

Quantifying incoming plate hydration and role of fluids on megathrust properties in and around the Guerrero Gap, offshore Mexico



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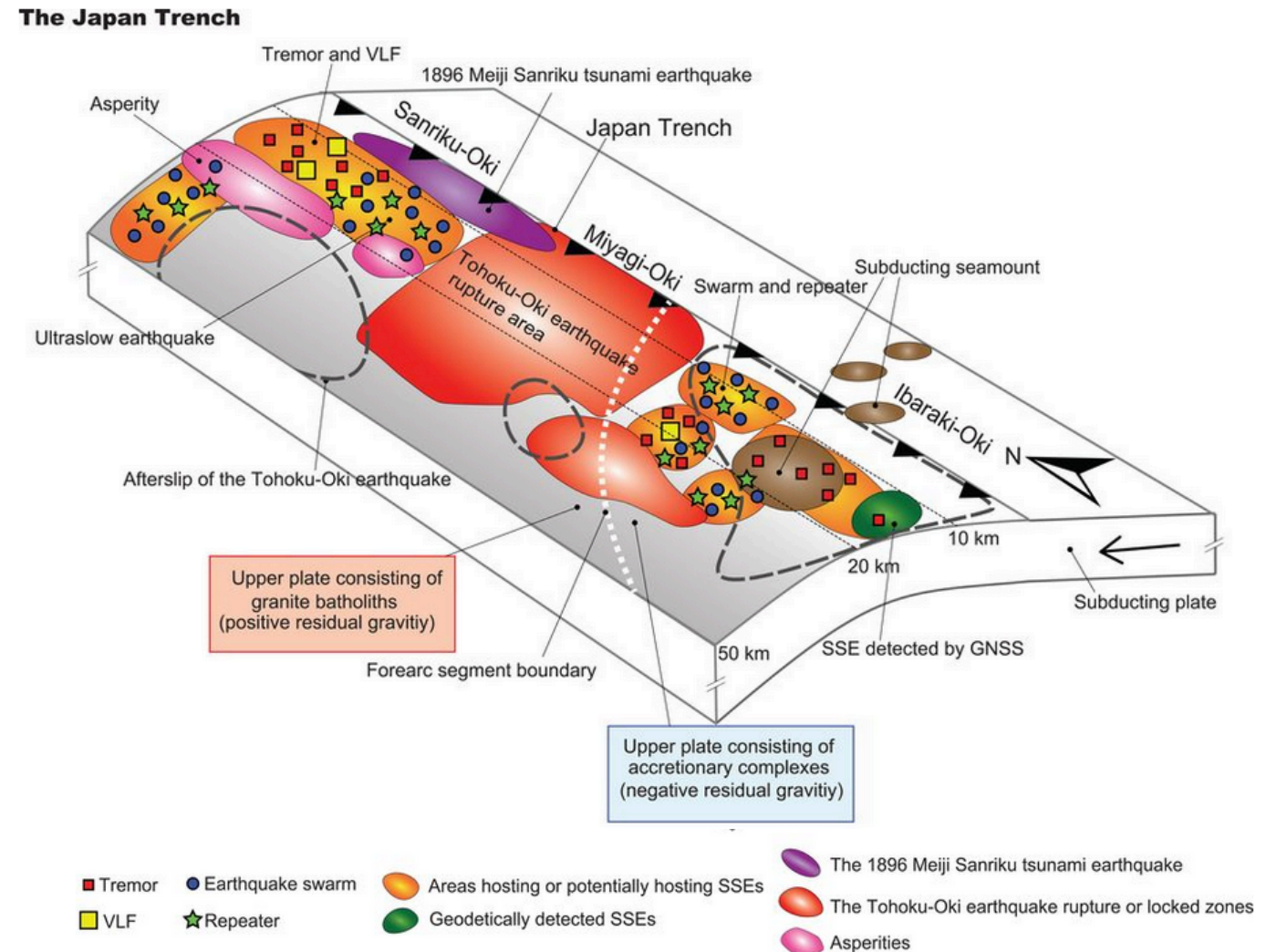
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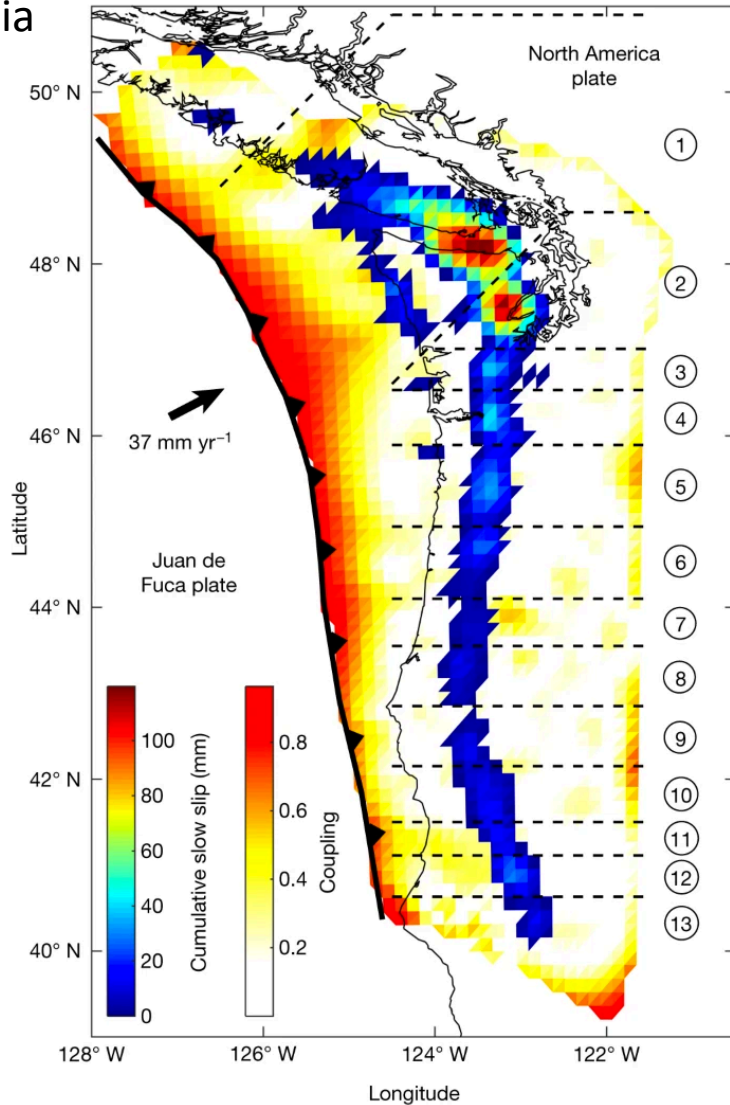
Main Science Question

- What controls the down-dip and along-strike variability in fault-slip behavior in subduction zones?



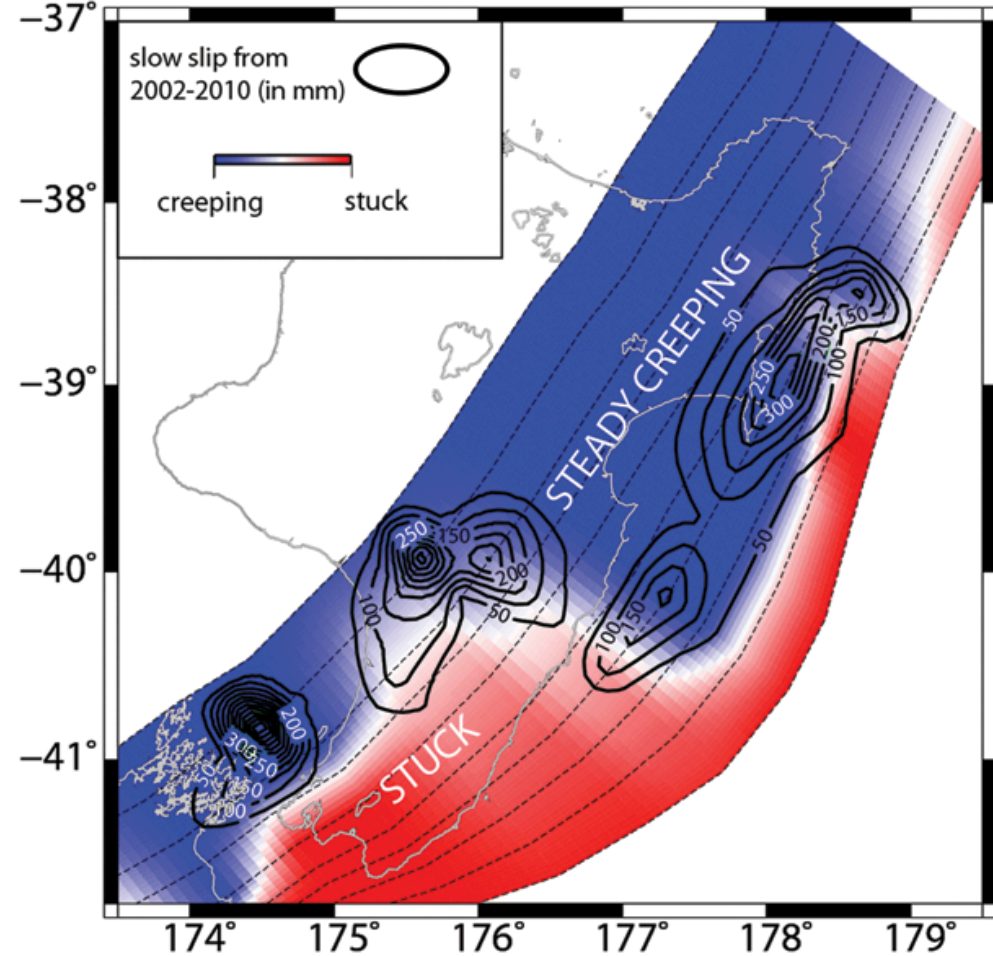
Relationship between SSE and fluids

Cascadia



Michel, Nature, 2019

Hikurangi

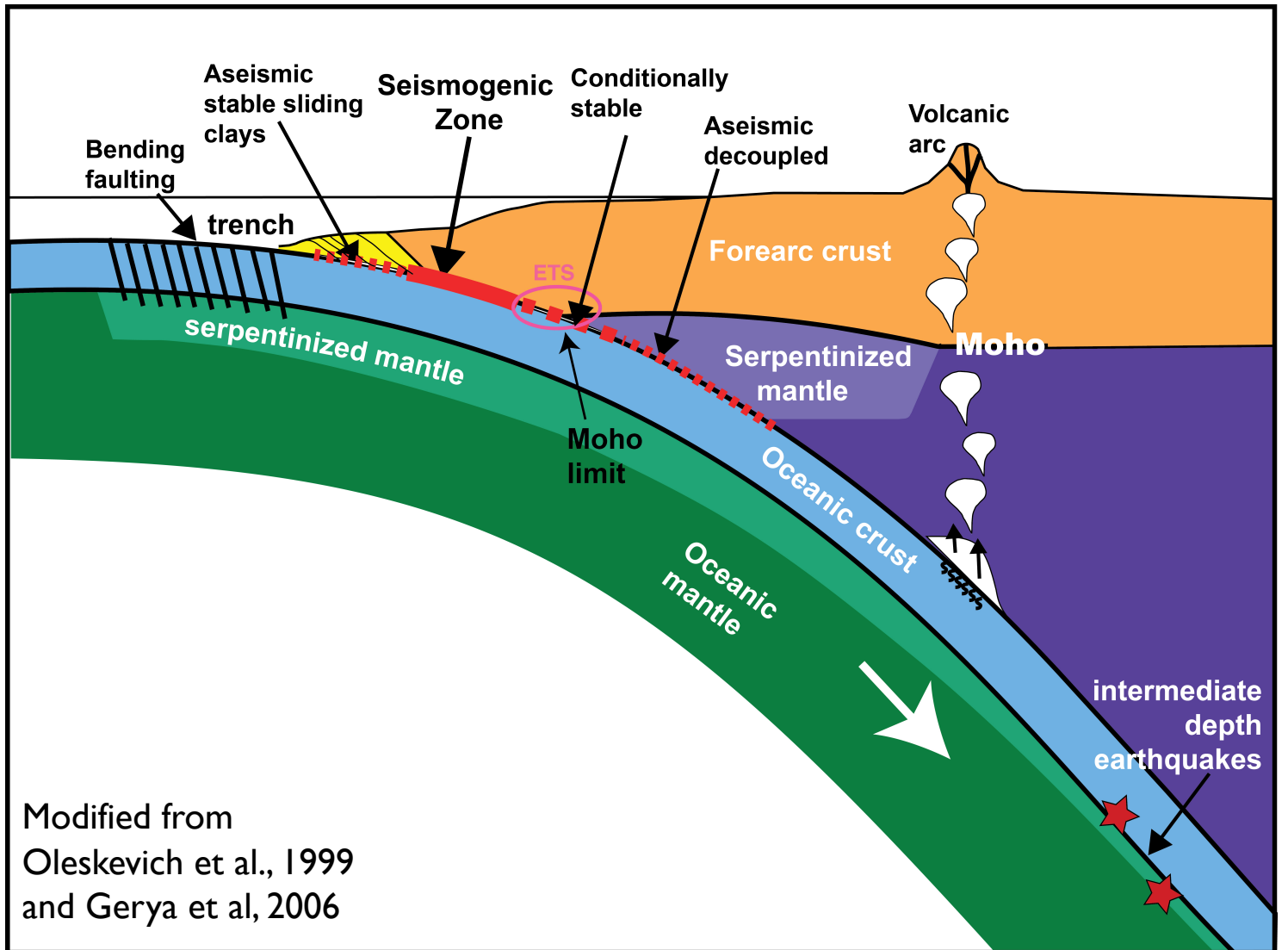


Wallace and Beavan, JGR, 2010

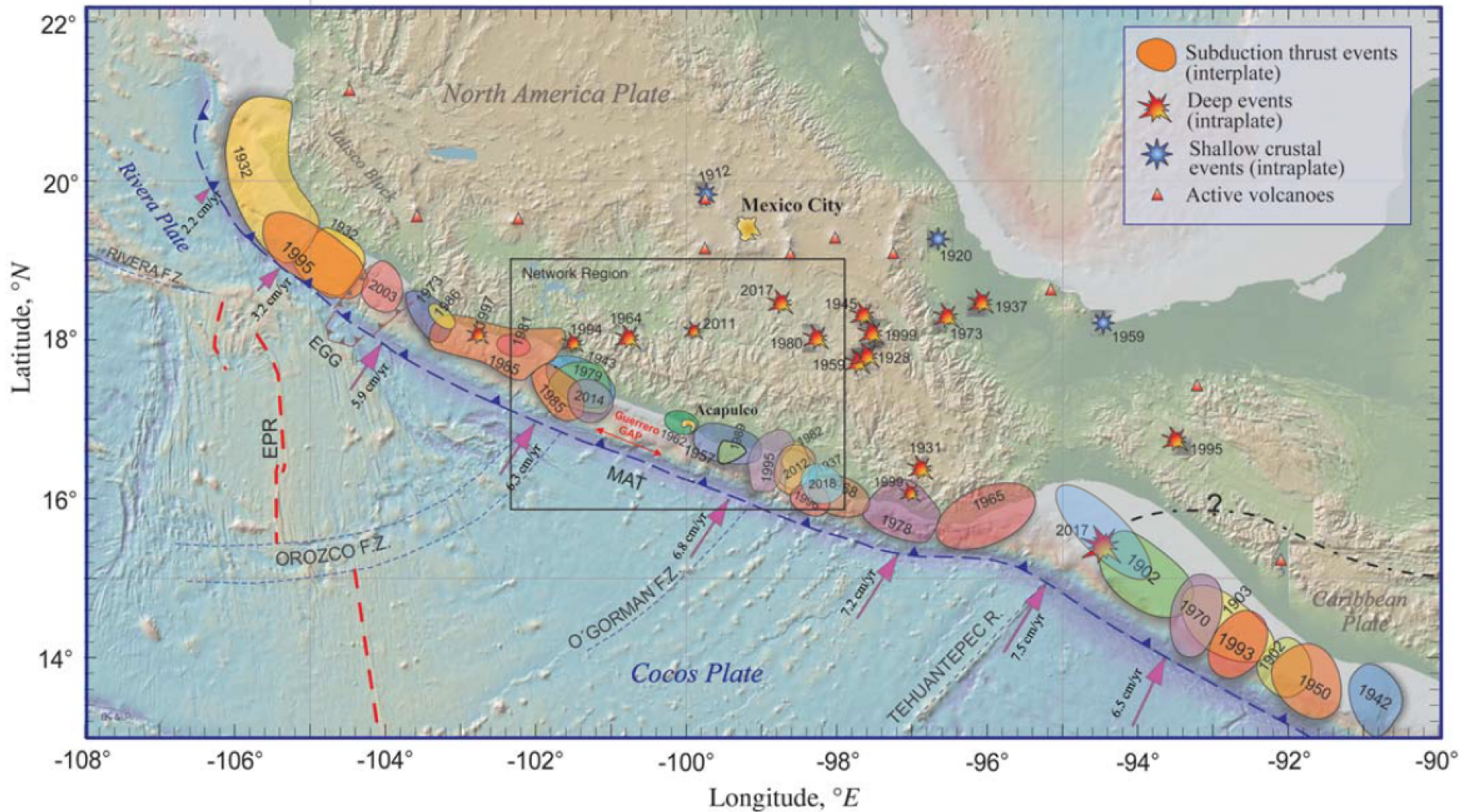
- SSE most commonly attributed to elevated pore-fluid pressures at the plate interface

Role of fluids in subduction zone processes

- Hydration of the forearc mantle wedge
- Generation of island arc magmatism
- Intermediate depth earthquakes



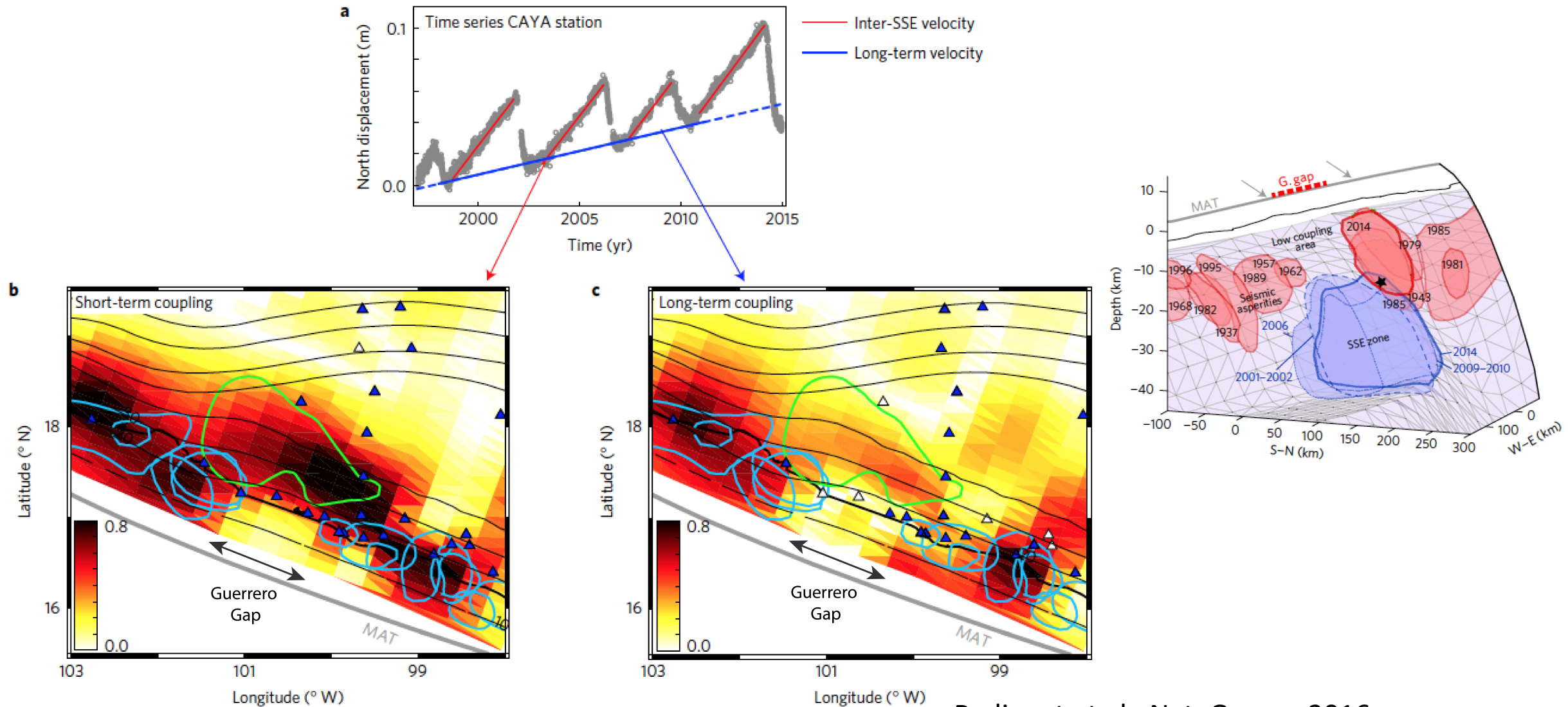
Middle America Trench offshore of Mexico



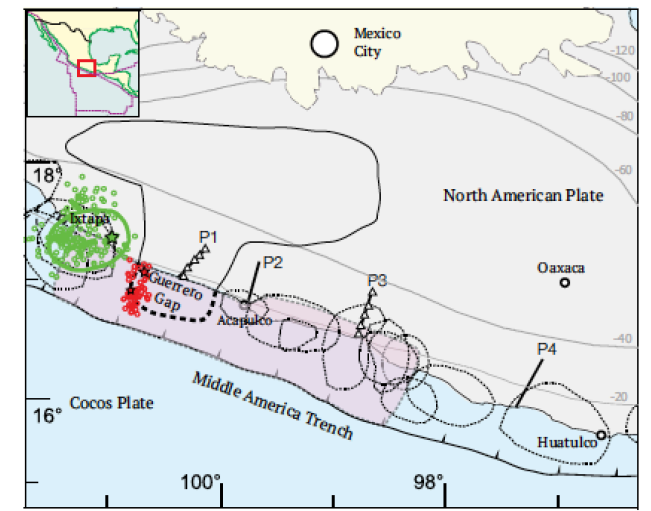
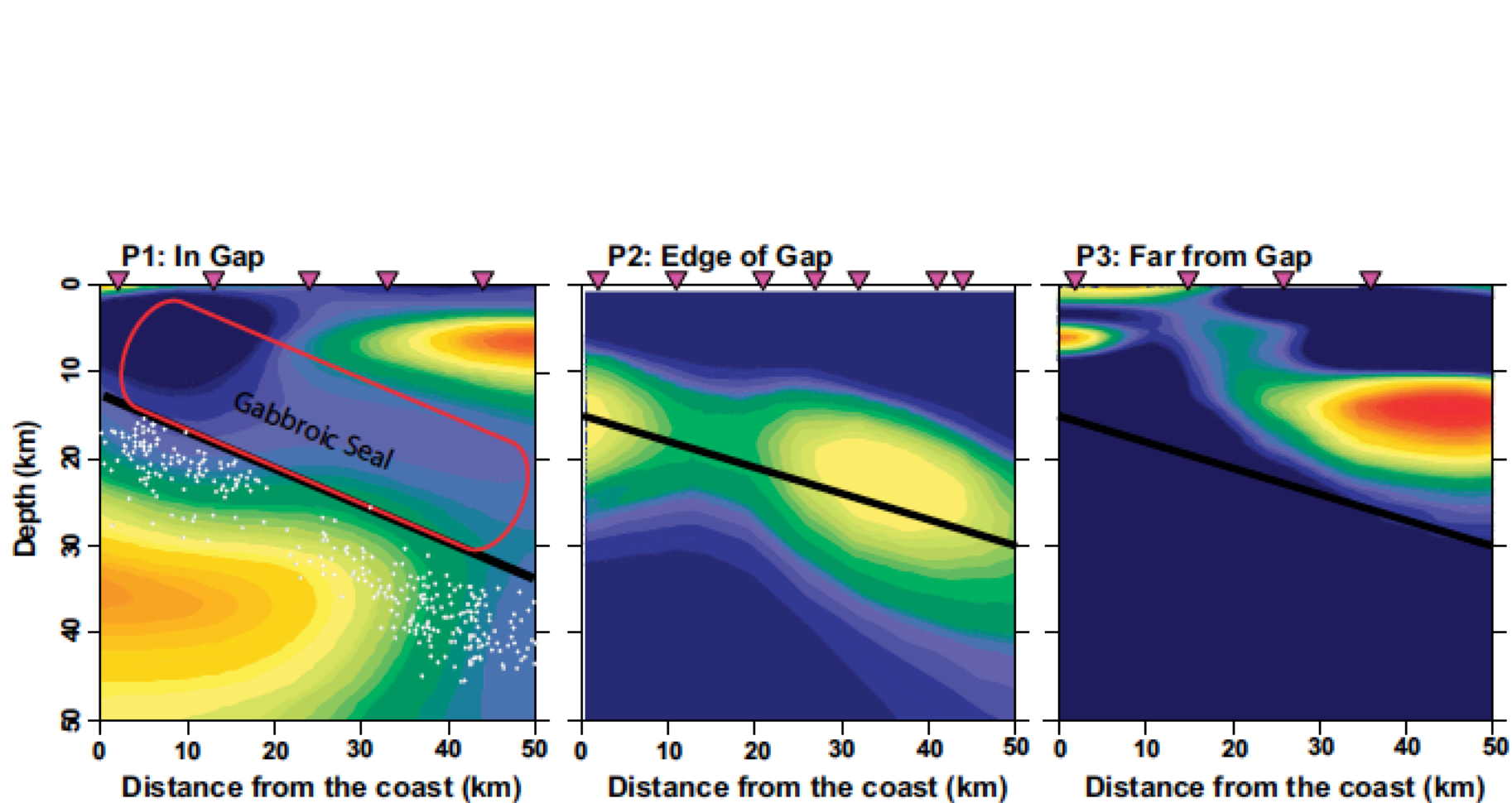
- Guerrero Gap and its neighboring segments
- Subduction of the young 13-14 Myr old Cocos plate at 6.5 cm/yr
- No large subduction zone earthquakes ($M > 7$) have occurred in the Guerrero Gap since at least 1911

Modified from Cruz Atienza et al., 2018

Slow-Slip Events (SSE) within the Guerrero Gap



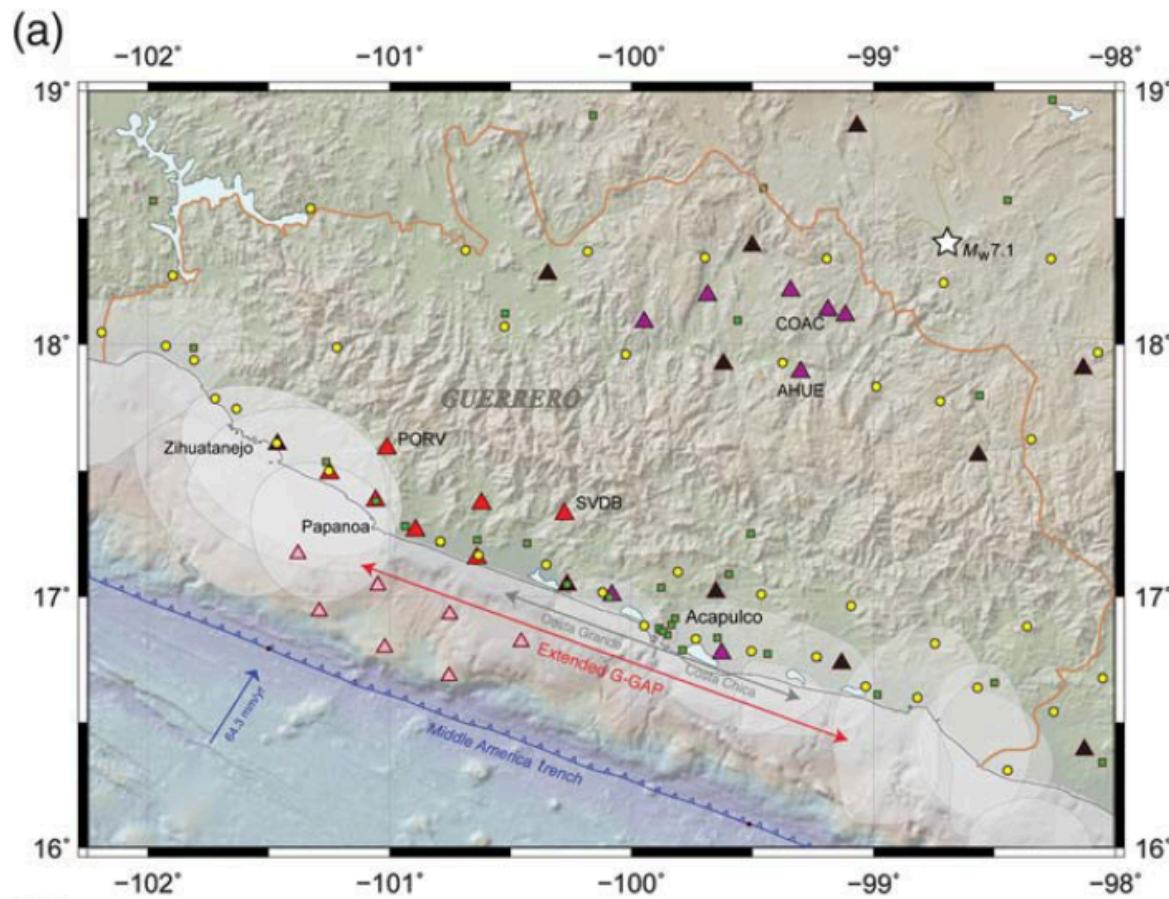
SSE: high pore fluid pressure on the plate boundary ?



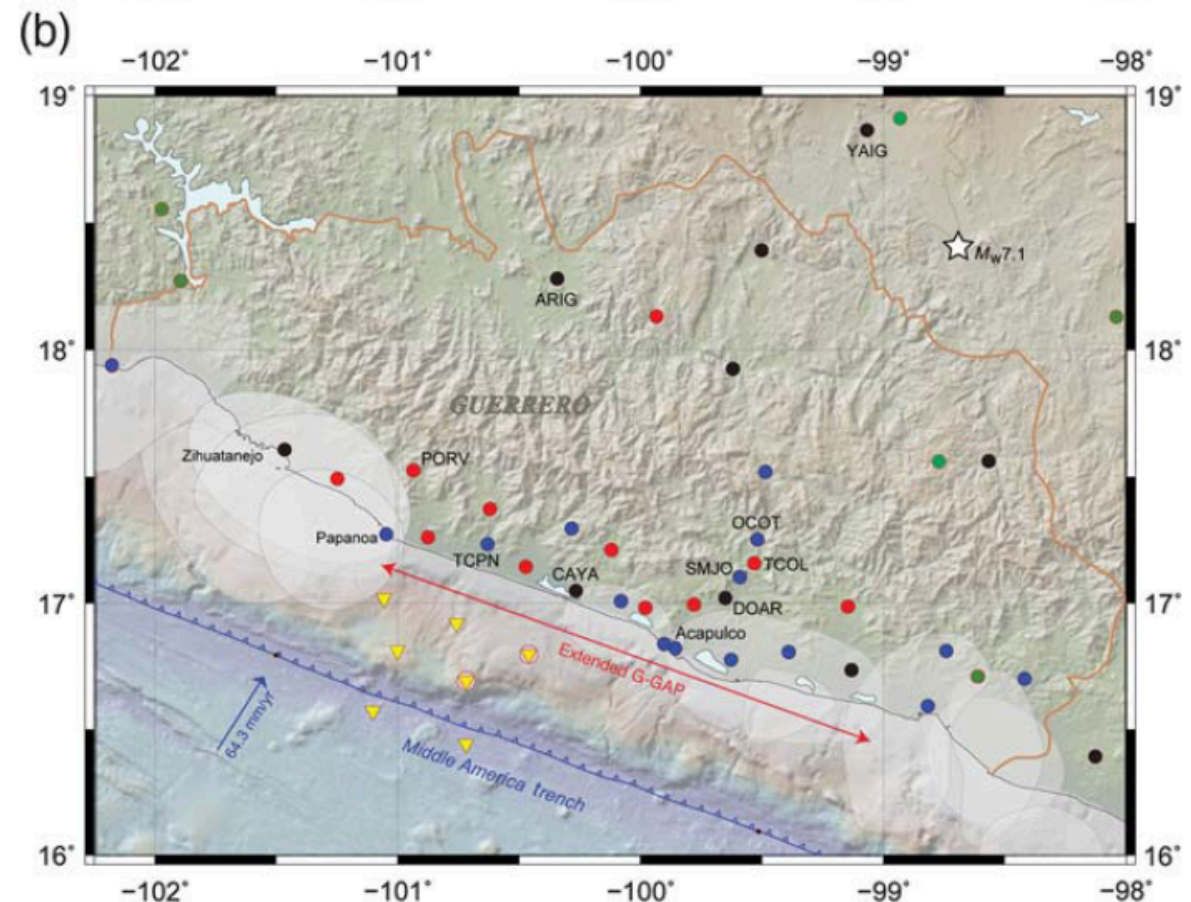
Husker et al., 2018

Ongoing amphibious geodetic and seismic deployment

Effort led by Victor Cruz Atienza and Yoshihiro Ito



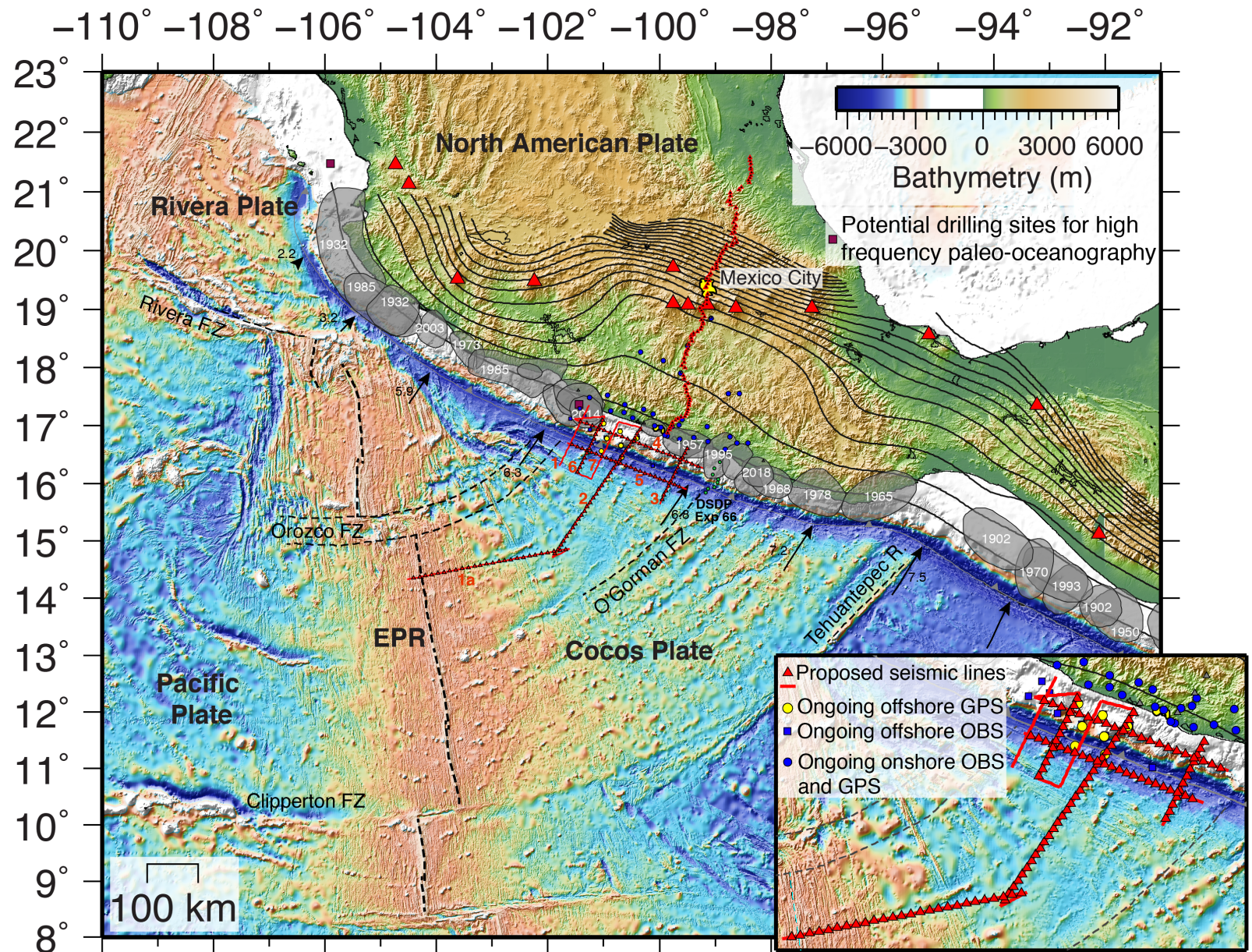
Seismological Network



Geodetic Network

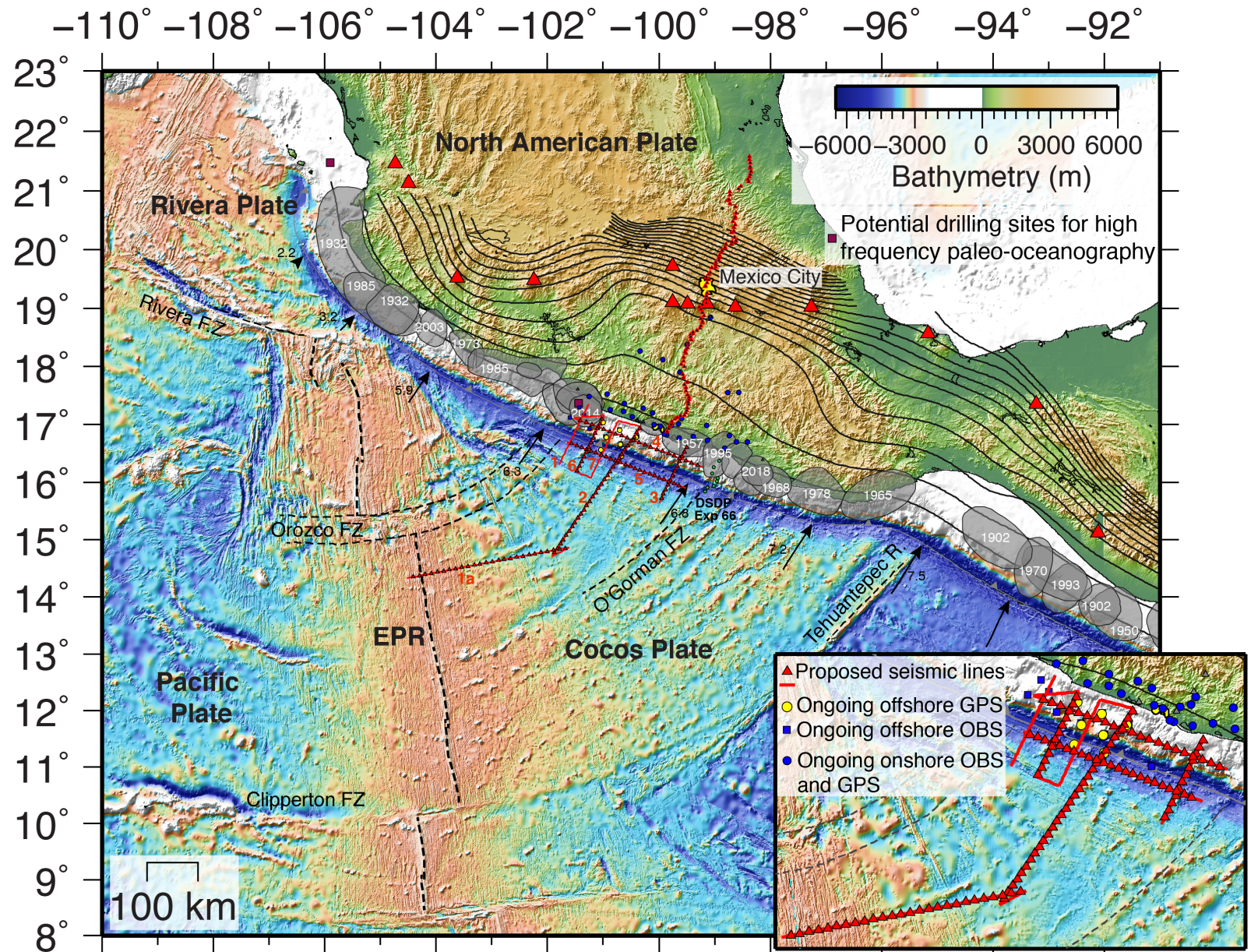
New NSF-funded seismic project

- *What is the hydration state of the incoming Cocos oceanic plate, and how does it vary along-strike and relate to changes in subduction zone slip behavior?*
- *How do geometrical and material properties of the downgoing and overriding plates influence slip behavior along the megathrust fault?*



Langseth active source seismic survey

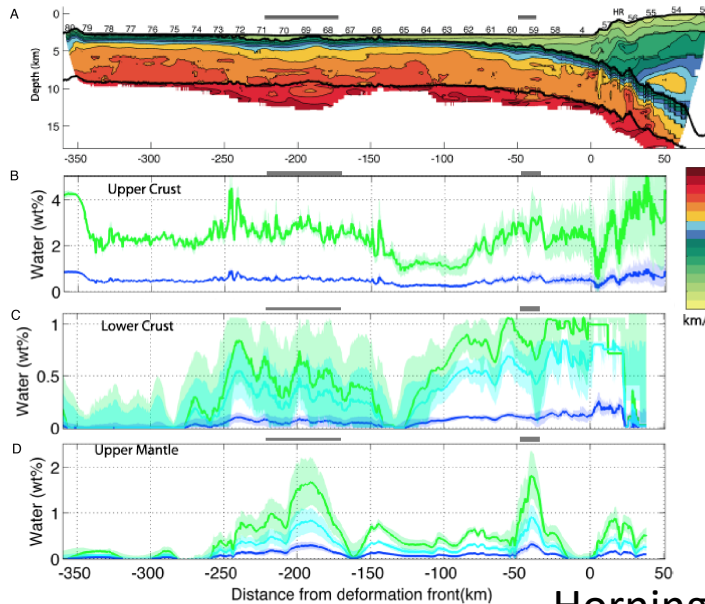
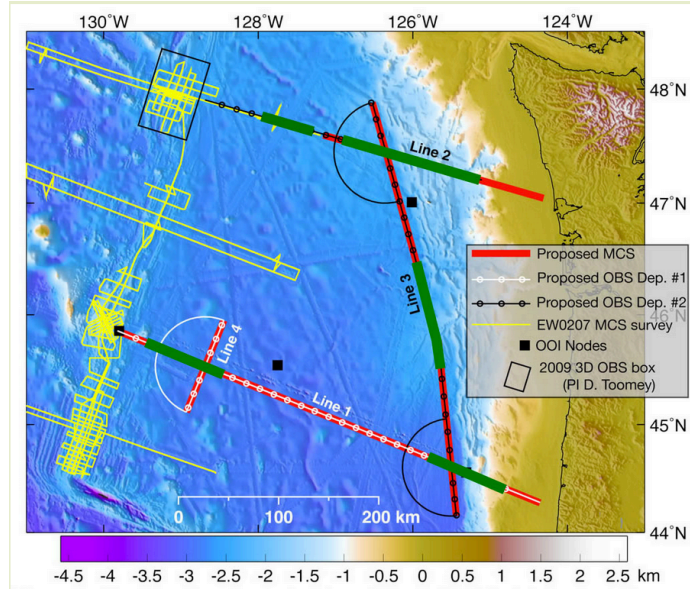
- combined 2D wide-angle seismic reflection/refraction and ultra-long offset multi-channel seismic (MCS) survey
- 48 day seismic program
- six primary MCS/OBS transects
- 15 km-long streamer and 6600 cu.in airgun array of the R/V Langseth



Comparison to Cascadia subduction zone

Ridge 2 Trench Experiment

Young, well-sedimented Juan de Fuca Plate

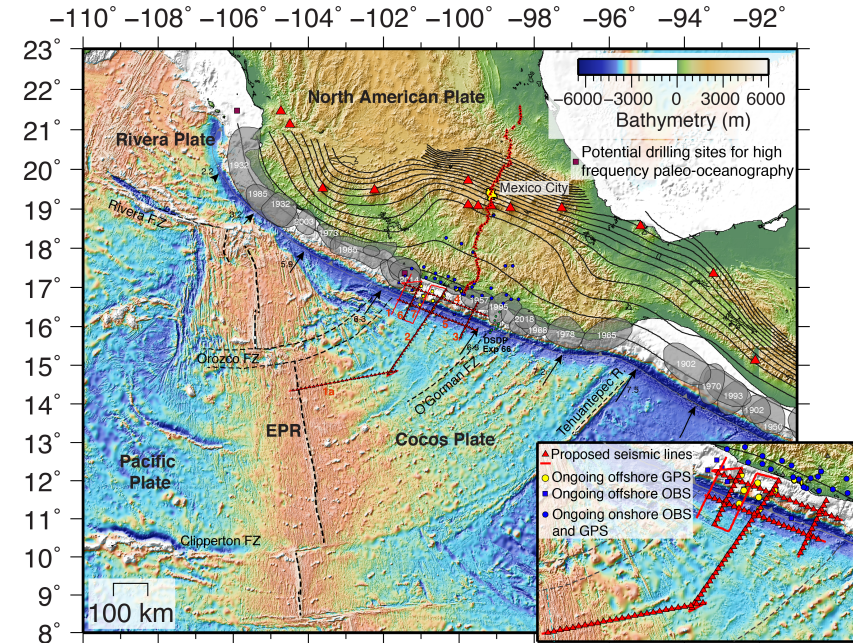


Limited hydration

Horning et al., 2016

Guerrero Gap Experiment

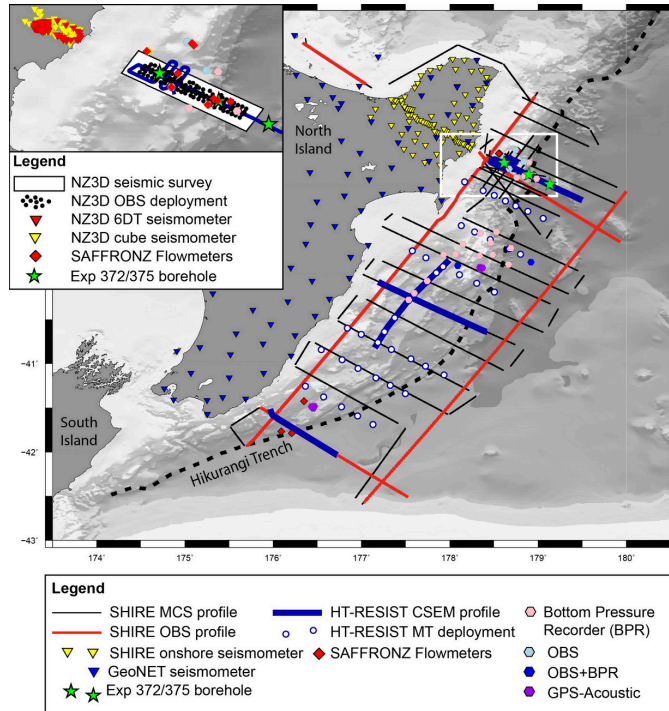
Young, sediment-starved Cocos Plate



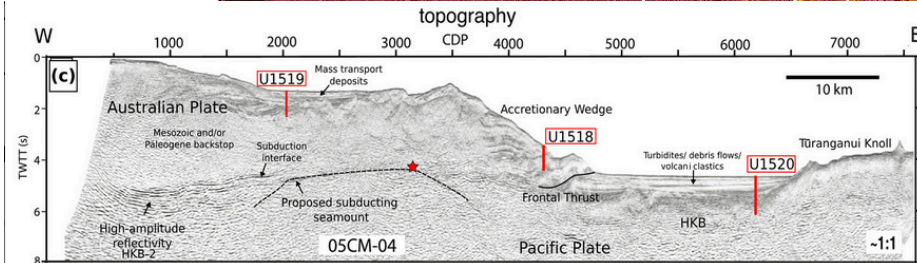
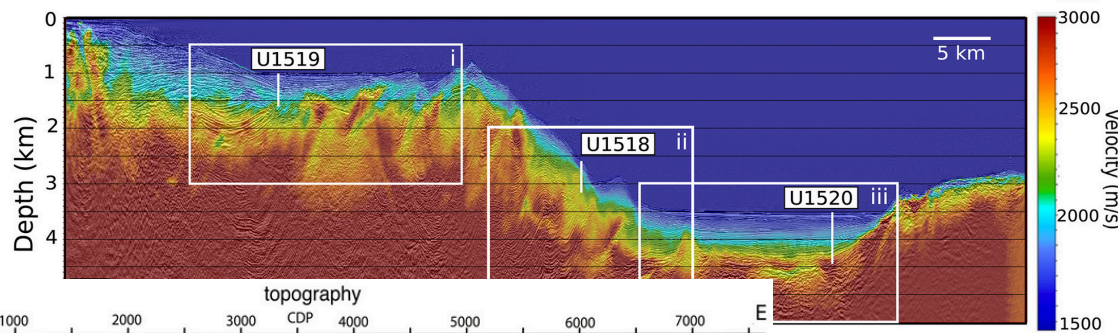
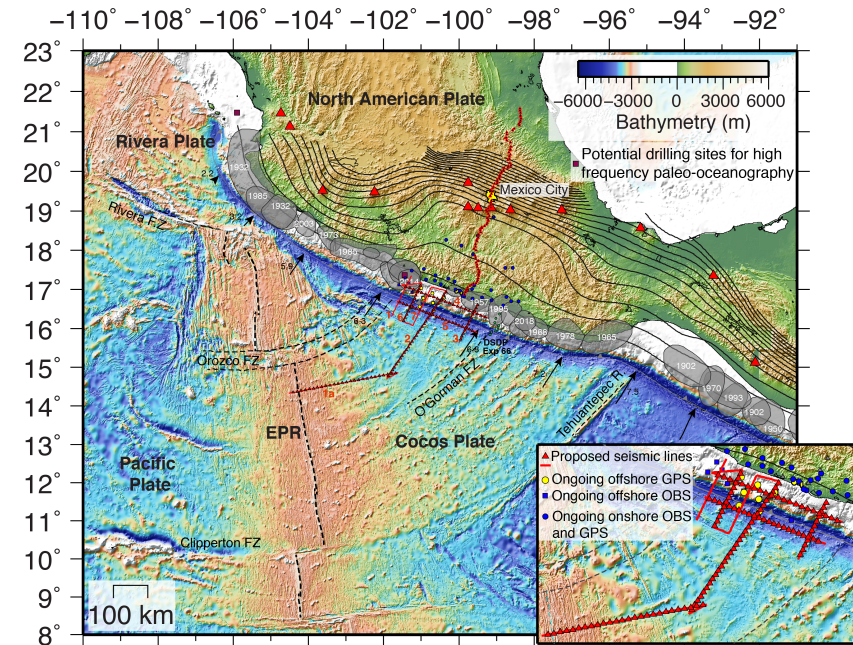
- Direct comparisons between these two subduction zones will provide key constraints on the influence of sediment thickness on the hydration state of young incoming plates

Comparison to Northern Hikurangi Margin

Hikurangi margin Experiment



Guerrero Gap Experiment



Gray et al., 2019

- test whether there is a ubiquitous parameter that lead to shallow slow slip events or a combination of parameters

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Thank you !

