

Seismic evidence for the subducting oceanic crust and serpentinization of the forearc mantle under Kyushu, Japan

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Both P (V_p) and S (V_s) wave velocity structures are determined beneath Kyushu in Southwest Japan by applying the tomographic method of Zhao et al. (1992) to 177,500 P and 174,025 S wave arrival times from 8515 local earthquakes. We selected these earthquakes carefully based on the following criteria. 1) All the selected events are recorded by more than 20 Hi-net seismic stations; 2) The uncertainties of the epicentral locations are less than 2 km while those of the focal depths are less than 3 km; 3) All earthquakes used are located within the seismic network. When we conduct the tomographic inversion, no a priori information on the subducted Philippine Sea slab is considered in the initial velocity model because our aim is to assess whether or not the subducting Philippine Sea slab can be detected without considering it in the initial model. The Poisson's ratio structure is calculated from the obtained V_p and V_s values. Our results show that significant low- V_p , low- V_s , and high Poisson's ratio zones are extensively distributed along the volcanic front in the uppermost mantle, which dip toward the back-arc side in the mantle wedge. In the crust, low- V_p , low- V_s and high Poisson's ratio exist beneath the active volcanoes. The subducting Philippine Sea slab is clearly imaged as a high- V_p , high- V_s and low Poisson's ratio zone from the Nankai Trough to the back-arc. A thin low-velocity zone is detected above the subducting Philippine Sea slab in the mantle wedge, and the earthquakes in the upper mantle are distributed along the transition zone between this thin low-velocity zone and the high-velocity zone of subducting Philippine Sea slab, which may imply that the subducting oceanic crust exists on the top of the slab and the forearc mantle wedge is serpentinized due to the slab dehydration.