

Hydration and dehydration of wedge mantle and triggering deep crustal seismic tremors beneath Tokai district, central Japan

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Hydrated mantle peridotite is detected seismologically by mapping Poisson's ratio beneath the Kanto and Tokai districts, central Japan at the tip of the mantle wedge of the Philippine Sea slab and within the subducting Pacific slab. We determine three-dimensional P and S wave velocity models using travel time tomography and then construct a three-dimensional map of Poisson's ratio.

We find low velocity anomalies near the upper boundary of the descending Philippine Sea slab beneath Tokai district at a depth about 30 km. In the low velocity region, there is an area with high Poisson's ratio, which we attribute to serpentinized peridotite because serpentinite has a higher Poisson's ratio than other rocks in the crust and upper mantle [Christensen, 1996]. The high Poisson's ratio region is located on the downward extension of a focal zone of a future large Tokai earthquake [Matsumura, 1997]. The geometry of serpentinized region and large earthquake focal zone is similar to that found beneath Kanto district by our previous study [Kamiya and Kobayashi, 2000]. In and around the high Poisson's ratio region beneath Tokai district, reflected S waves were observed [Obara, 1997] and slow slips were detected by GPS observation [e.g. Ozawa et al., 2001] at the upper boundary of the Philippine Sea slab. These slow slips at the plate boundary may be explained by the ductility of serpentinite. Moreover, Obara [2001] observed deep crustal seismic tremors near the high Poisson's ratio region. He pointed out that movements of fluid take part in the source mechanism of the tremors.

References

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