Geophysical Research Abstracts, Vol. 9, 03847, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03847

Active and Passive Seismic Imaging of the San-Andreas-Fault-System

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Recently high-quality active and passive seismic data have been acquired in the vicinity of the San-Andreas-Fault (SAF) system within EarthScope project SAFOD. We have processed parts of the available data sets using newly developed techniques in order to derive a high-resolution image of the subsurface in the vicinity of the fault system. On one hand we applied Fresnel-Volume-Migration to the SAFOD2003 reflection seismic data set. Along the 50 km long profile we obtained a structural image of the region around the fault system from the surface down to 10 km depth. The SAF appears as a strong subvertical reflector which can be followed from its surface trace down to about 4 km depth. At this depth it converges to a second similarly strong subvertical reflector which correlates with the Buzzard-Canyon-Fault about 2 km southwest of the SAF. Also the Waltham-Canyon-Fault about 4 km northeast of the SAF shows up clearly down to a depth of 5 km. Furthermore a bunch of subvertical reflectors appears at shallow depth over a distance of 10 km southwest of the SAF. Another reflector is visible 15 km southwest of the SAF penetrating through the whole section. Both latter features have no yet known surface expression, however geodynamic modeling results suggest that the existence of such faults is probably realistic.

On the other hand we applied a migration-type location algorithm to passive seismic data recorded with an 80-level-3C-receiver array in the SAFOD main hole. This location algorithm allowed the precise location of the target-events, which are the subject of the current drill activities and which we interpreted in terms of their relationship to the structure of the fault system. The hypocenters as well as the image from the active seismic survey are combined and together provide a basis for a combined interpretation of the structure and the earthquake dynamics of this mega-shear zone.