

Deformation structure off Niigata observed by seismic reflection data

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A multi-channel seismic reflection (MCS) survey after the 2007 Niigata-ken Chuetsu-oki Earthquake were carried out to investigate crustal structures and deformations off Niigata Prefecture region, by using the R/V KAIREI of Japan Agency for Marine-Earth Science and Technology (JAMSTEC). Some damaging earthquakes have been generated around the survey area: In 2004, the mid Niigata Prefecture earthquake occurred in the southeastern part of the Niigata Prefecture. In 1964, The Niigata Earthquake occurred on the shelf off Niigata. These events are located in the Niigata-Kobe Tectonic Zone. Since The Niigata-Kobe Tectonic Zone is recognized as a region of large strain rate along the eastern margin of the Japan Sea and in the northern Chubu and Kinki districts, large historical earthquakes and active faults are concentrated in this zone [e.g. Sagiya (2006)]. Three MCS survey lines with 190 km of total line length were obtained in this survey. An airgun array with a total capacity of 12,000 cubic inches (eight airguns with 1,500 cubic inches each) was shot with shot spacing of 50 m, air pressure of 2000 psi and towing depth of 10 m. The results of data processing and interpretation show that we identified thick sediment, growth of fold structure, and the form of many unconformities on seismic sections. Moreover, we referred results of petroleum explorations for understanding spatial connectivity of sedimentary strata for our data. A total of eight major seismic units were identified on the basis of seismic characteristics and the analyses by sequence stratigraphy, and on the petroleum exploration data. The results of data interpretation show that the development of anticline in the Joetsu Knoll is started by compression stress after about 3.6 Ma. In particular, the deformation of sedimentary layers by compressive stress occurred rapidly after about 1.3 Ma. For example, growth strata in the eastern margin of the Joetsu Knoll and the western margin of the Yoneyama-Ogi Uplifts were more remarkable than before about 1.3 Ma. Moreover, growth of fold structure after about 1.3 Ma has formed larger in eastern part than in western part. Besides, subsidence of sedimentary layers about 0.2 sec below sea floor can be specified at western margin of the Yoneyama-Ogi Uplifts, and it is suggested that very recent tectonic movement has advanced there. Finally, considering relation to the 2007 Niigata-ken Chuetsu-oki Earthquake, deformation structure in eastern area of Line S-2 (JAMSTEC seismic line) and N87-18 (JNOC seismic line) correspond to aftershock distribution of the 2007 Niigata-ken Chuetsu-oki Earthquake obtained by using an OBS network (Shinohara et al, submitted). Therefore, the result suggests that fold structure and its related faults in eastern area of seismic lines connect with mechanism of the 2007 Niigata-ken Chuetsu-oki Earthquake.