Seismic image across the epicentral area of 2016 Tottoriken-chubu earthquake to the southern part of Yamato basin

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Due to stress buildup by the upcoming Nankai Trough megathrust earthquake, SW Japan has been in seismically active period for last 20 years. In terms of the mitigation of earthquake and tsunami hazards, to construct seismogenic source fault models is first step for evaluating the strong ground motions and height of tsunamis. Since 2013, we performed intense seismic profiling in and around the southern part of the Sea of Japan to construct source fault models. In 2016, a180-km-long onshore –offshore seismic survey was carried out across the volcanic arc and back-arc basins (from Kurayoshi to the Yamato basin). Onshore section, CMP seismic reflection data were collected using four vibroseis trucks and fixed 1150 channel recorders. Offshore part we acquired the seismic reflection data using 1950 cu inch air-guns towing a 4-km-long streamer cable. We performed CMP reflection and refraction tomography analysis. Obtained seismic section portrays compressively deformed rifted continental crust and undeformed oceanic backarc basin, reflecting the rheological features. These basic structures were formed during the opening of the Sea of Japan in early Miocene. The sub-horizontal Pliocene sediments unconformably cover the folded Miocene sediments. The opening and clock-wise rotation of SW Japan has been terminated at 15 Ma and contacted to the young Shikoku basin along the Nankai trough. Northward motion of Philippine Sea plate (PHS) and the high thermal regime in the Shikoku basin produced the strong resistance along the Nankai trough. The main shortening deformation observed in the seismic section has been formed this tectonic event. After the initiation of the subduction along the Nankai trough, the rate of shortening deformation was decreased and the folded strata were covered by sub-horizontal Pliocene sediments. The amount of shortening is largest in the inverted half-grabens located near the coast of Honshu island. The thrusting trending parallel to the arc has been continued from Pliocene to early Pleistocene along the limited fault system. The change in the direction of the motion of PHS at 1 Ma produced major change in stress regime from NS compression to EW compression in the back-arc. Following the change of stress regime, former reverse faults reactivated as strike-slip fault. Reuse of pre-existing faults are common, and crustal deformation concentrates relatively narrow zone in the back-arc failed rifts. Two-months after from our survey, Mw 6.2 Tottoriken-chubu earthquake occurred just beneath the onshore part of the seismic line. The source fault corresponds to the boundary of abrupt change in P-wave velocity, however there were no surface ruptures and distinctive geologic faults. The bottom of seismogenic layer corresponds to TWT 4.5 sec., which is almost the top horizon of reflective middle crust.

Keywords: 2016 Tottori-ken Chubu earthquake, Crustal structure, Seismic reflection profile, Opening of the Sea of Japan

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