The cause of the low-velocity zone in the mantle wedge of NE Japan

Junichi Nakajima[1]; Akira Hasegawa[1]; Yasuko Takei[2]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.; [2] ERI, Univ. Tokyo

In the mantle wedge of northeastern Japan, an inclined low-velocity zone is clearly imaged sub-parallel to the subducting slab. In order to know the cause of this low-velocity zone, effects of thermal heterogeneities and fluid content on P- and S-wave velocities are quantitatively evaluated. First, P- and S-wave velocity variations expected from thermal heterogeneities are calculated with taking both effects of anharmonicity and anelasticity into consideration, in which three-dimensional thermal model by Nakajima and Hasegawa [2003] is used. As a result, it is found that the observed inclined low-velocity zone cannot be explained by the effect of thermal heterogeneities alone. Thus, another factors responsible for a reduction in seismic velocities are required. Melt-filled pores are then assumed as another factor since temperatures in the back-arc mantle wedge are higher than the wet solidus of peridotite. The aspect ratio of pores and the melt fraction are estimated from P- and S-wave velocity anomalies after correction for the thermal effect, based on the method of Takei [2002]. The obtained results show a systematic change of pore shape with depth, suggesting the existence of melts as nearly equilibrium texture at a depth of 90 km and as cracks or dikes at depths shallower than 65 km. Migration of melt through thin, interconnected crack-like pores may occur in the shallower regions of the low-velocity zone.