Seismic Anisotropy in the Mantle Wedge in the Tehuantepec Isthmus, Mexico

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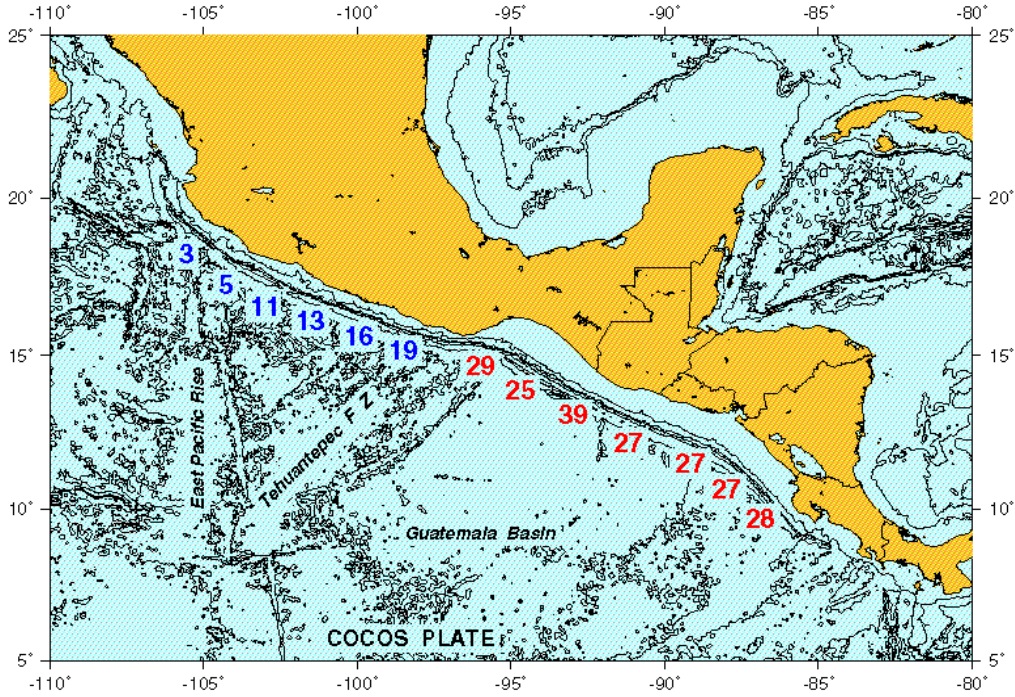
Tectonic Setting

- Cocos plate changes its subduction regime.
- Change of the dip of the subduction angle.
- Change in oceanic plate age.
- Low topography region.
- Subducting Tehuantepec ridge.



Gorbatov & Kostoglodov, 1997

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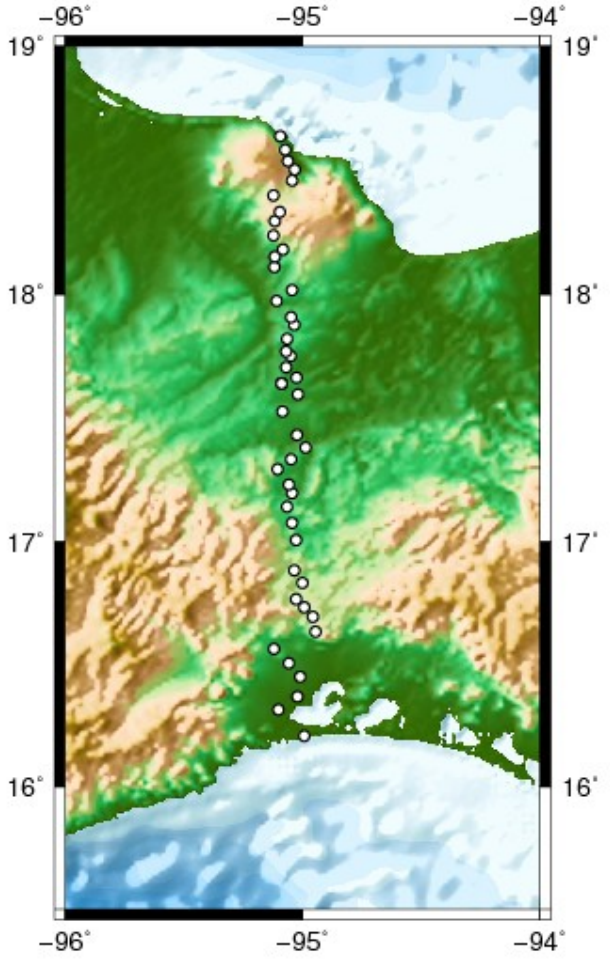

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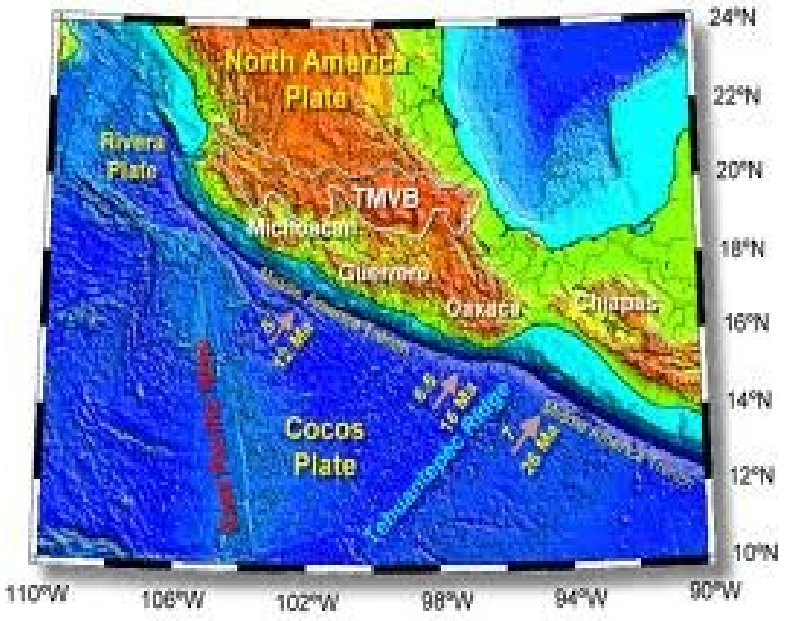
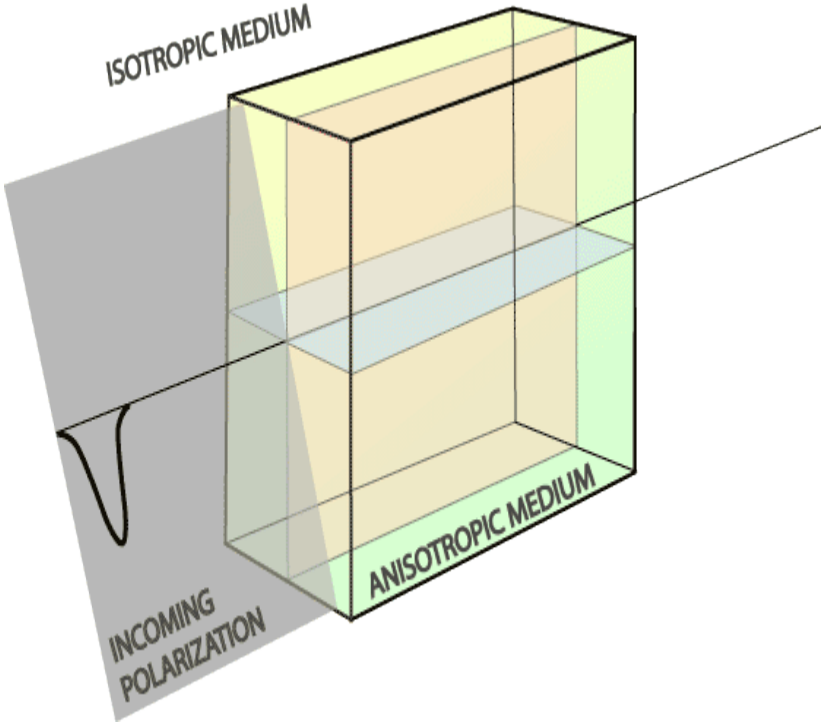


Shear Wave Splitting

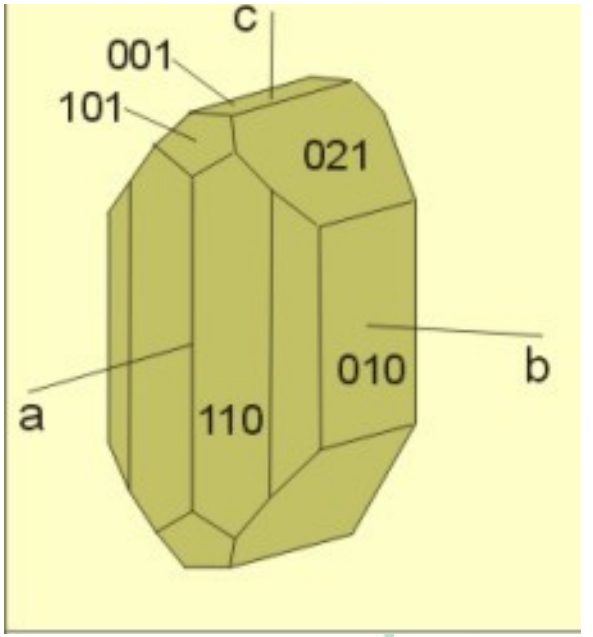
- Shear wave through an anisotropic layer splits in two orthogonal phases
- Shear wave splitting parameters: fast polarization orientation and delay time

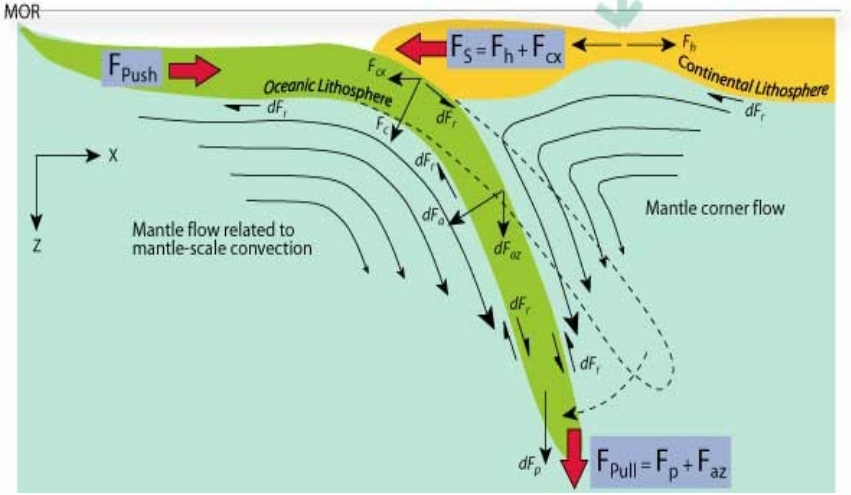


Animation by Ed Garnero
Arizone State University

SWS Mechanisms

- In the upper mantle SWS is mainly attributed to alignment of olivine crystals
- Fast polarization aligns with the olivine a-axis for wet conditions, with b-axis for wet conditions
- Asthenospheric flux as the main source of anisotropy in the upper mantle

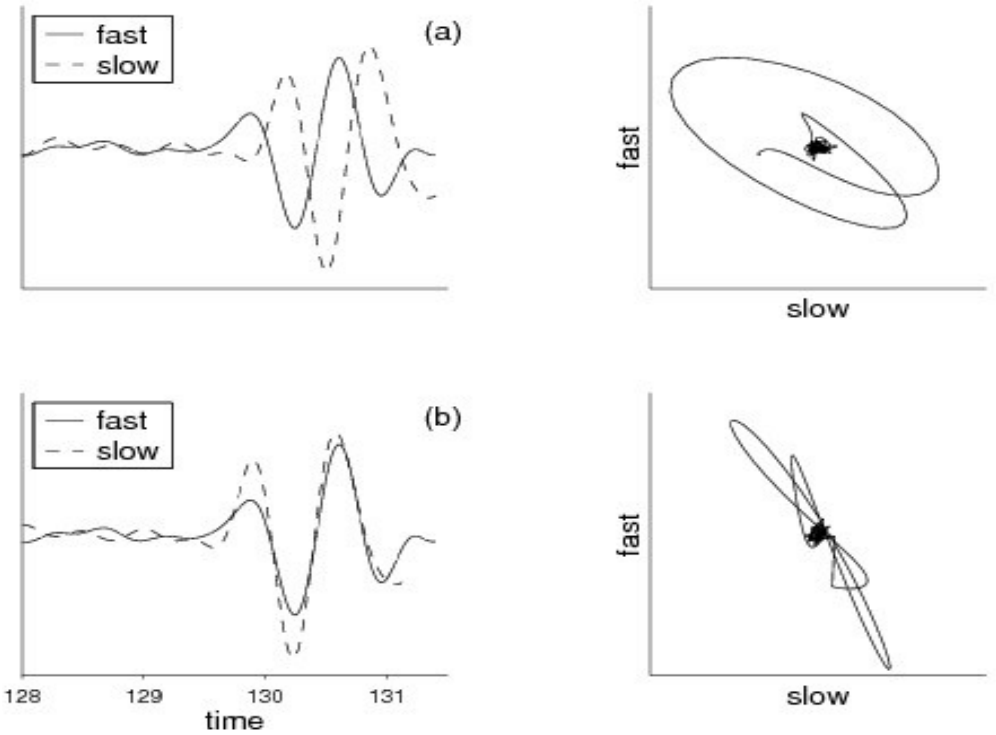




Silver & Chan Method

- Transverse anisotropy
- Horizontal axis of symmetry
- One layer of anisotropy
- Minimization of the smaller eigenvalue of the covariance matrix

$$c_{ij}(a,\delta t) = \int_{-\infty}^{\infty} u_i^a(t)\, u_j^a(t-\delta t) dt i,j = 1,2,$$



Data Set

- VEOX experiment
- (April 2007 – March 2009)

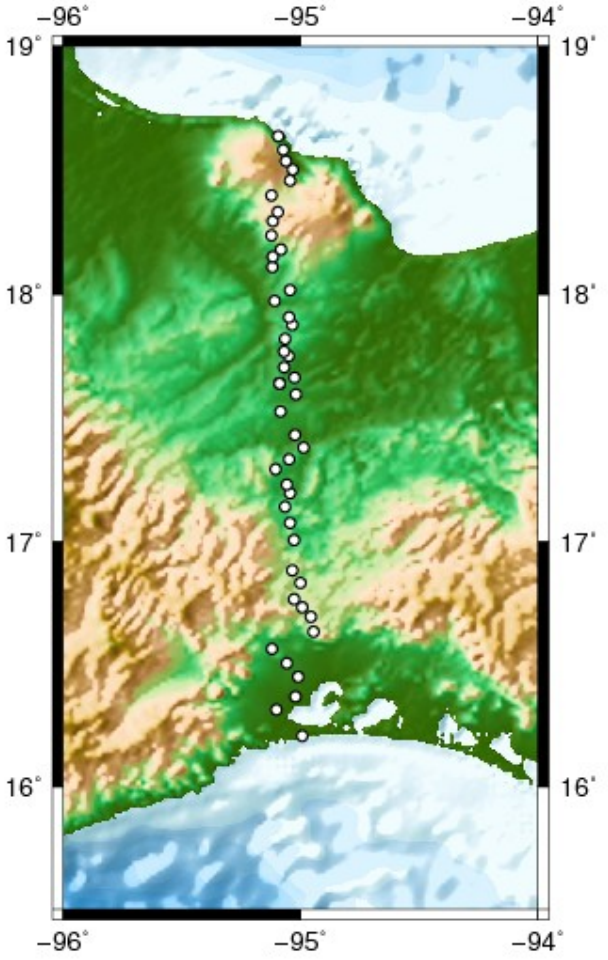
- Dense linear array

- 46 broadband stations

- N-S trending through the Isthmus

- Data catalog from the Mexican Seismological Service

- Events deeper than 60 km



Results

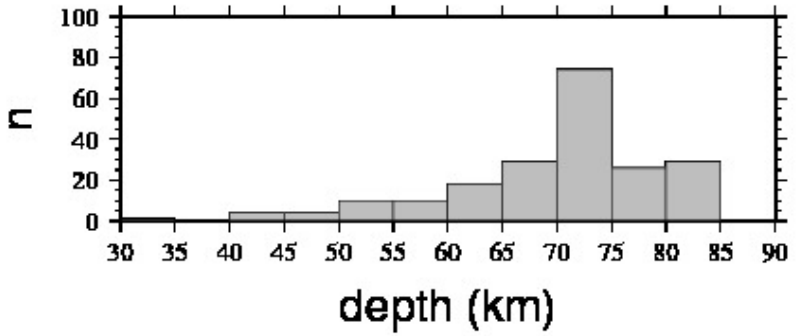
- 239 source – receiver pairs

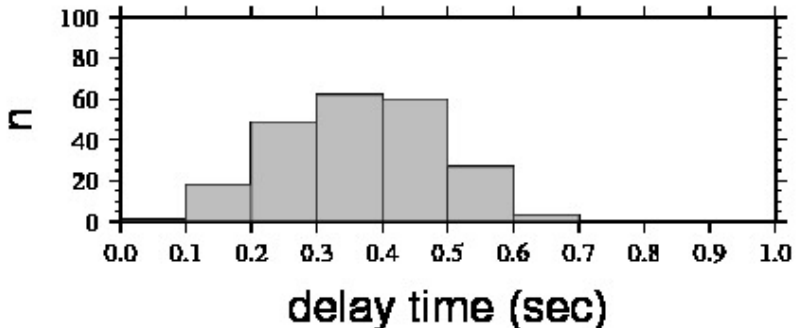
- 70 events

- Midpoint splitting

- 70 – 75 best mapped region

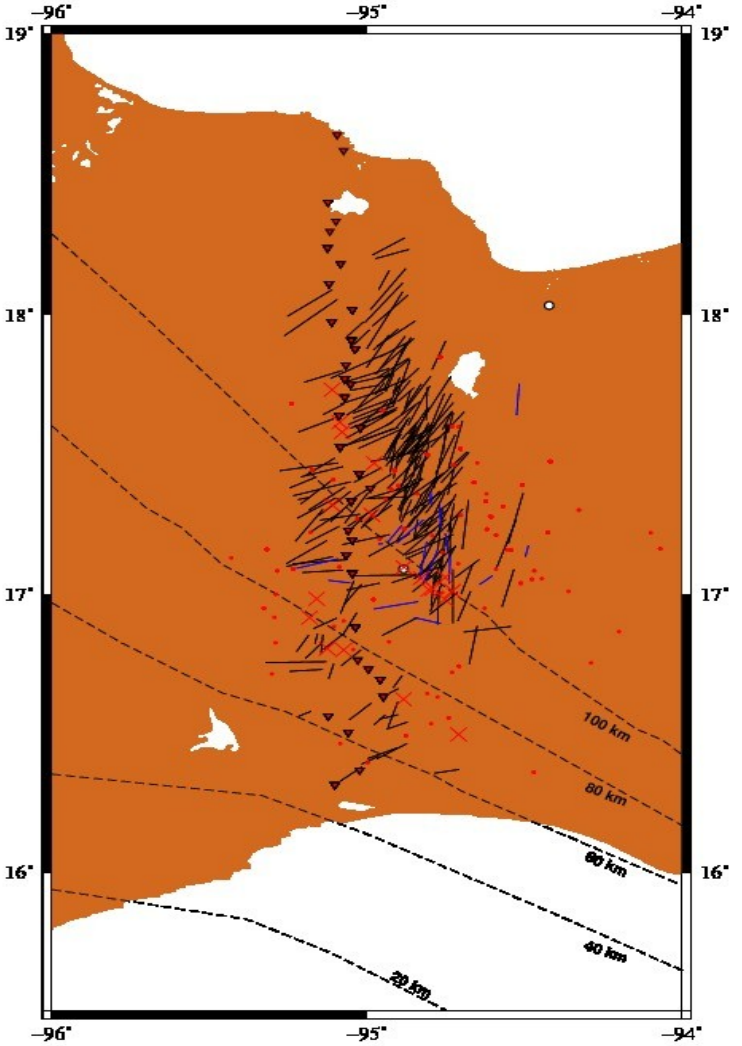
- Delay times between 0.2 – 0.5 seconds



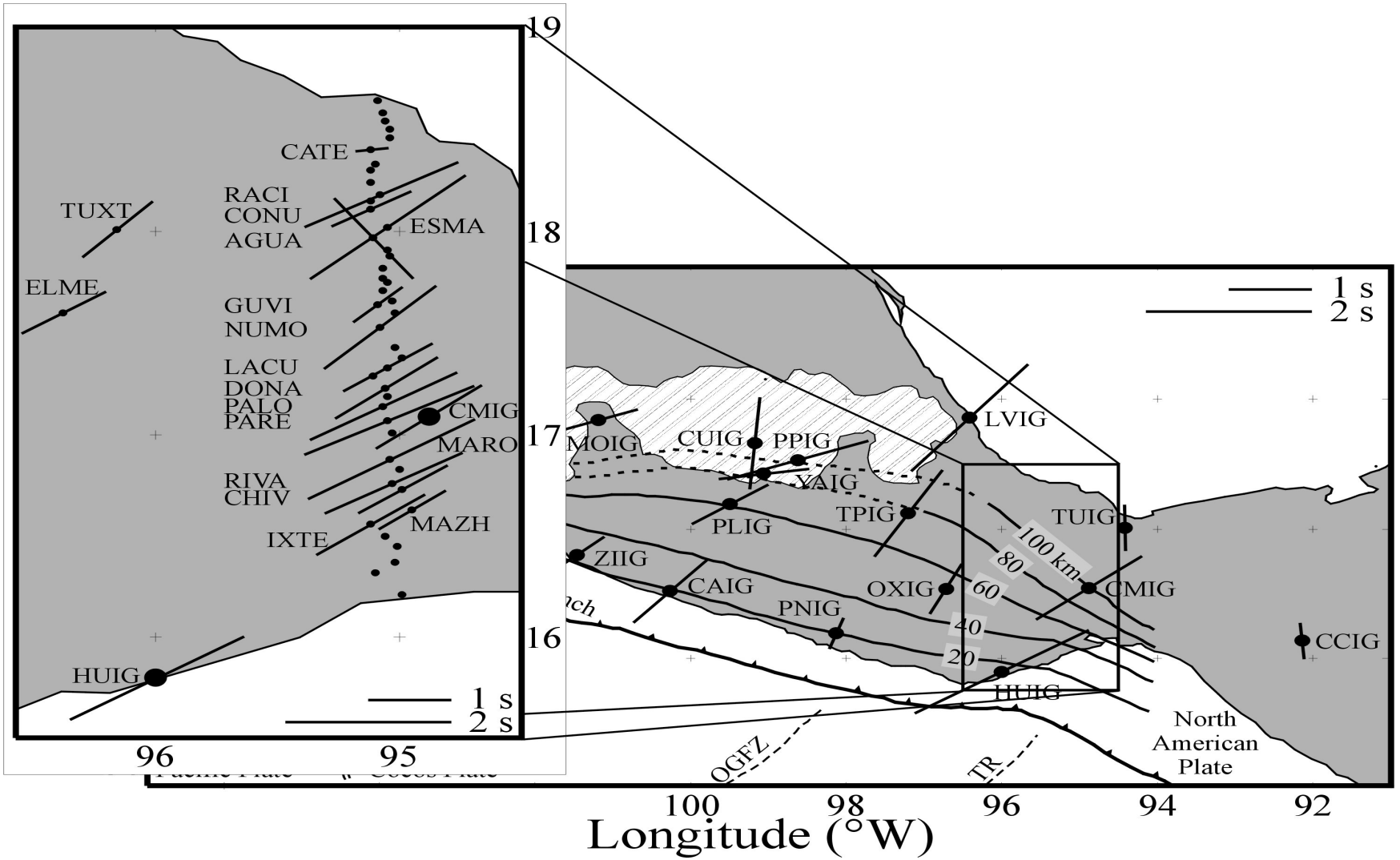


Results

- Normal to the trench pattern of fast directions for splittings deeper than 80 km
- Delay times up to 0.6 sec
- Assuming a-type petrofabrics
- Apparent corner flow in the mantle wedge



SKS – SWS Results



Conclusions & Questions

- Apparent corner flow in the mantle wedge above the subducting slab.
- Consistency of fast polarization directions with the SKS shear-wave-splitting parameters.
- Implication of Tehuantepec ridge?
- Where the normal to parallel to the trench flip occur in CA?