Geophysical Research Abstracts
Vol. 16, EGU2014-8441, 2014
EGU General Assembly 2014


# Crustal imaging using old industry seismic reflection data across the Coast Ranges and the Great Valley in Central Californa, USA

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We make use of the old industry seismic reflection data set SJ-6 in order to image middle and lower crustal structures beneath the California Coast Ranges and the Great Valley in Central California. For this purpose we use advanced imaging techniques in combination with a local 3D tomographic velocity model in order to map the reflectivity structure of the crust in particular across the San Andreas fault zone.
The SJ-6 data set is so far the only active seismic data set crossing the San Andreas fault where the transitional fault segment approaches into the locked segment that last ruptured during the 1857 M7.9 Fort Tejon earthquake. This particular region shows major non volcanic tremor activity that is related directly to and at close range to the deep San Andreas fault zone.
The SJ-6 data have been recorded along a crooked profile line that changes its predominating orientation from SW-NE to W-E after crossing the San Andreas fault surface trace. For this reason the imaging technique is implemented in 3D in order to account for the true source and receiver locations.
We use a Prestack Kirchhoff type migration method called Fresnel Volume migration that spatializes the recorded reflection energy to the vicinity of the actual reflector elements according to the subsurface model. The results are high quality seismic images of improved signal- to noise ratio compared to standard Prestack Kirchhoff migration techniques.
In order to extract reflection signals recorded from the deep crust we extend the record length of the data by adding zeros to the original field data and then crosscorrelate the latter with the source sweep signal. Several adjustments are applied to the migration and stacking schemes in order to obtain final 2D depth sections that represent the reflectivity structure directly beneath the crooked acquisition line.
The most prominent feature southwest of the San Andreas fault is a bundle of strong northeast dipping reflectors within the lower crust of the Salinian Block. Several northeast dipping coherent reflectors in the middle crust appear directly southwest to the San Andreas fault that disappear when they approach the fault zone.
The San Andreas fault can be localized in the image as zone that lacks of strong coherent reflectors in the middle and lower crust. The upper part of the fault zone reveals short truncated reflectors of variable orientations possibly representing fault gouge material. Microseismic events are located within the upper 13 km of that zone and non volcanic tremor locations correlate well with the minor reflective lower part of the fault zone.
The most significant feature beneath the eastern segment of line SJ-6 are west dipping reflectors in the middle crust beneath west tilted sedimentary layer sequences of the Great Valley. These structures may represent sequences of ultramafic rocks called Great Valley Ophiolites. Several geophysical investigations along the Great Valley indicate its existance and cause new debates on the pre-Cenozoic evolution of this major plate boundary.