STRATEGIES FOR CHARACTERIZING SEAFLOOR DEFORMATION ALONG THE SUBMARINE EXTENSIONS OF CONTINENTAL TRANSFORMS

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Recent near-bottom multibeam bathymetric and high-resolution subbottom profiling surveys in the Marmara Sea have documented the geometry of the North Anatolian Fault in great detail. An integrated approach that combines such high-resolution, near-bottom geophysical surveys with transects of shallow cores can also characterize the series of earthquakes that ruptured through a transform basin. Such high-resolution geophysical and sampling programs along fault segments that are expected to rupture in this century should allow for a reliable assessment of the seismic hazard facing the adjacent coastal areas. In addition, should the fault rupture, a series of repeat surveys would not only document the processes associated with underwater ruptures (homogenites, mass wasting, liquefaction, mud volcanoes, fluid seepages), but it could also be applied to precisely quantify the coseismic and postseismic deformations, in a fashion similar to InSAR interferometric studies on land.

Newly developed AUVs (=autonomous underwater vehicles) equipped with multibeam bathymetric sonars, subbottom profilers, and camera, can efficiently map seafloor ruptures at the sub-meter resolution over distances of several kilometers, a resolution higher than that of SAR data. Some AUVs are very portable and can be efficiently air-freighted anywhere in the world and deployed from small ships of opportunity, making them ideal tools for rapidly and accurately surveying fresh seafloor ruptures.

Novel but proven techniques for submarine geodesy that consist in deploying an acoustic array across a fault trace can directly quantify its slip rate. Long-term deployment of ocean bottom seismometers can also precisely monitor the fault background activity and illuminate its subsurface geometry. A program combining all these different approaches would provide unprecedented information on interseismic, coseismic, and postseismic seafloor deformation. The San Andreas Fault offshore California, and the North Anatolian fault beneath the Marmara Sea are prime candidates for such projects, considering the high population in these coastal areas. Because such projects would make use of emerging and costly technologies, they should realistically be planned and carried out as multinational collaborations.