Upper-mantle structure and seismic-slip distribution beneath the southern Gulf of California

The Sea of Cortez Ocean-Bottom Array (SCOOBA) seismic experiment consists of a 4-component broadband ocean-bottom seismic (OBS) array that recorded earthquakes and other natural seismic signals for nearly 12 months between October 2005 and October 2006. The 14-station array was designed to complement the onshore NARS-Baja experiment run by Utrecht University, Cal Tech, and CICESE. Two subarrays were centered within the Alarcon and Guaymas basins, coinciding with previous refraction and MCS lines (Lizarralde et al., Nature 2007)*, with ~20 km spacing (Figure 1). Four additional instruments were deployed at ~100 km spacing. The array successfully recorded dozens of local events, including over 30 well-located events with M > 3.5, and two large (M ~ 6) strike-slip events with numerous foreshocks and aftershocks (Figure 1). Most of these events are located on the major NW-SE strike slip faults that delineate the plate boundary, but a few appear to be located on faults well away from the nominal plate boundary. We are working to better characterize these events. In addition, we are currently analyzing surface-wave delay times from regional and teleseismic earthquakes, which are providing unprecedented resolution of cross- and along-axis velocity variations within the upper-mantle beneath the southern Gulf. Initial shear-velocity tomography models suggest that at a depth of 150-200 km, low seismic velocities are localized beneath the Gulf proper. At shallower depths (40-60 km), the low velocities are broken up by a high-velocity feature that extends from southern Baja towards the northeast. These results suggest north-to-south differences in the expression of extension in the shallow mantle. Additional analyses of the anisotropic and discontinuity character of the sub-gulf mantle are also underway.

Figure: Location of the SCOOBA OBS stations (triangles), and complementary on-shore broadband stations (squares). Also shown are CMT mechanisms for two large events recorded by the array, as well as locations for over 30 local events (black circles). NARS-Baja = Margins-funded temporary deployment. RESBAN = regional network operated by CICESE.

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Award: 03-05140, 03-05454 (July 2003), 04-36411 (June 2004)

References listed in appendix A.