Geophysical Research Abstracts,
Vol. 11, EGU2009-3151-3, 2009
EGU General Assembly 2009

Addressing submarine geohazards through scientific drilling

A. Camerlenghi
ICREA, c/o GRC Geociències Marines, Facultat de Geologia, Universitat de Barcelona (acamerlenghi@ub.edu)

Natural submarine geohazards (earthquakes, volcanic eruptions, landslides, volcanic island flank collapses) are geological phenomena originating at or below the seafloor leading to a situation of risk for off-shore and on-shore structures and the coastal population. Addressing submarine geohazards means understanding their spatial and temporal variability, the pre-conditioning factors, their triggers, and the physical processes that control their evolution. Such scientific endeavour is nowadays considered by a large sector of the international scientific community as an obligation in order to contribute to the mitigation of the potentially destructive societal effects of submarine geohazards.

The study of submarine geohazards requires a multi-disciplinary scientific approach: geohazards must be studied through their geological record; active processes must be monitored; geohazard evolution must be modelled. Ultimately, the information must be used for the assessment of vulnerability, risk analysis, and development of mitigation strategies.

In contrast with the terrestrial environment, the oceanic environment is rather hostile to widespread and fast application of high-resolution remote sensing techniques, accessibility for visual inspection, sampling and installation of monitoring stations. Scientific Drilling through the IODP (including the related pre site-survey investigations, sampling, logging and in situ measurements capability, and as a platform for deployment of long term observatories at the surface and down-hole) can be viewed as the centre of gravity of an international, coordinated, multi-disciplinary scientific approach to address submarine geohazards.

The IODP Initial Science Plan expiring in 2013 does not address openly geohazards among the program scientific objectives. Hazards are referred to mainly in relation to earthquakes and initiatives towards the understanding of seismogenesis. Notably, the only drilling initiative presently under way is the multi-platform drilling of the Nankai seismogenic zone.

Scientific initiatives are flourishing to drive IODP towards the study of submarine geohazards. In the last three years international workshops, were held to address the topic: ESF-ECORD sponsored a Magellan Workshop focussed on submarine landslides (Barcelona, Spain, 2006); IODP sponsored a world-wide Geohazard Workshop (Portland, Oregon, 2007); ESF-ECORD sponsored another Magellan Workshop focussed on Mediterranean submarine geohazards (Luleå, Sweden, 2008). In addition, following the ECORD-Net Conference on the Deep Sea Frontier (Naples, Italy, 2006), the history, monitoring and prediction of geohazards was identified as one of the 6 major areas for a European science plan to integrate Ocean Drilling, Ocean Margin, and Seabed research. More than 200 scientists and private companies representatives have been mobilized world-wide to attend these meetings, from where it emerged that Ocean Drilling will play a key role in the future to answer the following basic open questions on submarine geohazards:
- What is the frequency, magnitude, and distribution of geohazard events?
- Do precursory phenomena exist and can they be recognized?
- What are the physical and mechanical properties of materials prone to failure?
- What are the roles of preconditioning vs. triggering in rapid seafloor deformation?
- Can the tsunamigenic potential of past and future events be assessed?

Within the global-ocean geohazards, worth of note is the attention given in this preparatory phase to sub-

marine geohazards in the Mediterranean basin, a miniature ocean often called a “natural laboratory” because of the diversity of geological environments it contains. The coastline is very densely-populated, totalling 160 million inhabitants sharing 46,000 km of coastline. The Mediterranean is the World’s leading holiday destination, receiving an average of 135 million visitors annually. Submarine landslides, volcanic flank collapses, volcanic island eruptions, earthquakes and the associated tsunamis can lead to destruction of seafloor structures potentially capable of releasing hydrocarbon pollutants into Mediterranean waters, and damage to a dense telecommunication cables net that would cause severe economic loss. However, the most devastating effect would be that of earthquake or landslide-induced tsunamis. When compared to other basins, the Mediterranean has larger vulnerability due to its small dimensions, resulting in close proximity to tsunami sources and impact areas. Recent examples include the 1979 Nice airport submarine landslide and tsunami and the 2002 Stromboli volcano landslide and tsunami.

Future international scientific drilling must include submarine geohazards among priority scientific objectives. The science advisory structure must be prepared to receive and evaluate proposal specifically addressing submarine geohazards. The implementing organizations need to be prepared for the technological needs of drilling proposals addressing geohazards. Among the most relevant: geotechnical sampling, down-hole logging at shallow depths below the seafloor, in situ geotechnical and physical measurements, capability of deployment of long-term in situ observatories. Pre-site surveys will often aim at the highest possible resolution, three dimensional imaging of the seafloor ant its sub-surface. Drilling for submarine geohazards is seen as an opportunity of multiplatform drilling, and for Mission Specific drilling in particular.

Rather than turning the scientific investigation in a purely engineering exercise, proposals addressing submarine geohazards should offer an opportunity to scientists and engineers to work together to unravel the details of basic geological processes that may turn into catastrophic events.