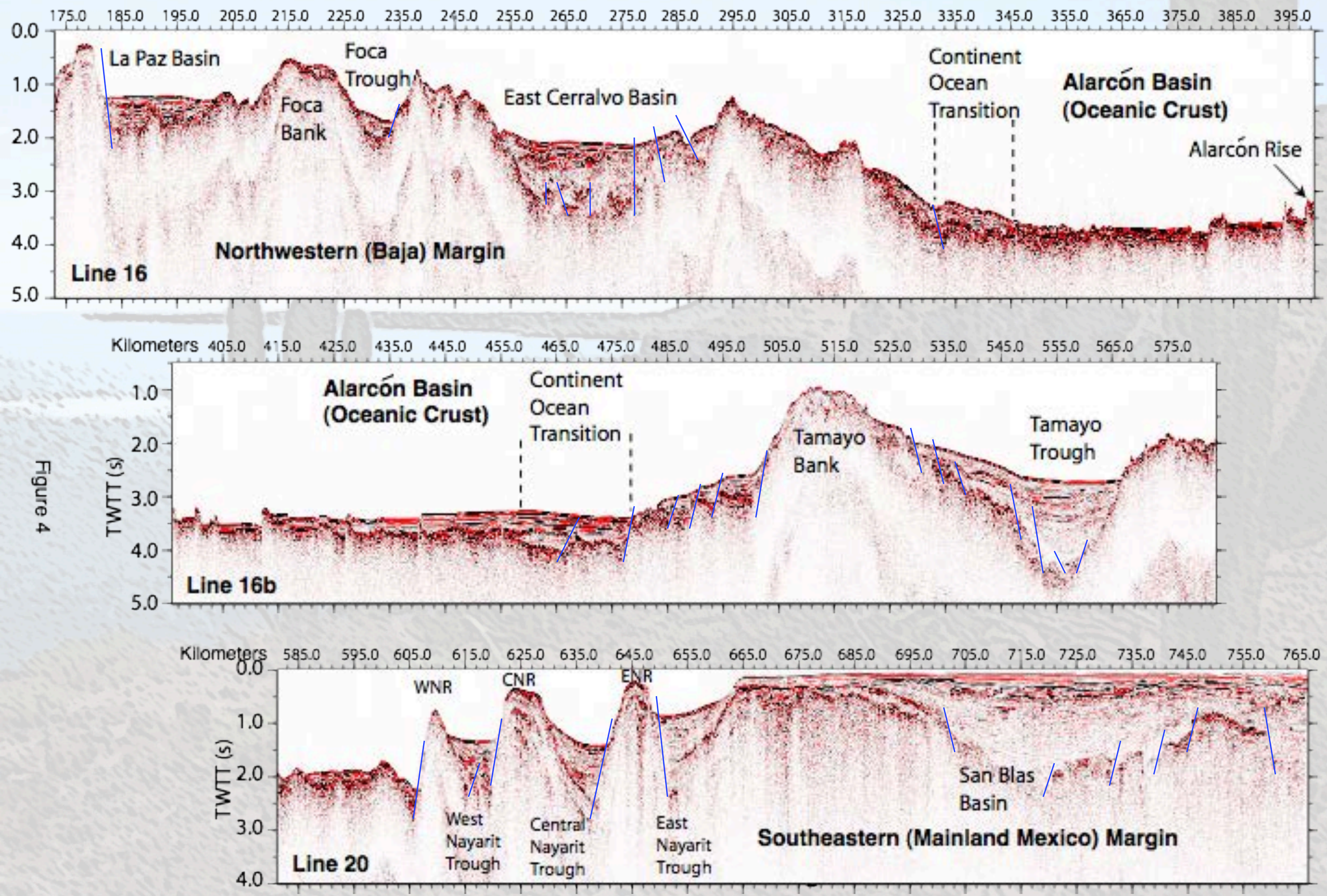
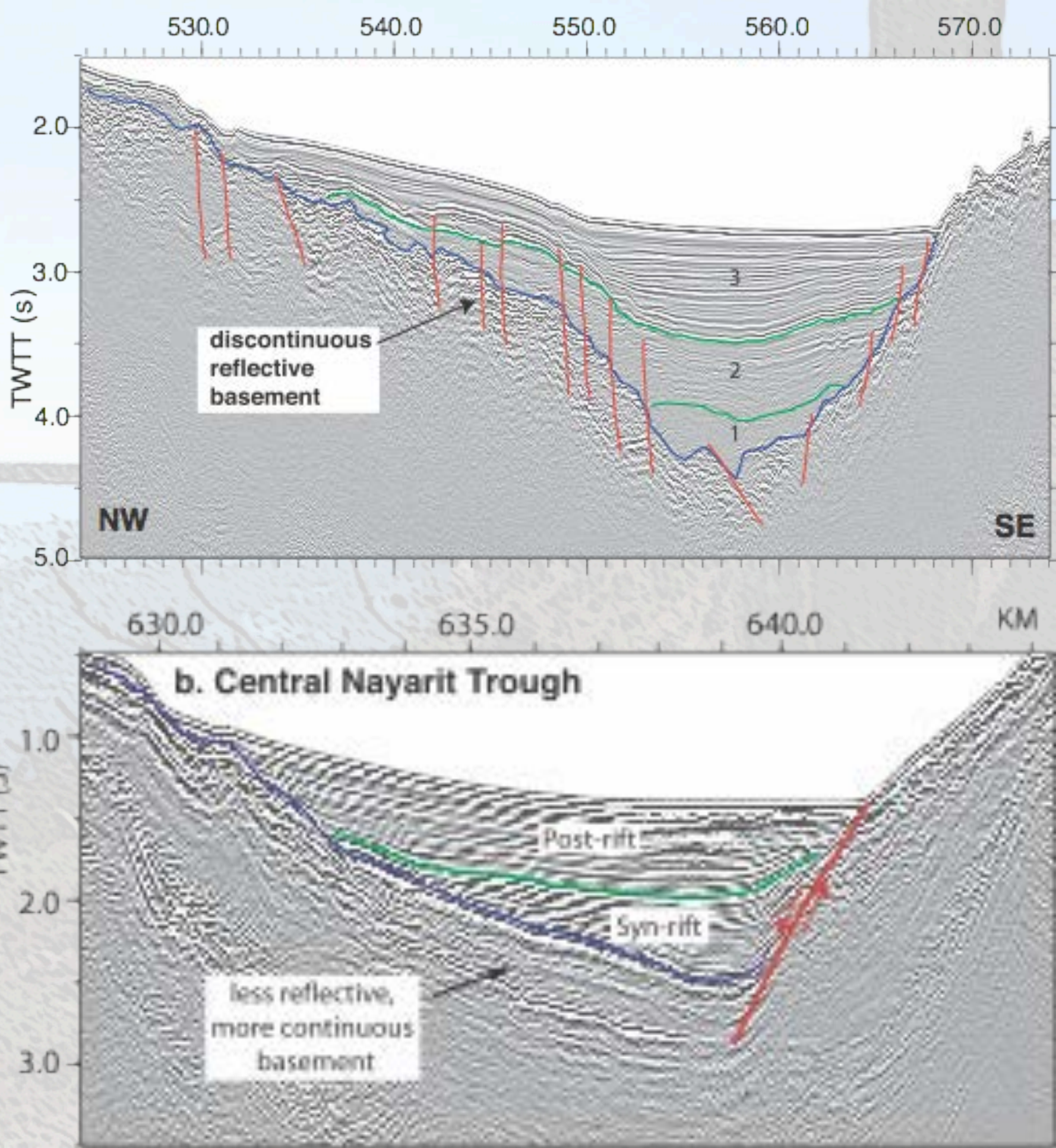


Figure 4

No Synrift Sediments

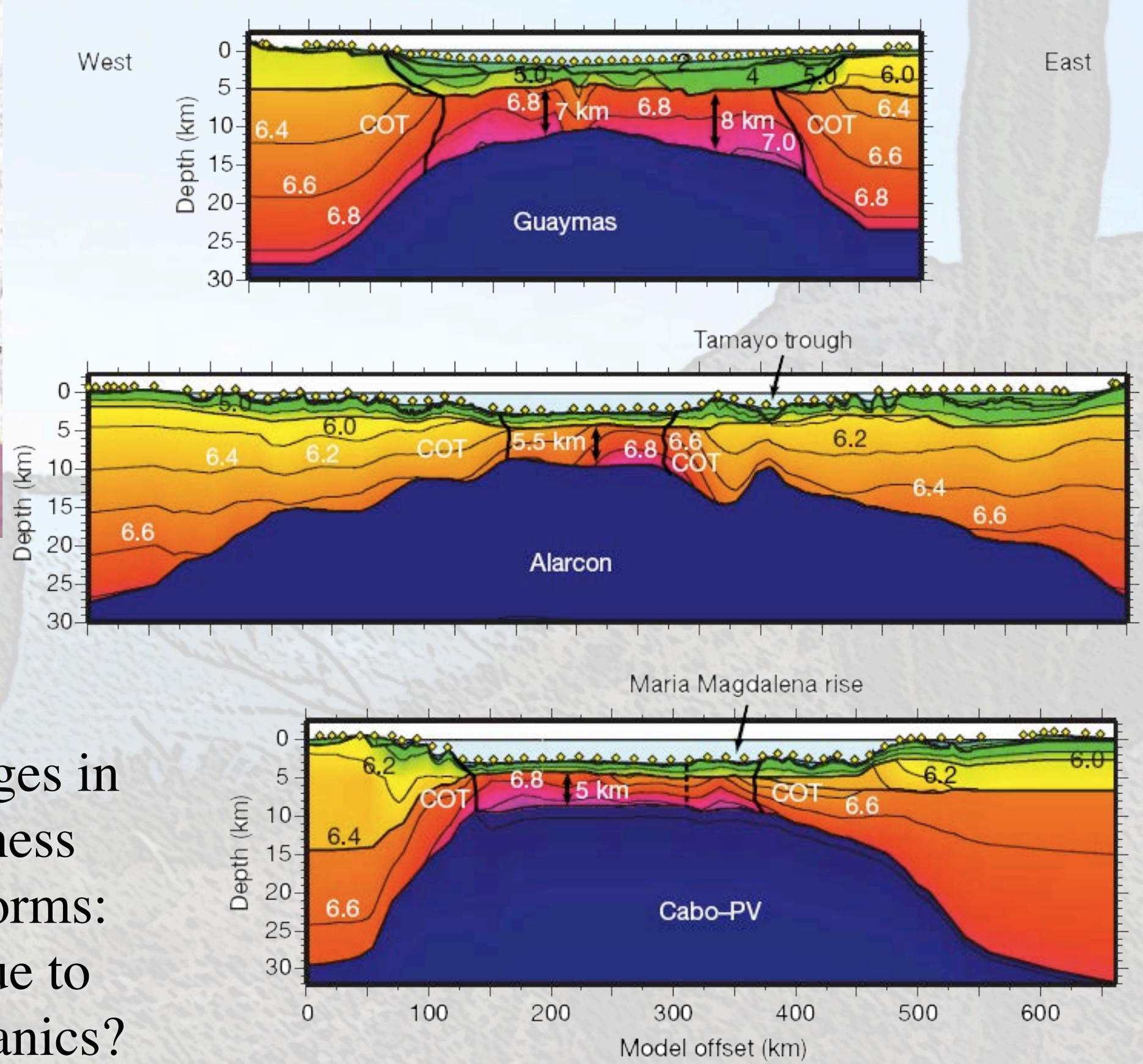
Synrift Sediments



Wide Rift

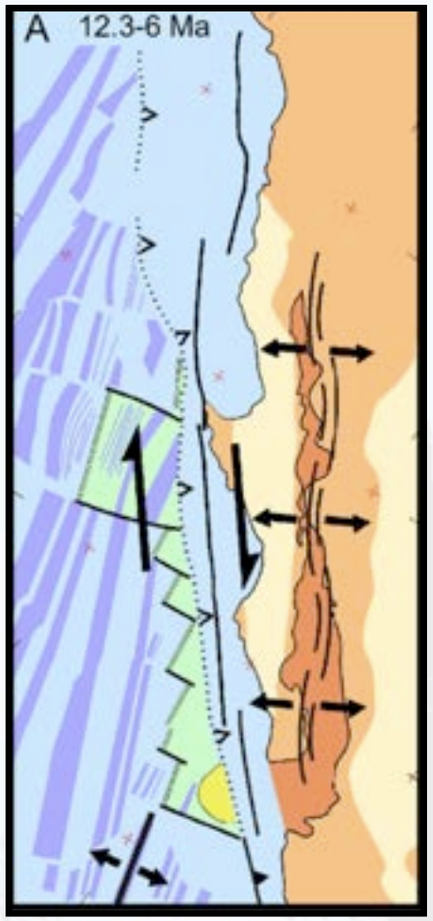
—Yes?—

No....Maybe

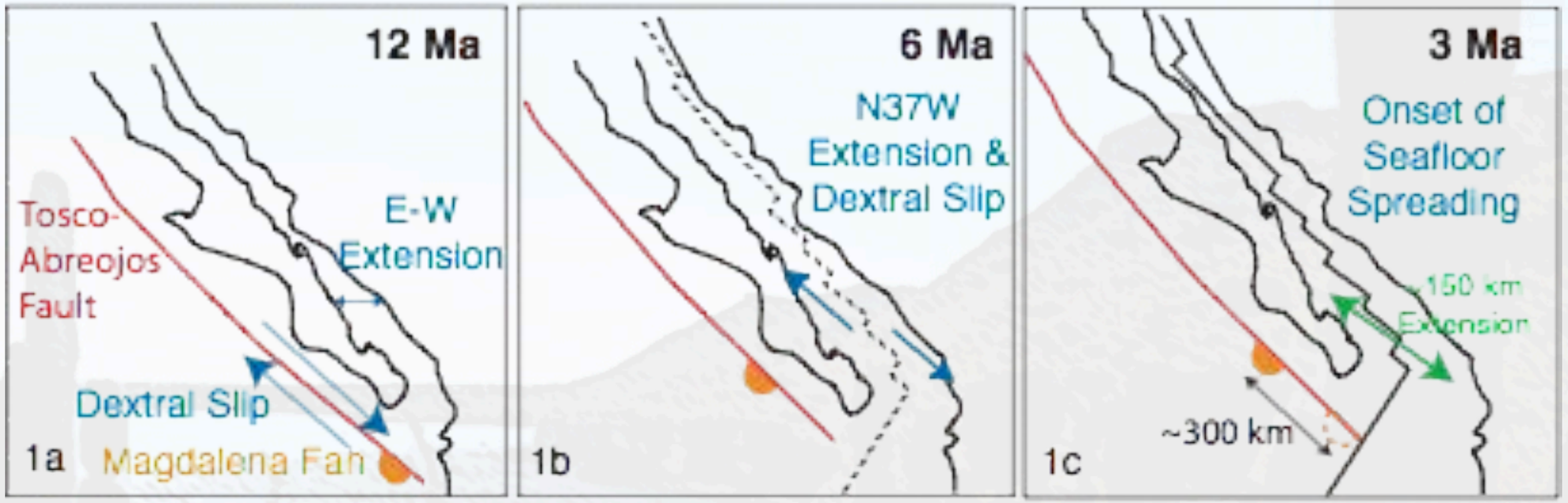


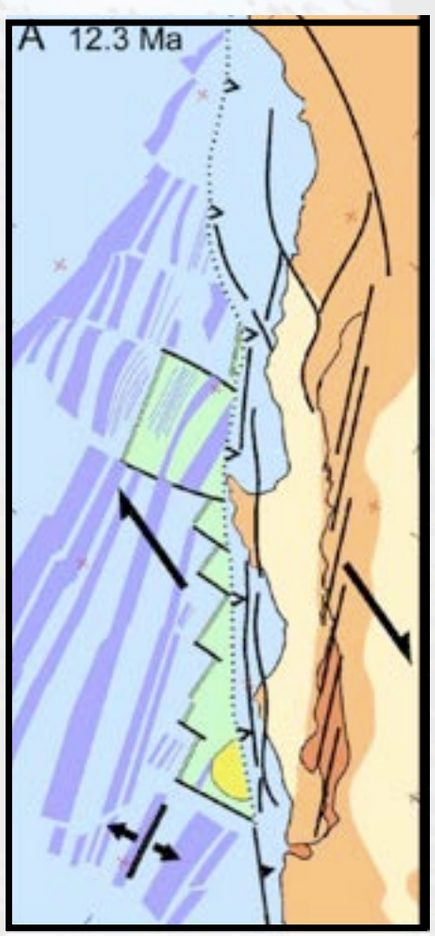
Dramatic changes in crustal thickness profiles transforms: dewatering due to Comondú volcanics?

Lizarralde et al. 2007

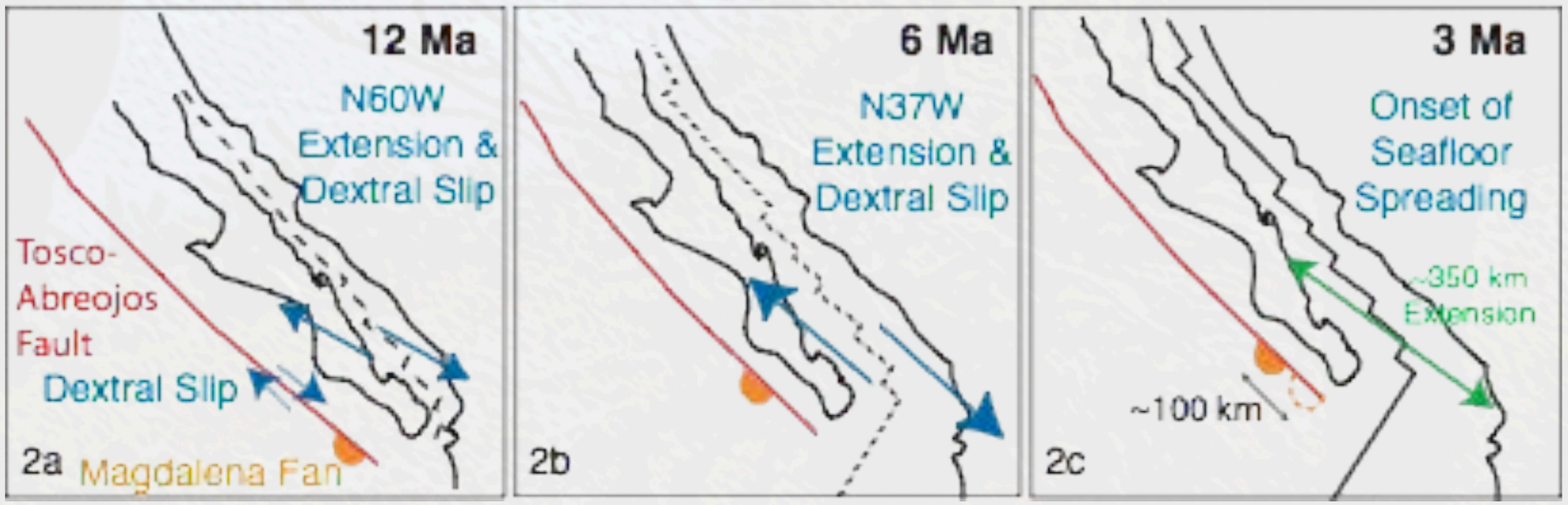


Tectonic Evolution: Model 1





Tectonic Evolution: Model 2



"Rift to Drift"

... Rift Initiation

Faults Studied: 2006-8

California

FARALLON BASIN

Fuerte Delta

Sinaloa

Coastal

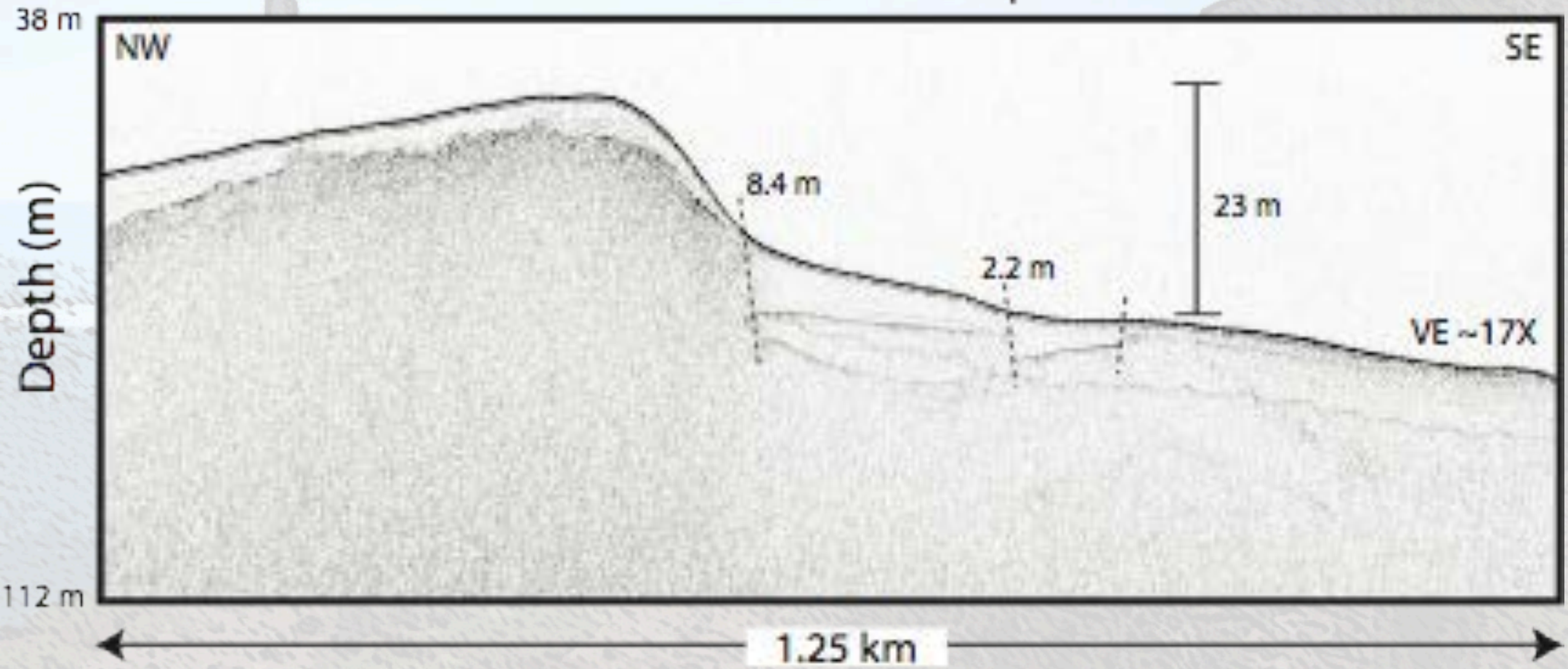
PESCADERO BASIN

Sinaloa

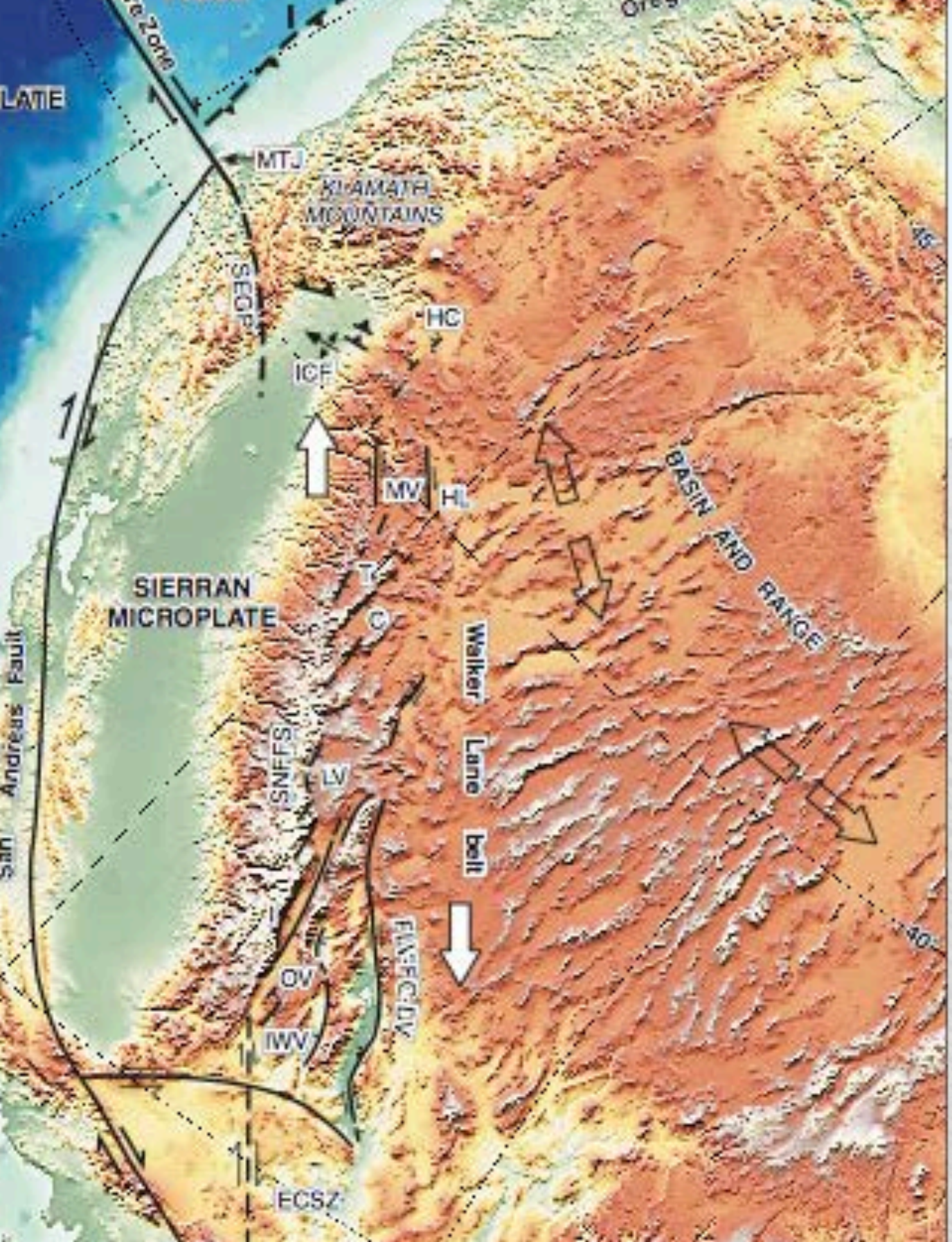
Cape Mountains

ALARCON RISE

Saltito Fault: Offshore Expression

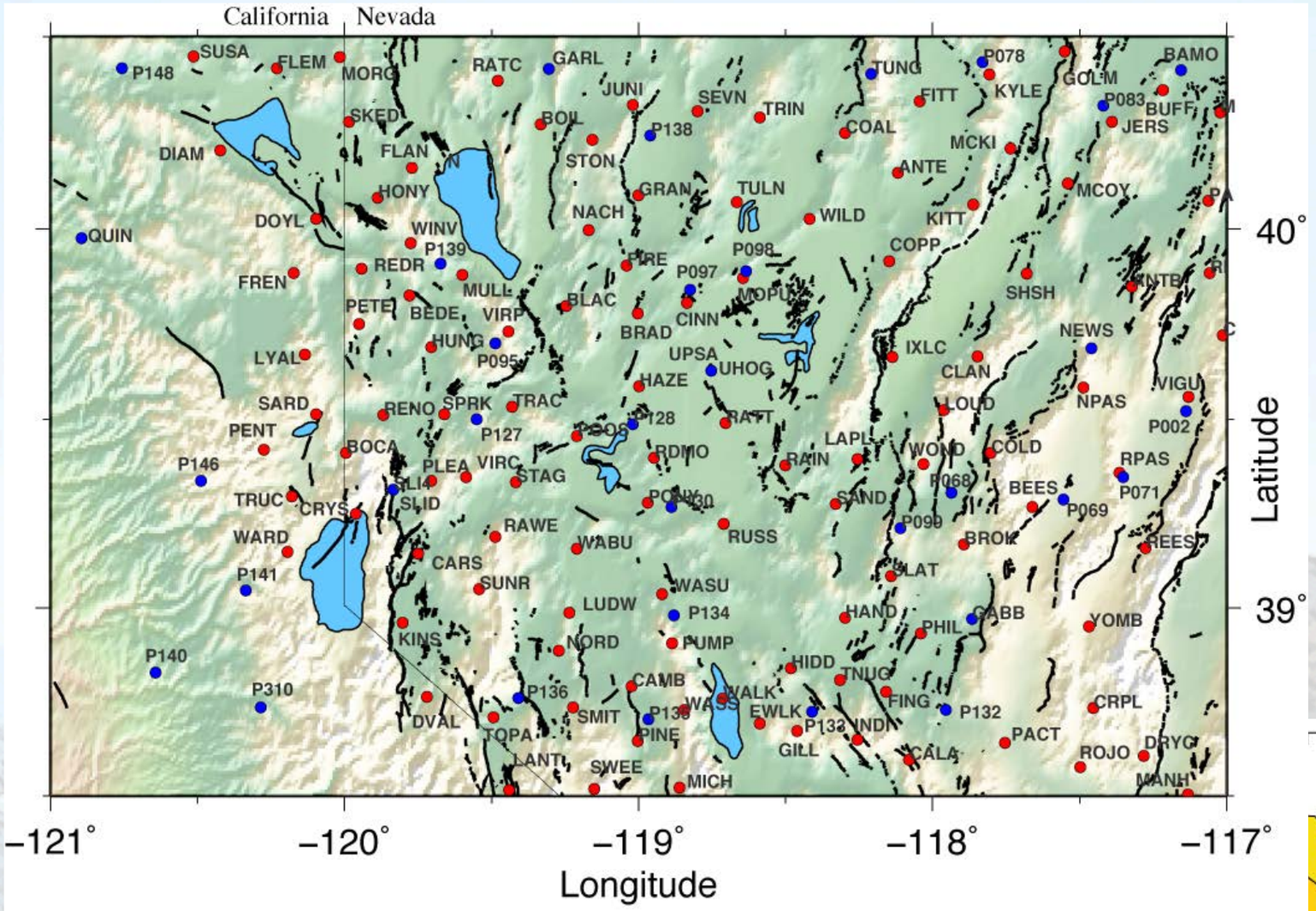


Along-track Distance (km)

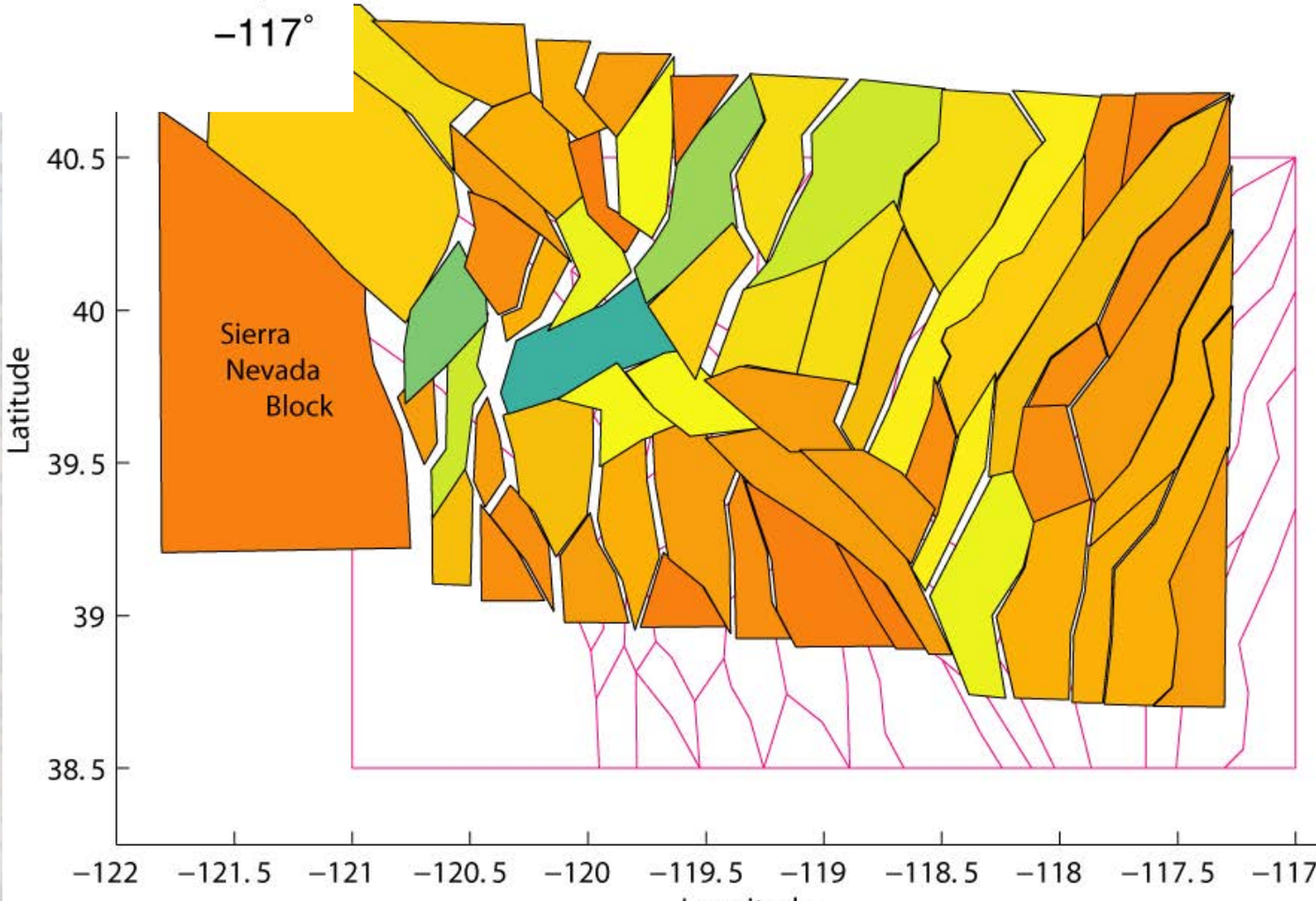


Central/Northern Walker Lane

Dextral shear not accommodated along through-cutting transforms faults…
only furthest north WLB



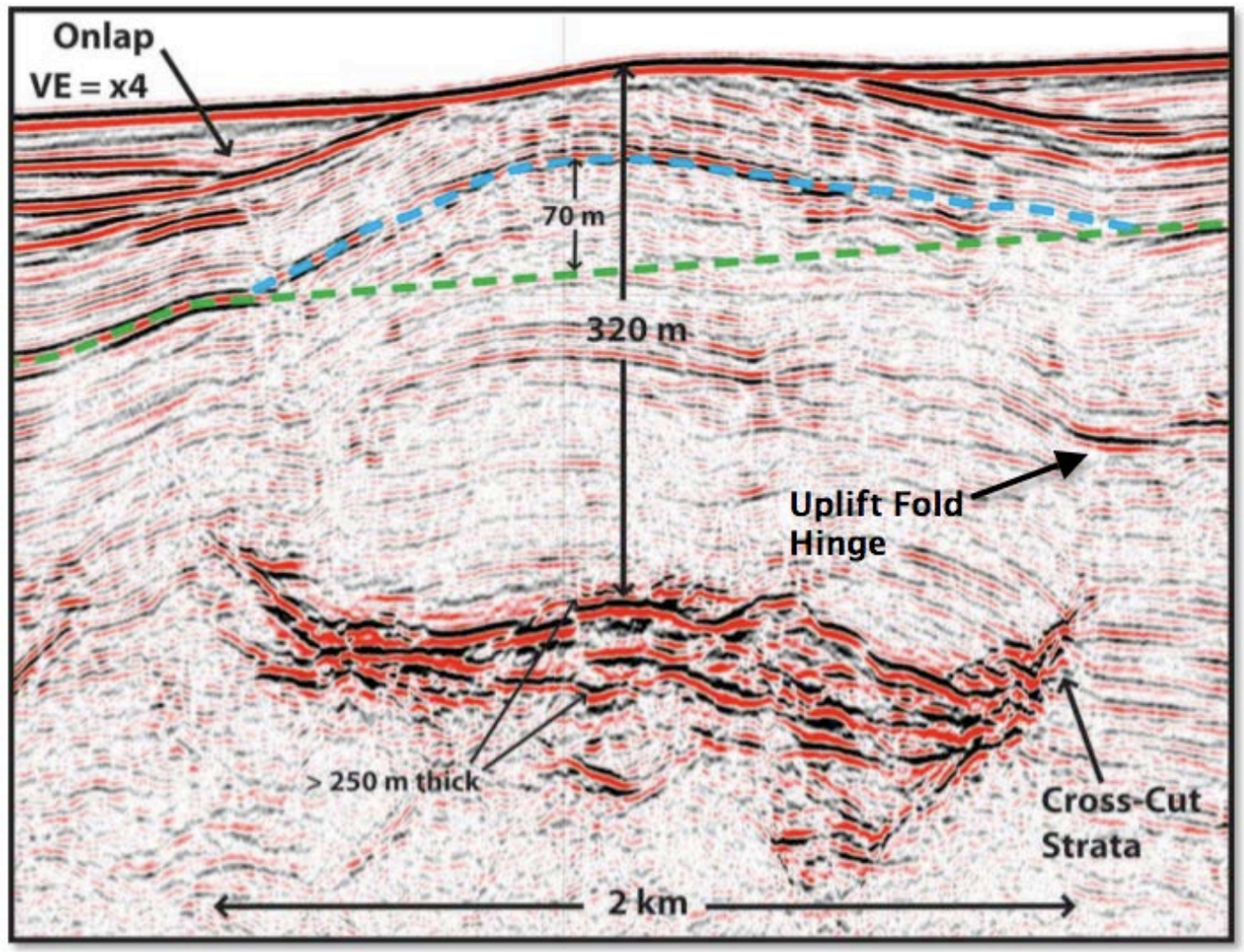
Ongoing GPS Studies

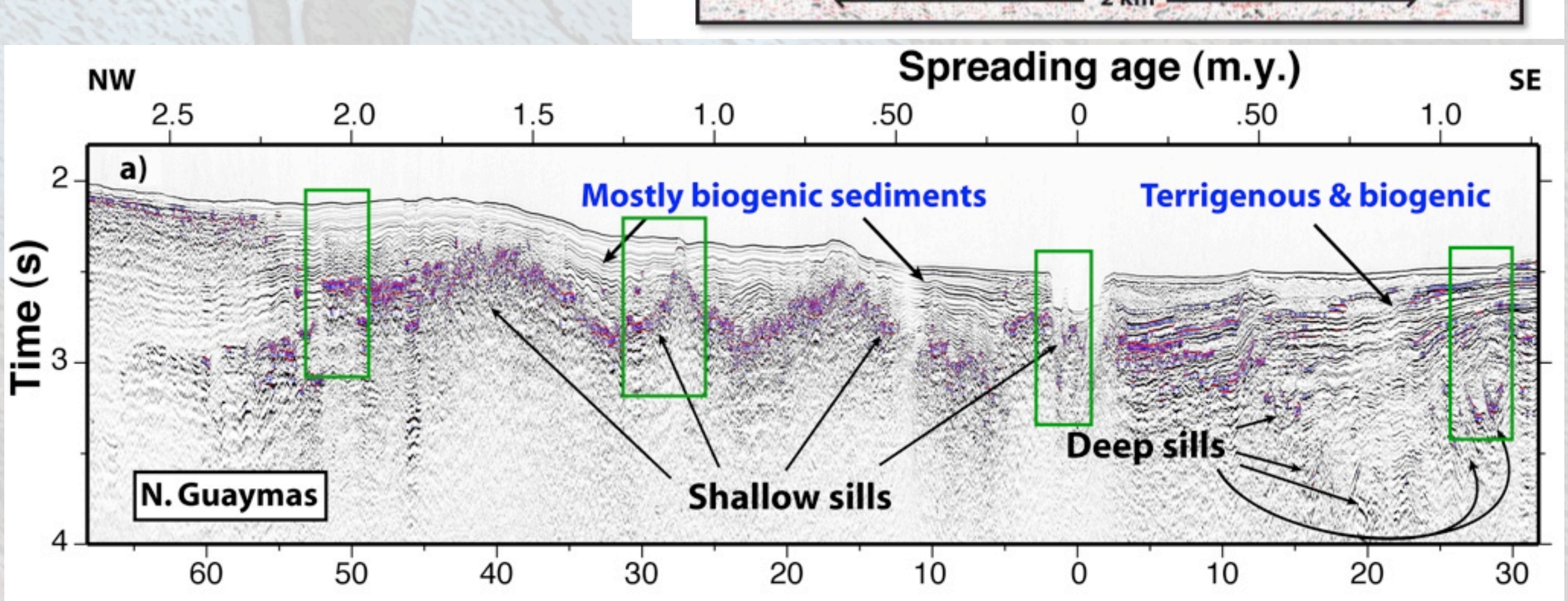


Bill Hammond, NBM&G

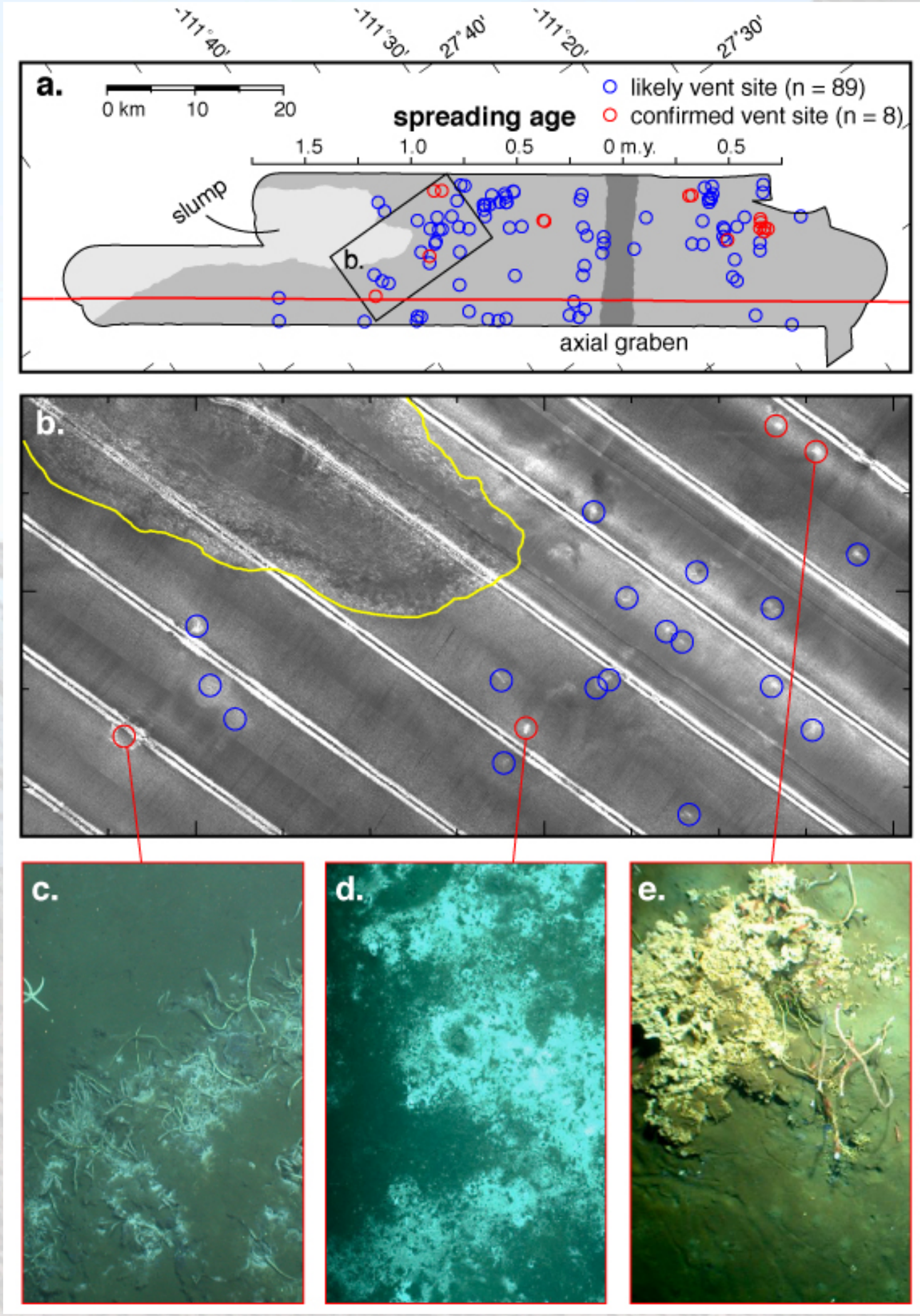
“Sediment Influence”

Sill Emplacement—Central GoC



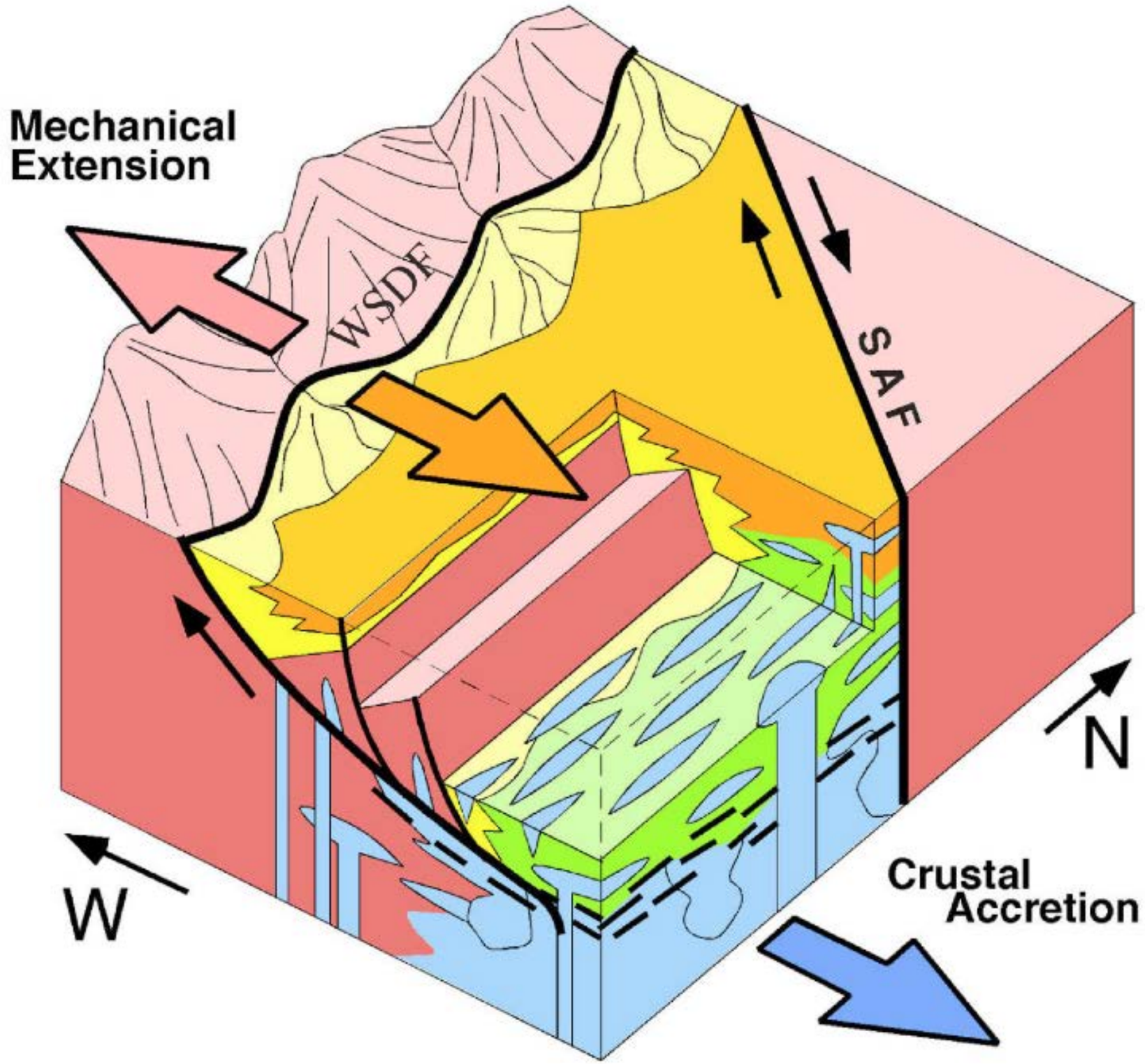


“thick sediments may promote broad magmatism”

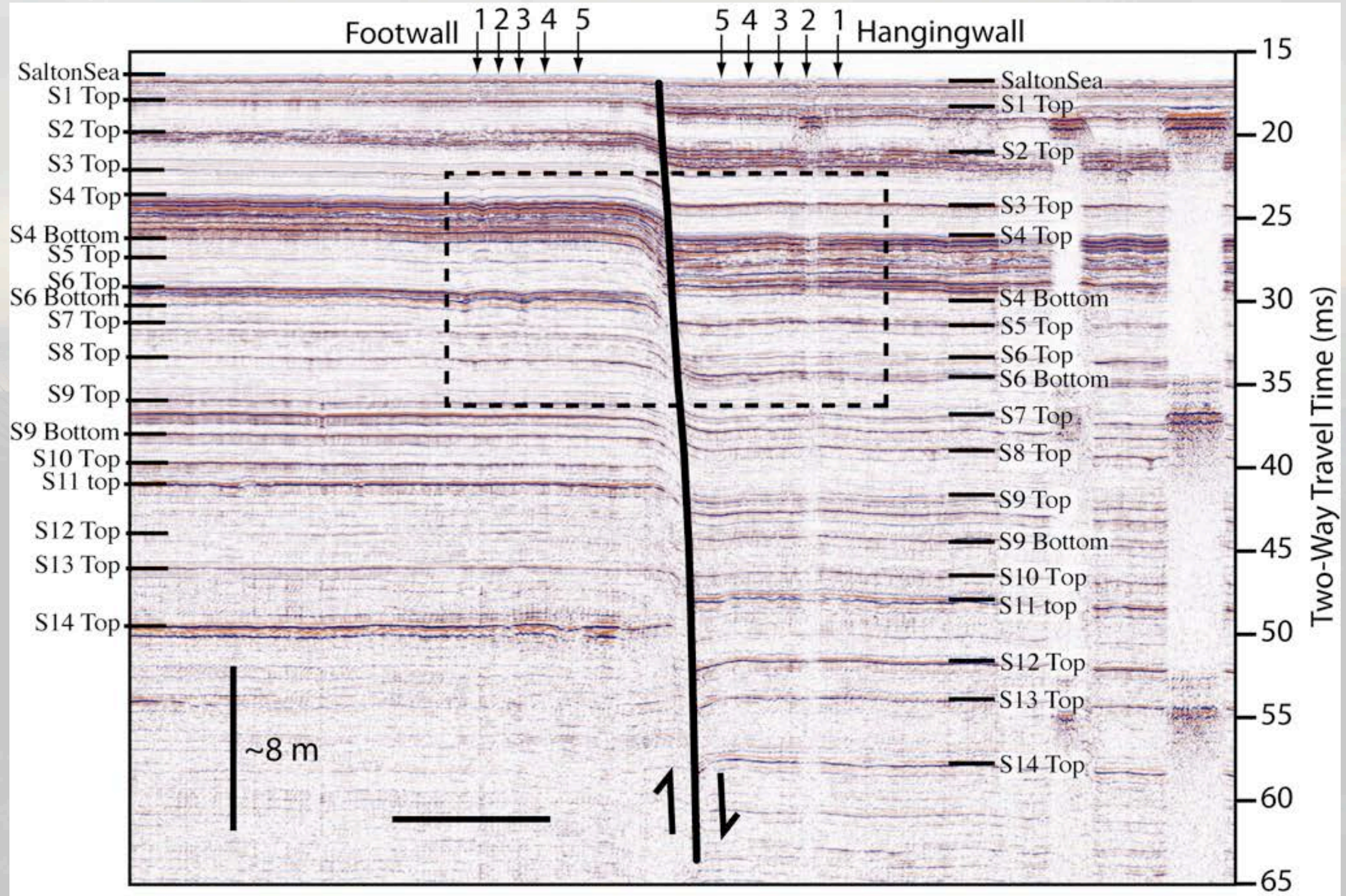


Lizarralde et al., 2010

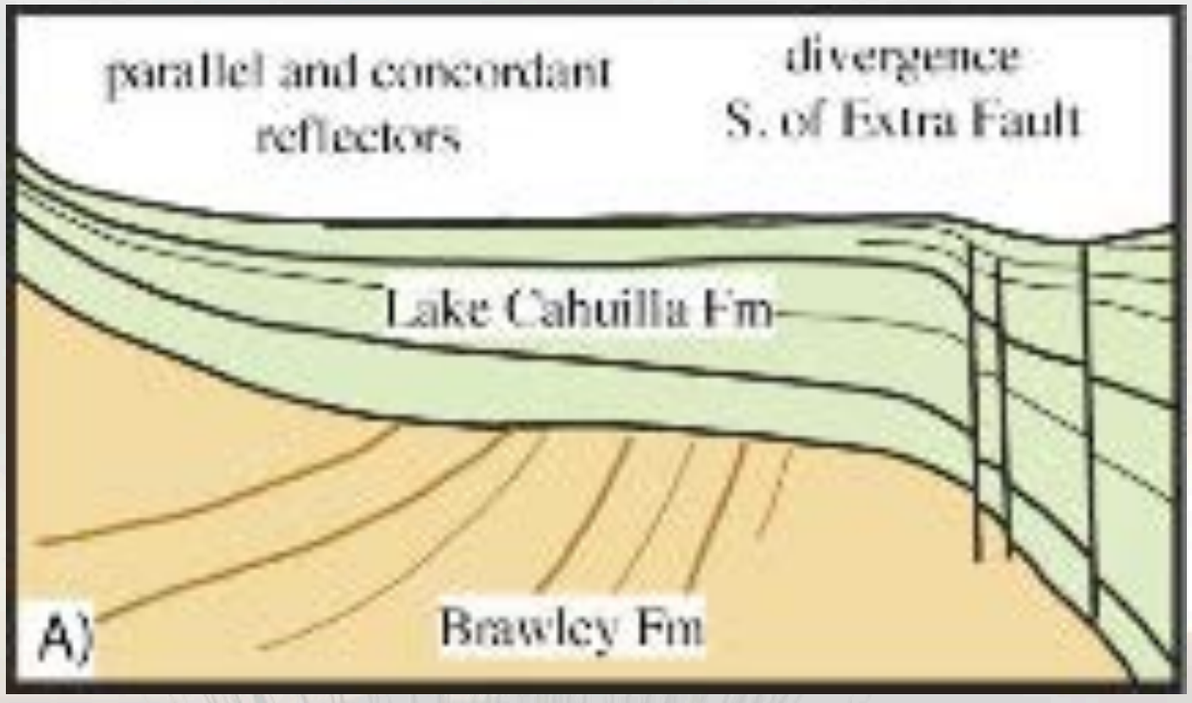
ASYMMETRIC SPREADING IN THE SALTON TROUGH:
Near-surface detachment slip accommodated by accretion at depth?



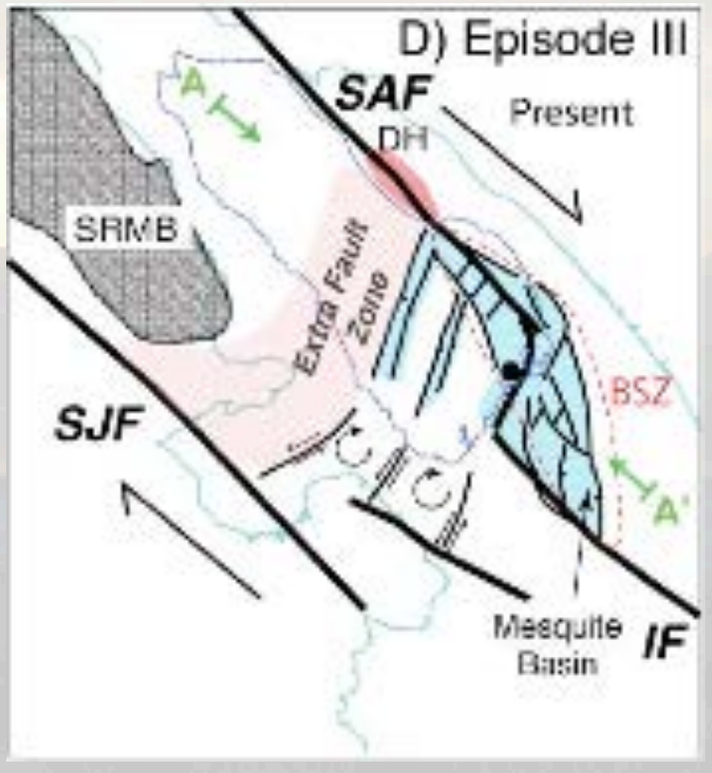
Salton Sea


Footwall
1 2 3 4 5
5 4 3 2 1
Hangingwall
SaltonSea
S1 Top
S2 Top
S3 Top
S4 Top
S4 Bottom
S5 Top
S6 Top
S6 Bottom
S7 Top
S8 Top
S9 Top
S9 Bottom
S10 Top
S11 top
S12 Top
S13 Top
S14 Top
~8 m
15
20
25
30
35
40
45
50
55
60
65
Two-Way Travel Time (ms)

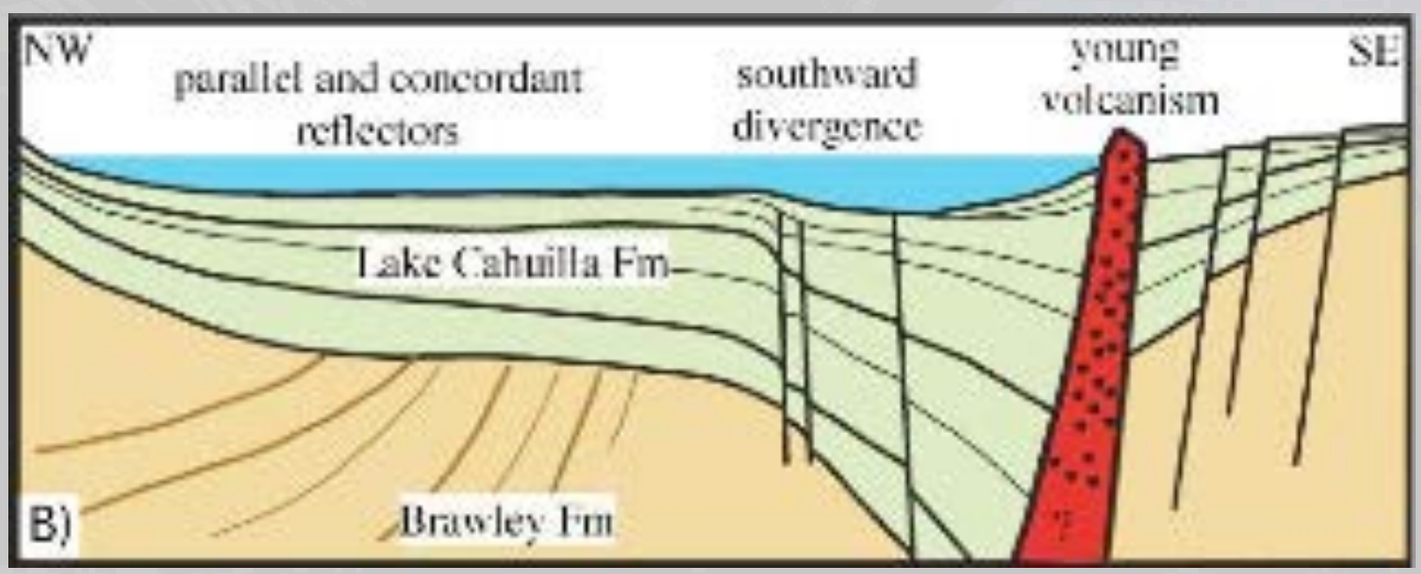
Observed Structure



Brawley Seismic Zone



Focused Extension



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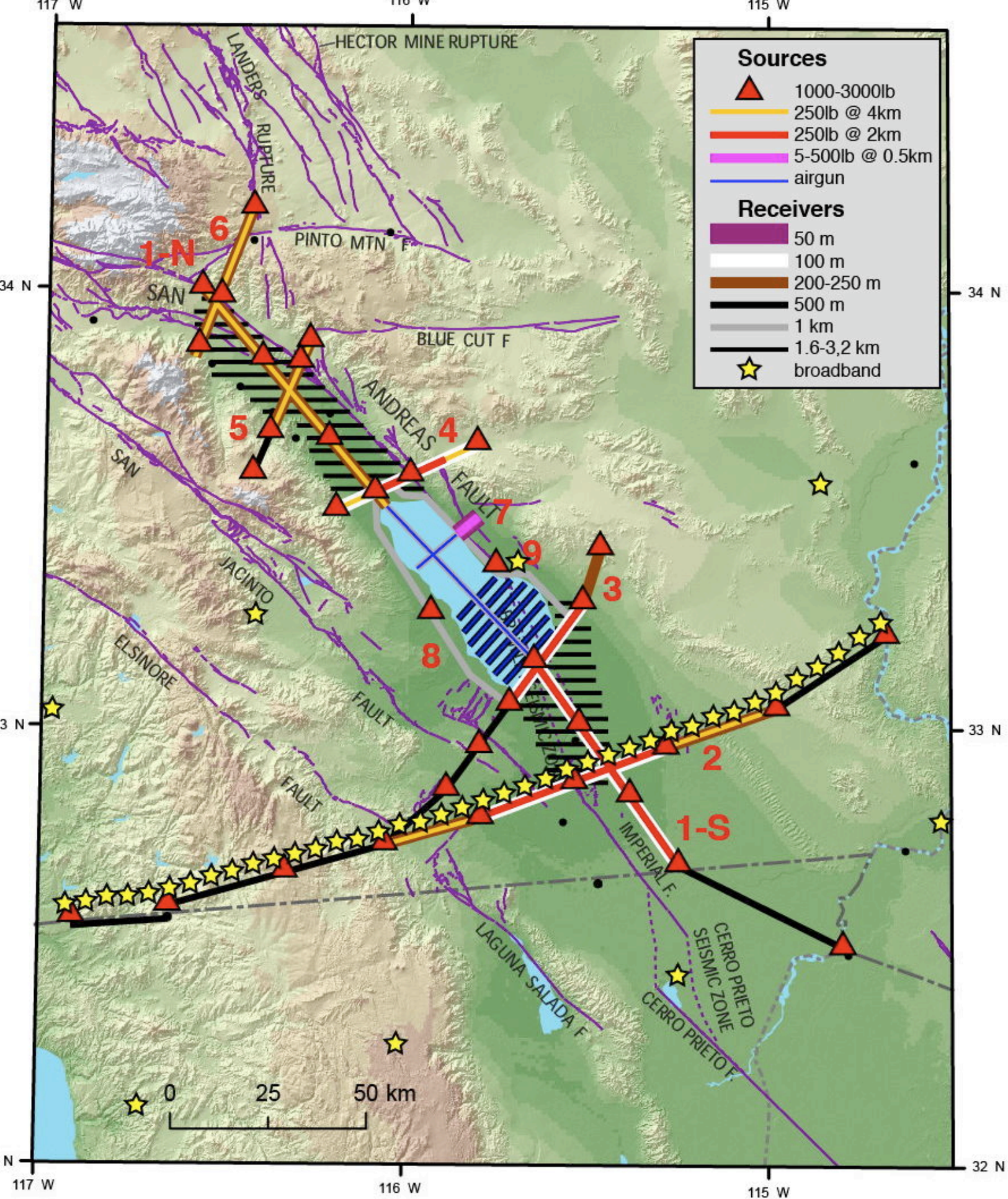
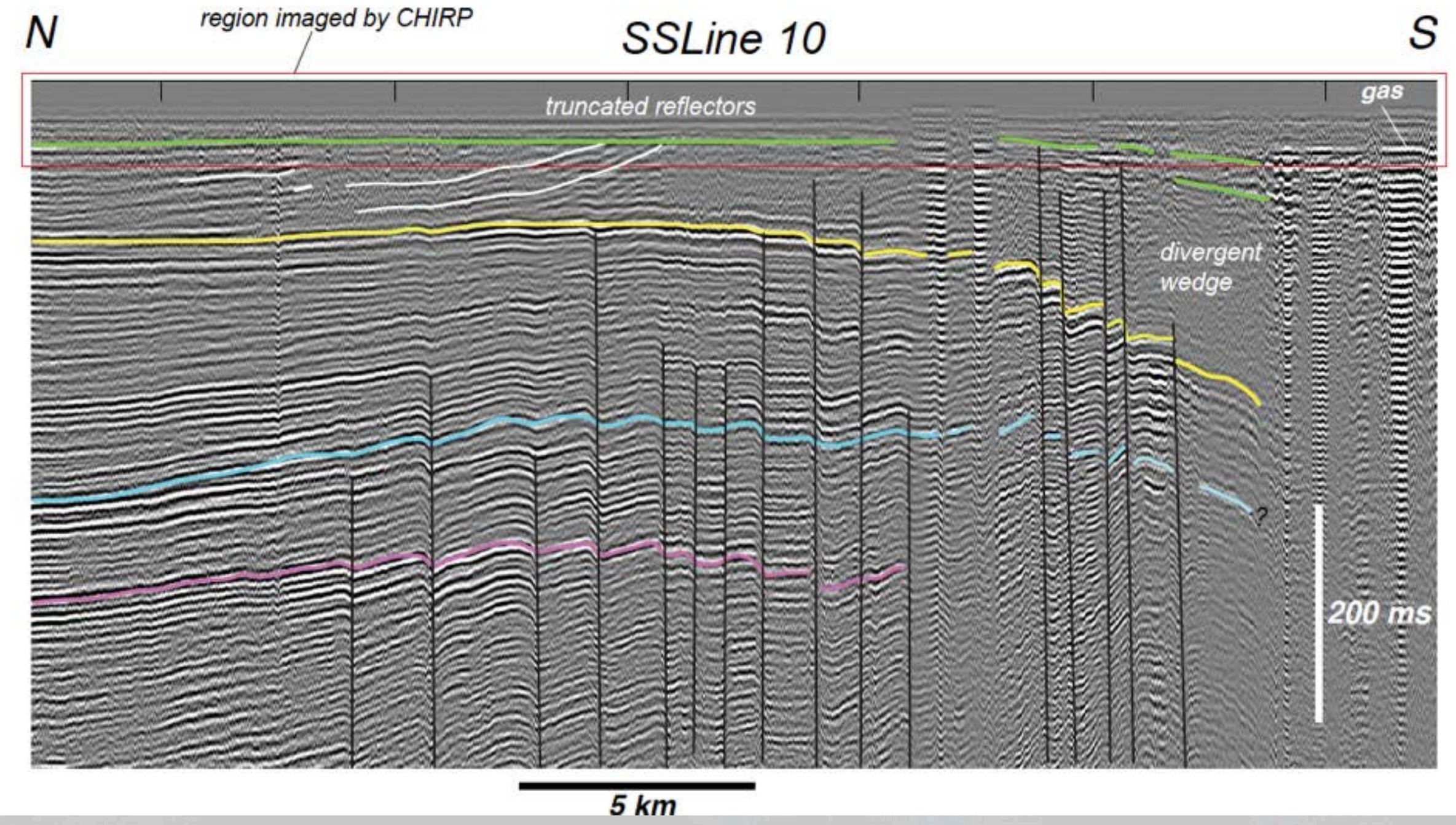


Salton Sea Imaging Project—a cast of thousands (of receivers)...

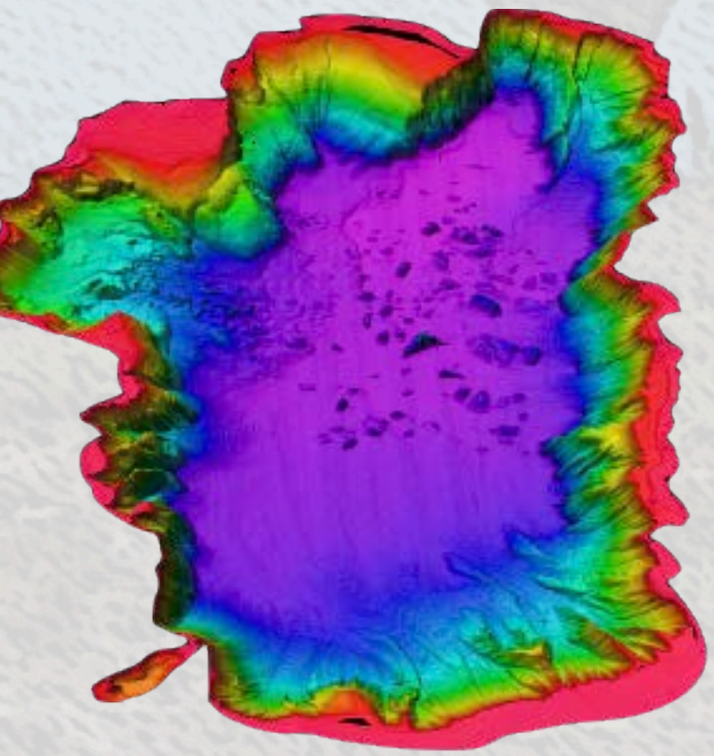
February—2010

SSIP—Main Experiment Feb. 2010

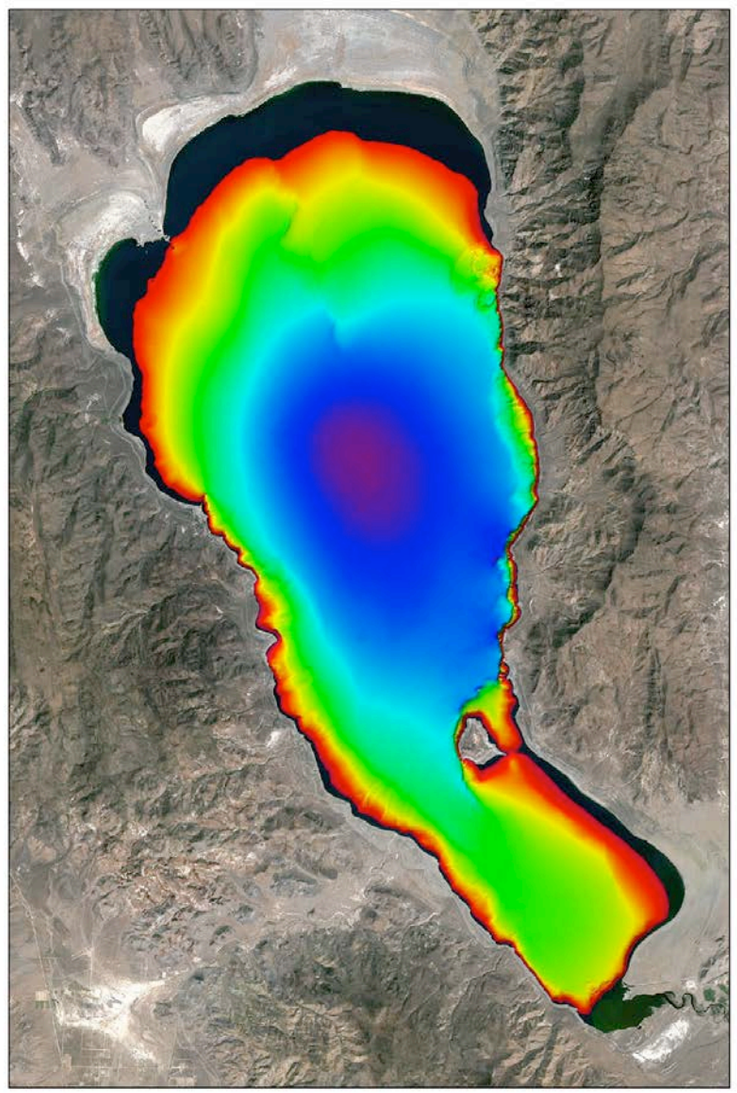


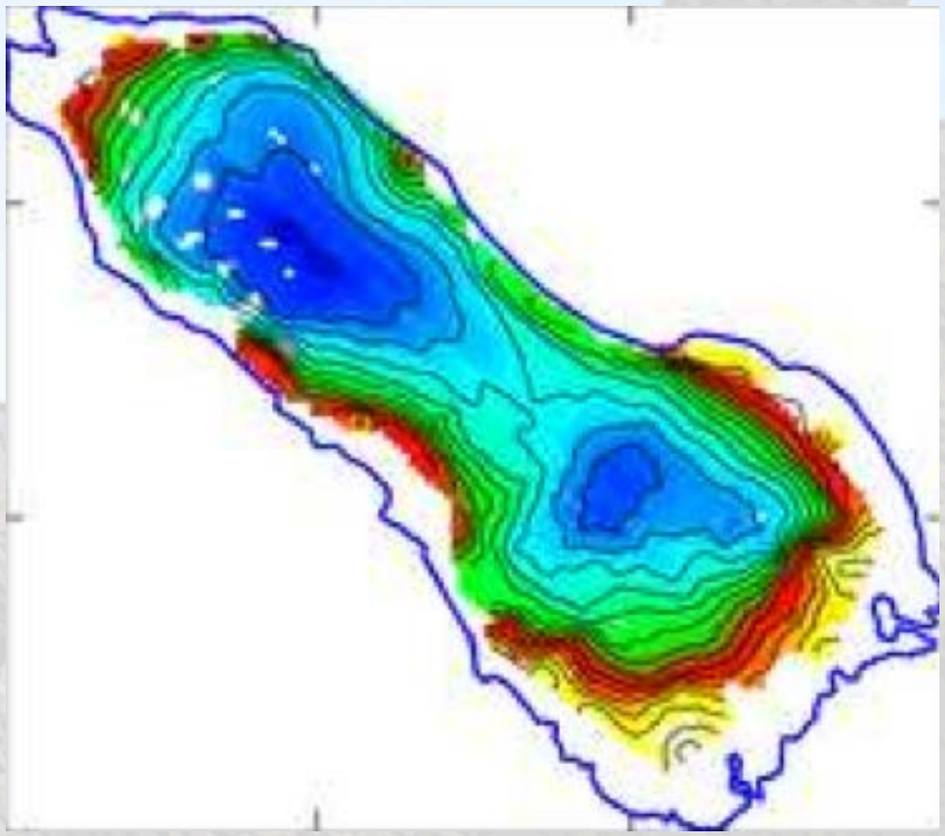
Influence of Sedimentation on Rift Development

Lake Tahoe



Pyramid Lake





Salton Sea

<—Sediment Starved

Thank You...