

Seismic velocity structure and fault rupture behavior in the source region of the 2008 Iwate-Miyagi nairiku earthquake

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We have studied a role of heterogeneity of the crustal structure to control fault behavior in the Ou backbone range based on the seismic tomography (Aoyagi and Kimura, 2014JpGU; Aoyagi et al., 2014 SSJ). In this paper, we focus on the velocity structure and its influence on fault behavior of the 2008 Iwate-Miyagi nairiku earthquake using the same dataset.

The result of the seismic tomography analysis in the upper crust shows the remarkable low Vp/Vs areas in the western and southern side of the Mt. Kurikoma volcano. The low Vp/Vs areas correspond well with the dense distribution of the late Neogene calderas (eg. Sanzugawa, Onikobe, Naruko caldera). Nakajima and Hasegawa (2003) reported similar results and inferred that the caldera has vapor-filled fracture systems near the surface. In contrast, high Vp/Vs areas are distributed in the NE side of the low Vp/Vs areas. Their sharp boundary runs from Yuzawa city to Iwate-Miyagi border in WNW-ESE direction. The source region of the Iwate-Miyagi nairiku earthquake extends across the velocity boundary with NNE trend in the eastern part of the Mt. Kurikoma. The aftershock distribution is clearly concentrated in low Vp/Vs areas. Even in the NE (higher Vp/Vs) side of the velocity boundary, we can find narrow low Vp/Vs zone in which the aftershocks limitedly occurred in the eastern foot of the Mt. Kurikoma. The northern margin of the aftershock distribution corresponds well with the next high Vp/Vs area in NW direction.

These results suggest that lateral change of the crustal structure, such as material properties, might control the fault behavior (rupture termination). We interpret that the best account for the lateral change in the crustal structure can be found in the dislocation by the WNW striking sinistral faults during the back-arc opening.

Keywords: Iwate-Miyagi Nairiku earthquake, seismic velocity structure, seismogenic layer, fault rupture behavior