

Summary of an Expanded TAIGER Survey

The TAIGER is an US-Taiwan collaboration research project jointed by scientists from France to investigate the mountain building processes, plate boundary dynamics, and seismogenic processes on and around Taiwan. Both natural earthquakes and large airgun array will be used as sources for seismic imaging of the interior of the deep crust and upper mantle. On land seismographs and broadband ocean bottom seismometers will be deployed for a longer period of time (up to one year) to observe the natural earthquake activities (passive source experiment), while large multichannel seismic system of the new US seismic research vessel R/V Marcus Langseth and short-period ocean bottom seismometers will be used to image crustal transects during the active source experiment. Taking the opportunity of having a modern multichannel seismic vessel coming to Taiwan, the marine geosciences community in Taiwan has obtained additional funds from several agencies in Taiwan to carry out an expanded TAIGER survey. The R/V Langseth is scheduled to conduct the TAIGER active source survey in the areas around Taiwan, in the northern South China Sea and in the western Philippine Sea from March 31 to July 20, 2009.

The purpose of this expanded TAIGER survey is to have a complete investigation on the Taiwan arc-continental collision system and its adjacent continental margins and marginal seas, thus to have a better understanding on the structural characters and tectonic evolution of the region. There are several important scientific issues as well as issues having societal impacts can be addressed by conducting additional marine seismic survey, as described below:

1. The subduction system south of Taiwan to northern Luzon Island: The area south of Taiwan is a transition zone from subduction to arc-continent collision. Two E-W trending profiles across the Luzon subduction system have already been planned in the TAIGER survey, however, we would like to lengthen these two profiles to cover the northern South China Sea Basin and the Western Philippine Basin, and to add couple more transects southward to the Luzon Island. From a recent USGS report on the potential risk of large Tsunami hazard zones around the Pacific region, the subduction system from North Luzon to Taiwan is ranked among the highest. Additional seismic profiles across this region will help to understand the tectonic processes, and provide critical information for earthquake and tsunami hazards investigation.
2. Structure and evolution of the northern South China Sea continental margin: The early evolution of the South China Sea Basin and its relationship to the Huatung Basin/West Philippine Basin is still unclear. It has been suggested that there may exist a fossil plate boundary in the most northeastern corner of the South China Sea Basin. We would like to collect several long MCS/OBS

profiles across the continental margin of the northern South China Sea to better constrain the structural and tectonic evolution of this region.

3. Seismogenic processes and earthquake hazards off eastern Taiwan: There is a highly active seismic zone off eastern Taiwan in the western Ryukyu forearc region where the Ryukyu subduction system transforms into Taiwan collision system westward. Earthquakes of magnitude 7 or larger occur frequently, and the risk of tsunamigenic large earthquakes (magnitude > 8) is very high. Two of the planned TAIGER onshore-offshore transects will pass through this region roughly in E-W trending, we propose to collect additional two N-S trending MCS/OBS transects in this region. One of the added transects will pass through the center of the most densely distributed earthquake zone. This profile is the key profile of the Taiwan-France cooperative ACTS project, and French OBSs will participate in this part of the investigation.
4. The nature of the Gagua Ridge and evolution of the western Philippine Sea Plate: The Gagua Ridge is a N-S trending linear volcanic ridge separating the Huatung Basin and the West Philippine Basin. This ridge has been suggested to be a fossil plate boundary, but the nature of it is still unclear. We suggest to lengthen the planned E-W trending TAIGER profiles and to add additional MCS/OBS transects across the Gagua Ridge so that this series of transects from north to south could provide insights on the nature of the Gagua Ridge and tectonic evolution of the western Philippine Sea Plate.
5. Gas hydrates on different tectonic settings: Marine geophysical and geochemical data have shown that gas hydrates are present both in the passive northern South China Sea continental margin and the accretionary wedge environment southwest of Taiwan. The area SW of Taiwan thus provides a rare opportunity to compare the formation, migration and accumulation of gas hydrates in both active and passive tectonic settings. The Central Geological Survey of the Ministry of Economic Affairs, Taiwan, has funded 12 days of MCS/OBS surveys off SW Taiwan for the purpose of imaging the deep crustal structures of this region where the accretionary wedge of the Luzon subduction system meets with the passive continental margin of the South China Sea.

Taiwan will also provide additional ships during the TAIGER active source experiment to deploy and retrieve OBSs, thus reducing the time spent for handling OBSs onboard R/V Langseth to a minimum. We expect R/V Langseth will be used to collect 2-D MCS data during most of her survey time, and the seismic data collected will greatly enhance the understanding of the regional tectonics, crustal structures and seismogenic processes of the region.