Searching for Records of Past Earthquakes Under Water

European Science Foundation Research Conference: Submarine Paleoseismology—The Offshore Search of Large Holocene Earthquakes; Obergurgl, Austria, 11–16 September 2010

PAGES 48

The 2004 Sumatra–Andaman Islands earthquake and tsunami highlighted the urgent need to better understand the long-term history of underwater earthquakes and tsunamis and to better define hazards for the significant populations in coastal areas. As a result, a European Science Foundation Research Conference was convened to review research in the rapidly expanding field of marine and lake paleoseismology.

The 4-day-long meeting brought together scientists engaged in interdisciplinary research from paleoseismology and marine science. Sixty-six participants from 21 countries attended the conference, which took place at the Innsbruck University Centre, in Austria. The conference consisted of three main parts: (1) new techniques and results for on-fault and off-fault investigations, which summarized the most advanced marine methods for mapping, imaging, and dating underwater paleoseismic events; (2) case studies from different active tectonic continental margins, such as subduction zones, and from lakes or coastal environments that monitor tectonic systems; and (3) the contributions of marine and lake paleoseismology to seismic hazard assessment.

Scientific highlights of the meeting included examples of successful underwater fault characterization (slip rate, length, and kinematics) and identification of segment boundaries. In some cases (e.g., Marmara Sea and New Zealand), earthquake ruptures were identified at the seafloor and vertical and strike-slip components for each event (i.e., coseismic slip) could be obtained. This research can result in recognition and dating of individual earthquake event horizons similar to those in trenches on land. The underwater off-fault studies, based on seismically triggered mass transport deposits and turbidites (deposits generated by turbidity currents), provided (1) marine examples of up to 10,000-year records for recurrence intervals of large-magnitude earthquakes in subduction zones, transform faults, and megathrusts (e.g., Cascadia, northern San Andreas, southwestern Iberian Margin) and (2) lake examples from Chile, monitoring the subduction zone, and from Switzerland, monitoring Alpine fault earthquakes. These case studies highlighted the need for detailed studies of turbidite paleoseismology in many existing long cores from other tectonically active locations. The Haitian 2010 case study outlined sedimentologic characteristics of paleoseismic deposits from the coastline to the deep sea. This and other studies show that characteristic paleoseismic turbidites include megaturbidite homogenite (homogeneous ponded turbidite often related to a catastrophic event) deposition, multipulsed individual turbidites, and stacked turbidite lithologies.

The meeting showed that marine and lake paleoseismology provided powerful new techniques to combine with the existing onshore Holocene (~10,000 years ago to present) faulting and paleoseismic knowledge to improve seismic hazard assessment models. This meeting was the first of what could become a biennial event, with the next meeting suggested for 2012 in Crete (Greece). A special issue of *Natural Hazards and Earth System Sciences* is planned for papers from the conference and other contributions. More information can be found at http://www.esf.org/activities/esf-conferences/details/2010/confdetail313.html.

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