

Heterogeneous structure and fluid: implication for generation of intraplate earthquakes

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Many large intraplate earthquakes occurred in a high-strain rate zone, which was termed as the Niigata-Kobe Tectonic zone (NKTZ), in Japan. The NKTZ was located along the Japan Sea coast line. It was discovered by the spatially high dense GPS array operated by the Geospatial Information Authority of Japan (GSI). We deployed temporary seismic stations in the area. The shear-wave splitting analysis was done using the spatially high dense seismic network. A clear large lateral variation of the polarization directions was found on the shear-wave splitting data. The polarization directions of NE-SW, ESE-WNW, and ENE-WSW, were observed at the northeastern, central, and southwestern parts, respectively. The shear-wave splitting was caused by the anisotropic region in the mantle wedge. The polarization directions of NE-SW and ENE-WSW are consistent with subduction directions of Philippine Sea plate and Pacific plate, respectively. Those two polarization directions can be explained by the mantle flow caused by the subducting oceanic slabs. But, the polarization direction of ESE-WNW, which was observed at the central part of Chubu region, central Japan, was not consistent with the subduction directions of the oceanic slabs. The low seismic velocity and low resistivity structures were reported at the mantle wedge. It had been explained that the heterogeneous structure with low velocity and low resistivity was caused by the fluid which were dehydrated from oceanic slabs. The anisotropic region with the polarization direction of ESE-WNW in the mantle wedge should be caused by the heterogeneous structure. The fluid, which rises up in the mantle and crust, reaches to the upper crust. The crustal fluid is closely related to the crustal weakening. The weakening of the crust might cause the large 1891 Nobi earthquake. Another example of the existence of fluid beneath fault was reported in Atotsugawa fault. The fault is also located in the NKTZ. The fluid beneath the fault plays important roles in cause of intraplate earthquake.