



ÉCOLE DOCTORALE SCIENCES DE LA TERRE



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Pré-tsunami and seismic risk study of SW Sumatra seismic gap using deep reflection data acquired by CGGVeritas

The Sumatra subduction zone is one of the most active zones in the world and has experienced three great megathrust earthquakes in the last four years, including one of the largest earthquakes of the 21st century ($M_w=9.3$) on December 26, 2004 causing a devastating tsunami in the Indian Ocean region which took more than 230,000 lives and caused unaccountable loss of properties. The second earthquake ($M_w=8.7$) occurred three months later, on March 28, 2005 about 150 km SE of the 2004 event. The earth waited for three years, and then broke again in September 2007 at 1300 km SE of the 2004 event producing a twin earthquake of magnitude 8.5 and 7.9 at 12 hours' interval, leaving a gap of about 600 km (Mentawai Island) between the second and third earthquake. Seismological and geodetic studies (Sieh et al., 2008; Konca et al., 2008) suggest that this gap is fully locked and may break any time.

In order to study this locked zone and estimate the tsunami and seismic risk, CGGVeritas has agreed to acquire (fund) deep seismic reflection data using a very long streamer (15 km, longest streamer ever deployed) and a large airgun source capable of imaging the seismogenic zone from rupture initiation at depth (30-45 km) to the seafloor. They will also use advanced processing techniques, which should provide seismic images of the subduction zone of unprecedented nature, and should lead to discoveries about the subduction and earthquake processes that have not been possible for far (e.g. Singh et al., 2008). The objective of this project is to use these exceptional data and provide detailed interpretation incorporating other geological and geophysical data to address the problem of seismic and tsunami risk, SW Sumatra.

A student interested in earthquake and subduction processes, seismic and tsunami risks is encouraged to apply. A sound knowledge of geological processes and geophysical techniques would be essential for the success of the project. The student should be a computer literate capable of handling a large amount of deep seismic reflection data and use processing and interpretation software. The student will receive training in seismic data analysis and interpretation and will work closely with CGGVeritas. He/she may also participate in the seismic survey, which is likely to take place on board the CGGVeritas seismic vessel, Geowave Champion, in the coming months.

Reference

- Konca *et al.* Partial rupture of a locked patch of the Sumatra megathrust during the 2007 earthquake sequence. *Nature* **456**, 631-635 (2008).
- Sieh *et al.* Earthquake supercycles inferred from sea-level changes recorded in the corals of West Sumatra. *Science* **322**, 1674-1678 (2008).
- Singh, S.C., *et al.* Seismic evidence for broken oceanic crust in the 2004 Sumatra earthquake epicentral region. *Nature Geoscience* **1**, 777-781 (2008).