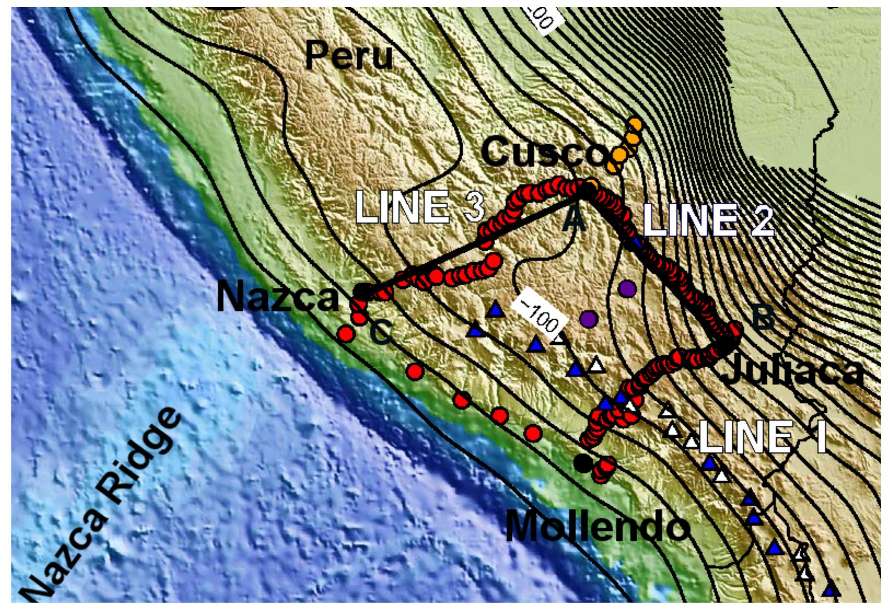

PeruSE: Subduction in Southern Peru

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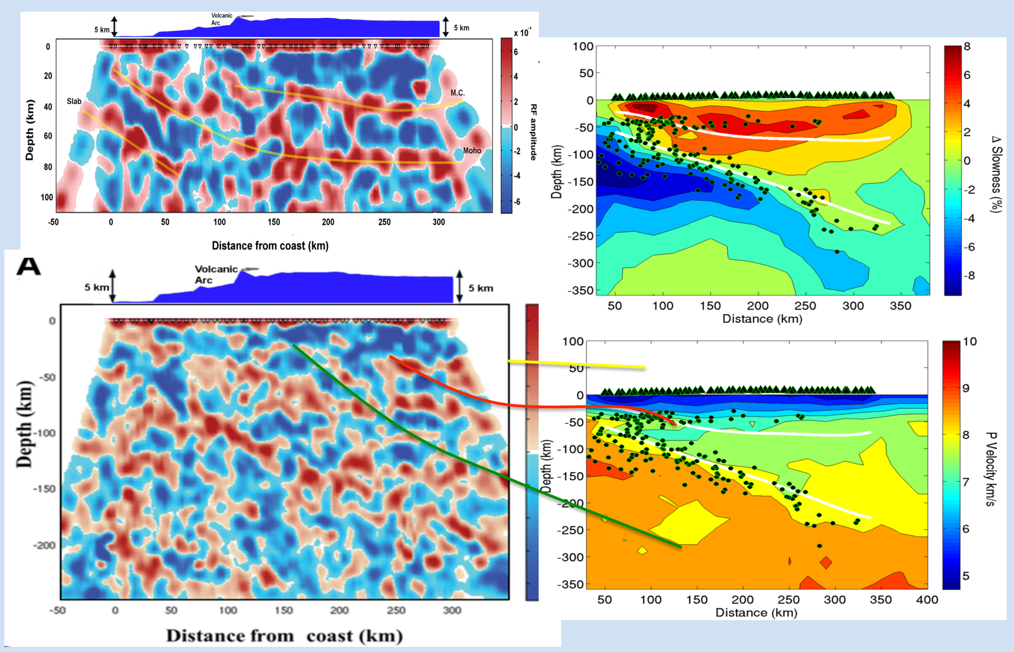
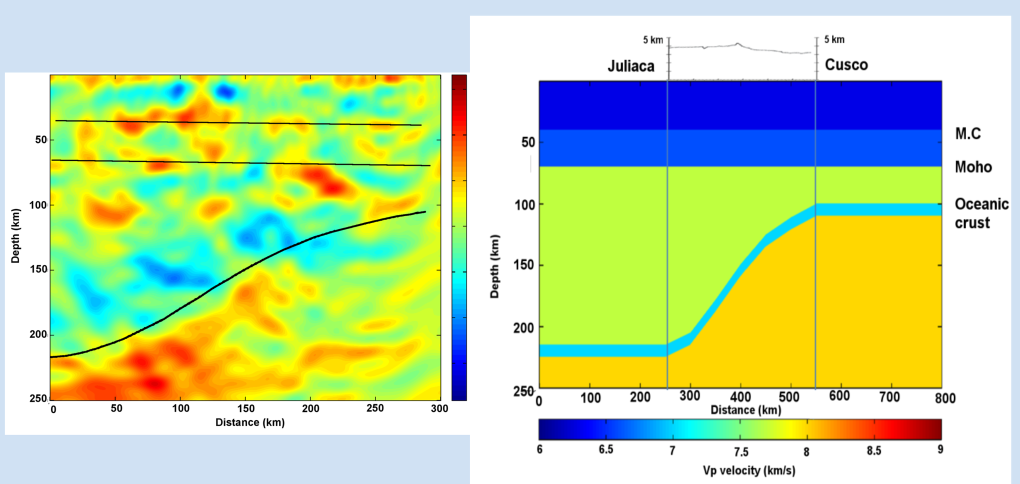
Web Site: http://www.gps.caltech.edu/~clay/PeruWeb/PeruSE.html

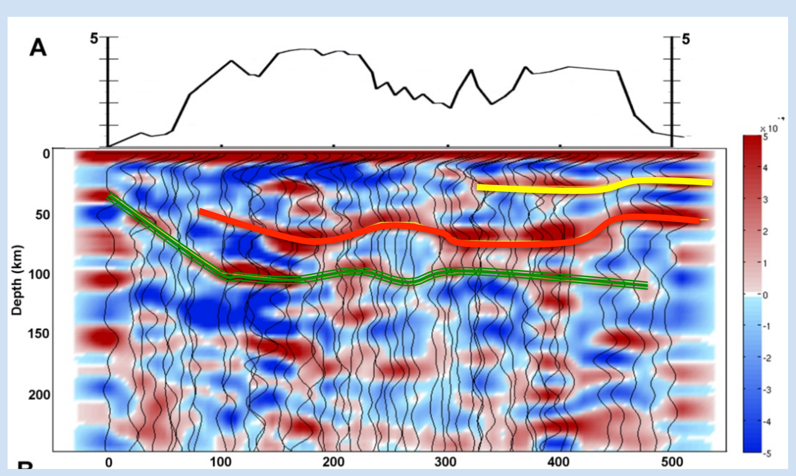
Slab Structure



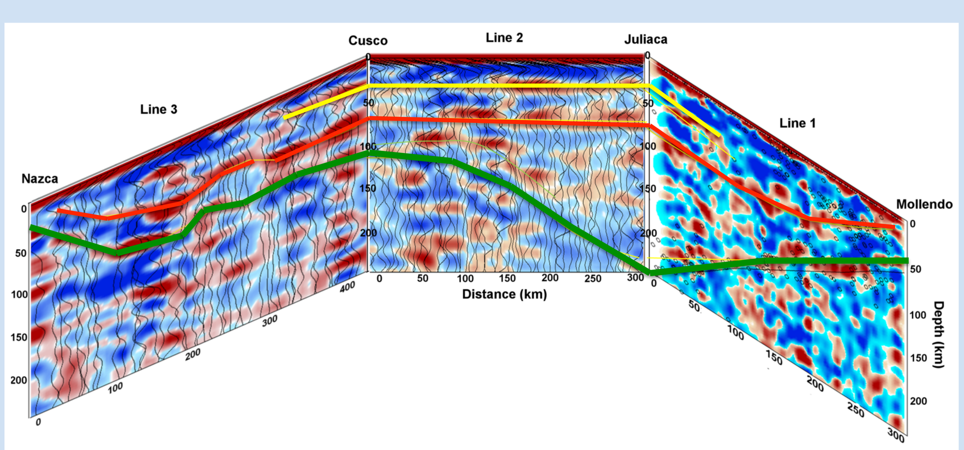
Line 1: On the left are receiver functions with the top image constructed from teleseismic P and PP waves, and the bottom image image from PKP phases. The slab and Moho are clearly evident. A positive-impedance feature in the mid-crust can also be seen, which we interpret and the underplated Brazilian Shield. On the right are tomographic images. The upper image is relative velocity, while the bottom is absolute velocity.



Line 2. The line is the transition between flat and normal subduction. The left is a receiver function and the right is a model that is used to do waveform modeling of the receiver functions. The results indicate that the slab is highly stretched (10% strain) but not torn.

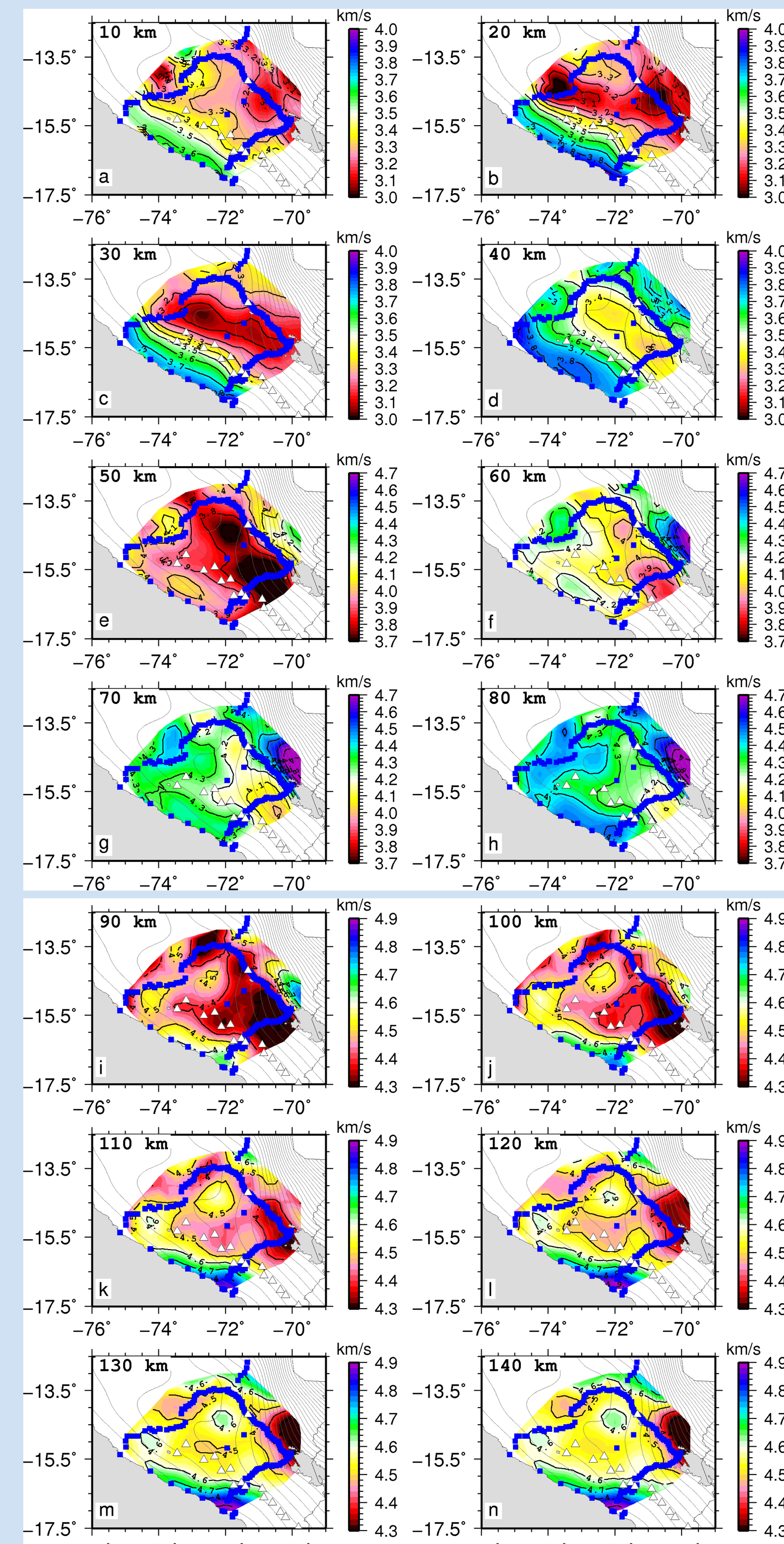


Line 3. This is region of flat subduction. Here the slab is horizontal for about 300-400 km, with a gap of 25-50 km between the slab and the overriding continent. Also evident is the mid-crust interface (yellow).

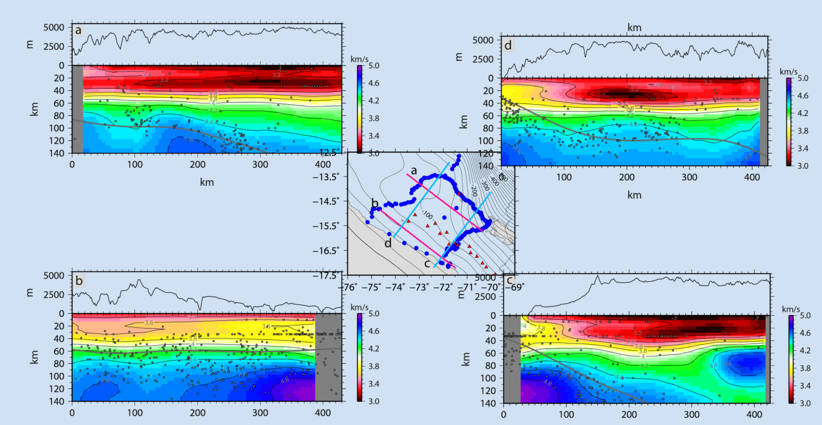


Composite of all lines. Shown are the receiver function images in a pseudo perspective view looking from the west. The slab, Moho and mid-crust interfaces are continuous across all panels.

Surface Waves

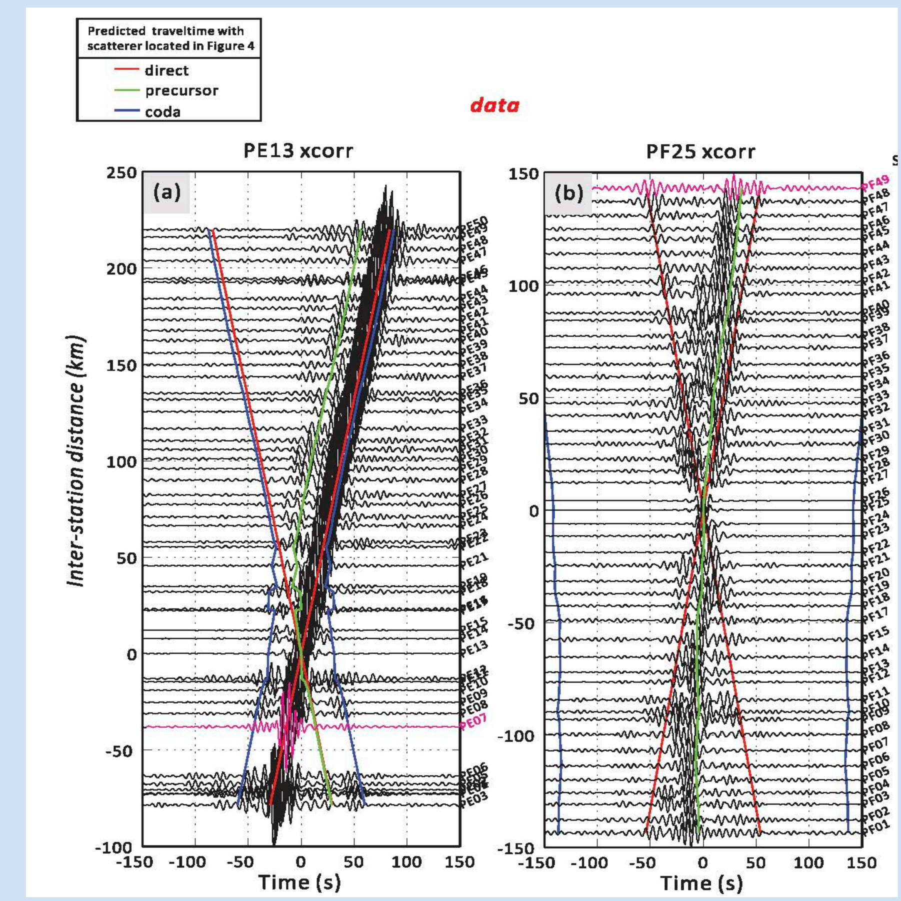


Shear wave velocities are constructed from Rayleigh wave dispersion curves and are shown in depth slices above. In general the images indicate normal subduction along line 1 and flat subduction along line 3.

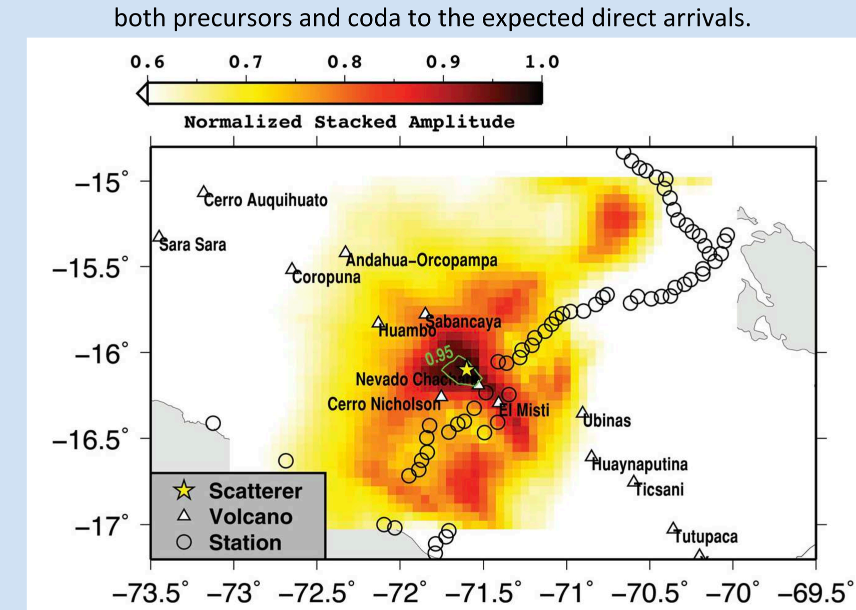


Depth slices of the shear wave velocities. Evident is a mid-crustal low-velocity zone, and on the image along Line 1, there appears to be a fast anomaly at 80 km, which might be the Brazilian Shield

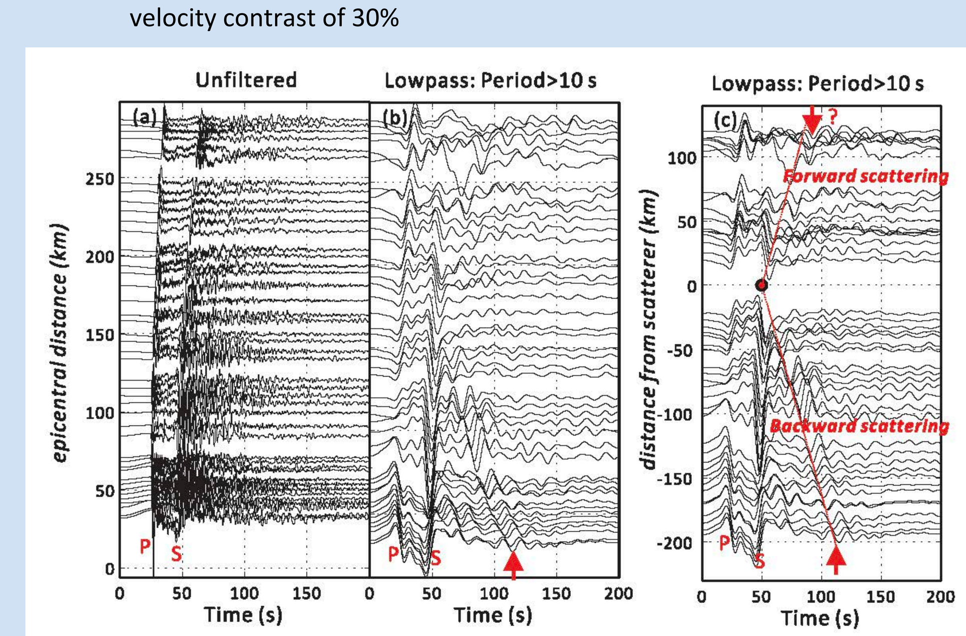
Passive Scatterer



The ambient noise correlations showed several anomalous arrivals, particularly on Line 2 (right panel). These arrivals are both precursors and coda to the expected direct arrivals.

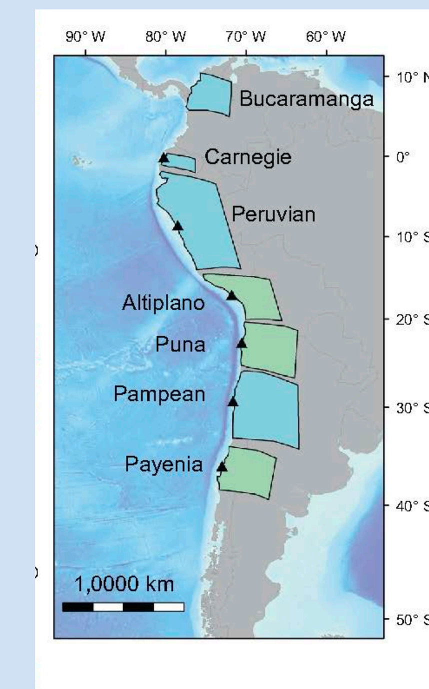


The anomalous arrivals are interpreted as due to a scatterer, which located in the yellow star in the above map. The scatterer is estimated to be 5km in diameter, 10 km deep, and have a low-velocity contrast of 30%



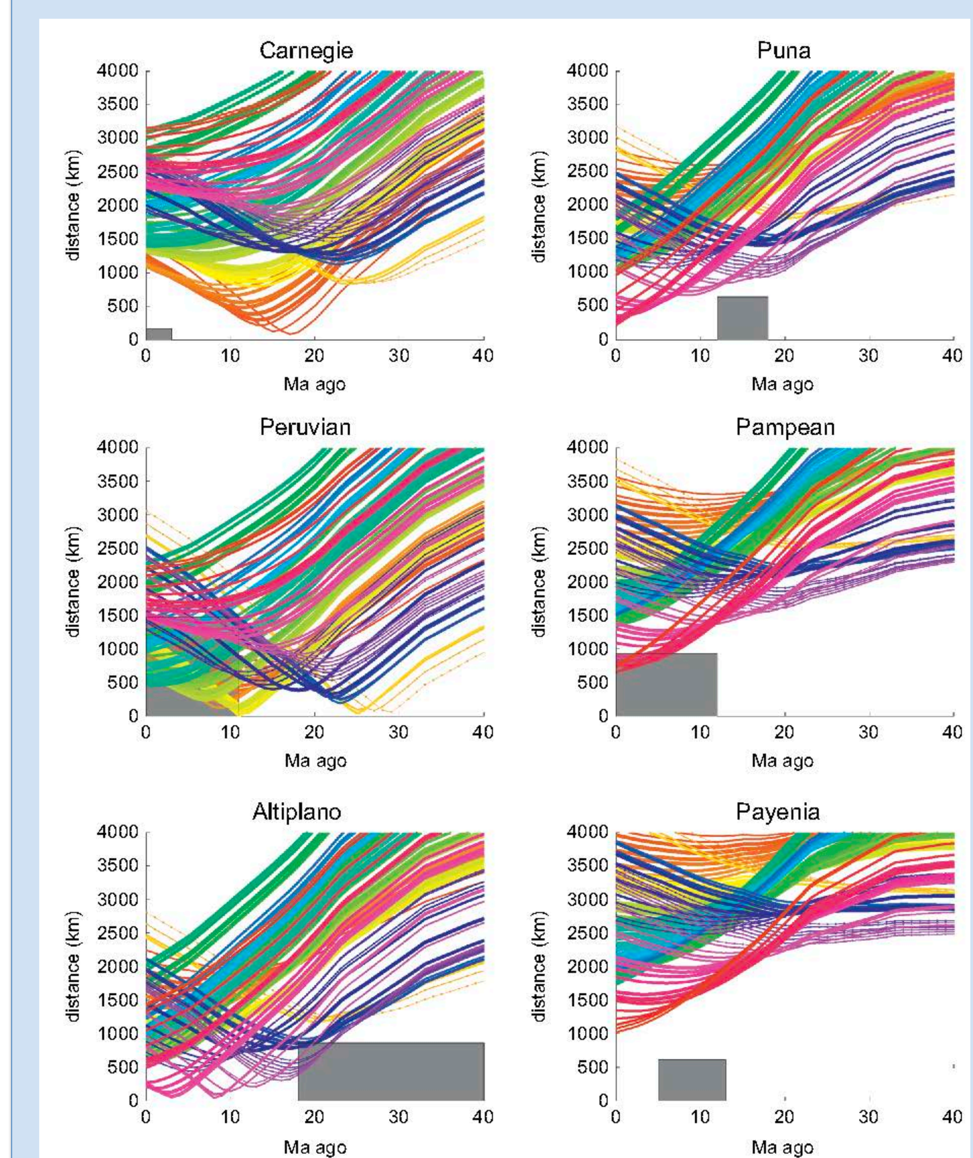
The presence of passive scatterer is confirmed by the fact that it scattered the waves from an earthquake located about 200 km deep along Line 1.

Impactor Tracking



The western margin of South American has experienced several episodes on slab flattening over the past 40 Myrs. On the plot to the left, the blue patches are current flat-subduction zones, and the green are ones were flat in the past (Ramos and Folguera, 2009).

To test the hypthesis that the flattening is caused by impactors brought in by the subduction process, we follow the time and space trajectories of topographic features (ocean plateaus of various sizes) that can be seen on the conjugate plate, to their impact point on the trench off S. America. To be a reasonable choice for the cause of flattening, an impactor should intersect the trench near the time of the start of flattening.



Publications

1. Ma, Y., R. Clayton, V. Tsai, and Z. Zhongwen, 2013, Locating a Scatterer in the Active Volcanic Area of Southern Peru from Ambient Noise Cross-correlation, Geophys. J. Int., 192(3), pp. 1332-1341. doi:10.1093/gji/ggs103
2. Phillips-Alonge, K. and R. Clayton, Structure of the Transition Region from Seismic Array Data in Southern Peru, in revision, GJI, Aug 2013.
3. Phillips, K., R. Clayton, P. Davis, H. R. Guy, S. Skinner, I. Stubailo, L. Audin, and V. Aguilar, (2012), Structure of the Subduction System in Southern Peru From Seismic Array Data, J. Geophys. Res, 117, B11306, doi: 10.1029/2012JB009540.

Data Products

PeruSE (2013): Peru Subduction Experiment. Caltech. Dataset. doi:10.7909/C3H41PBZ