

Detailed analysis of hypocenters and mechanisms of the M5.4 Eastern Yamanashi Prefecture earthquake on 28 January, 2012

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An M5.4 earthquake occurred in the eastern part of Yamanashi Prefecture, central Japan, at 7:43 on January 28, 2012. Intense aftershock activity followed the main shock. The main shock was located beneath Tanzawa Mountains where the Izu Bonin arc that belongs to the Philippine Sea plate (PHP) has been colliding into Honshu island. The ordinary seismicity around the focal area is particularly high. In order to elucidate the tectonic meaning of the activity, we precisely determined hypocenters and focal mechanisms of the pre- and aftershocks as well as the main shock.

We used data from the permanent online stations operated by the Hot Springs Research Institute of Kanagawa Prefecture, National Research Institute for Earth Science and Disaster Prevention Hi-net, the Japan Meteorological Agency, Tokyo University and MeSO-net. We located the hypocenters based on the double-difference relocation method (Waldhauser and Ellsworth, 2000). We determined the focal mechanism using the absolute P- and SH-wave amplitudes besides the P-wave polarities.

The aftershocks near the main shock are distributed along a plane inclining to the southeastward with a high dip angle. The focal mechanism of the main shock is a reverse fault type with the P-axis oriented to the NW-SE direction. One of the nodal planes of the main shock is coincident with the trend of the southeastward dipping plane where the aftershocks are distributed. This result suggests that the nodal plane dipping to the SE direction corresponds to the fault plane of the main shock. On the other hand, the largest aftershock occurred at a site about 5 km to the north from the main shock hypocenter, making two distinctive earthquake clusters in the main shock - aftershock sequence. The aftershocks near the largest aftershock are distributed on a plane with a strike of the EW direction. The focal mechanism of the largest aftershock contains some of a normal fault component.

The main shock occurred within the cluster of the western side in the ordinary seismic activity under Tanzawa Mountains (Yoshida, 1990; Yukutake et al., 2012), and the hypocenter was located beneath the upper boundary of the PHP estimated by Tsumura et al. (1993). The geometry of the main shock fault inferred from the aftershock distribution is not consistent with the configuration of the upper boundary of the PHP. These results indicate that the main shock occurred within the PHP, not on the plate boundary. The difference of the focal mechanisms found between the main shock and the largest aftershock suggests heterogeneity of the stress field within the PHP in the region.

Keywords: Tanzawa Mountains, Tectonics, Izu collision zone