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Active Tectonics of off-Hokuriku, Central Japan, by two ships seismic reflection profiling

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Along the southern to eastern margin of the Sea of Japan, active faults are densely distributed. These submarine active faults produced tsunami disasters, such as 1983 Nihonkai-chubu earthquake (M7.7) and 1993 Hokkaido Nansei-oki earthquake (M7.8). To estimate tsunami hazards, we performed deep seismic reflection profiling to obtain the information of tsunami source faults, off-Hokuriku area in the central part of Honshu, Japan. The survey is carried out as a part of research project named "the integrated research project on seismic and tsunami hazards around the Sea of Japan" funded by MEXT. To obtain long offset data in busy marine activity area, we used two vessels; a gun-ship with 3020 cu. inch air-gun and a cable-ship with a 2-km-long, streamer cable with 156 channels and 480 cu. inch air-gun. Common-midpoint reflection data were acquired using two ships at 4 km offset. The survey area consists of stretched continental crust associated with rifting and opening of the Sea of Japan in early Miocene and is marked by densely distributed syn-rift normal faults. Fault reactivation of normal faults as reverse faults is common. Two phases of fault reactivation are identified from the seismic sections after termination of opening of the Sea of Japan. One is the late Miocene NS trending shortening deformation. This is produced by NS-trending convergence of the Shikoku basin (15 Ma), which belongs to the Philippine Sea plate (PHS) to SW Japan at Nankai trough (Kimura et al., 2005). After the initiation of the subduction of PHS at Nankai trough, the strong shortening deformation is terminated and the fold-and-thrust belt was unconformably covered by sub-horizontal Pliocene sediments. Some horizons of unconformities represent multiple events of shortening driven from the subduction interface. Some normal faults reactivated as active strike-slip and reverse faults in Quaternary. Well observed example is the 2007 Noto peninsula earthquake (M6.8). The 2007 Noto peninsula earthquake occurred by the oblique motion on source fault dipping 60 degrees, which is favorable normal faulting. The geometry is well constrained by deep seismic reflection profiling using two-ships and hypocentral distribution (Sato et al., 2007, BERI).