Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SCG089-04 会場: 101 時間: 5月27日11:30-11:45

伊豆前弧マントルウエッジの蛇紋岩化：関東下の地震波速度構造からの考察

Possible serpentinization of the fore-arc mantle of the Izu-Bonin arc: Implications from seismic velocity beneath Kanto

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The Izu-Bonin arc has a chain of serpentine seamounts that is exposed at the fore-arc slope 40?50 km west of the Izu-Bonin trench, and few large earthquakes (>M7.0) have occurred at shallow depths (0?100 km) along the trench. These geological and seismological features different from the NE Japan arc are considered to be related to serpentinization of the mantle peridotite immediately above the plate interface.
Kamimura et al. (2002) detected a low-velocity layer in the mantle of the Philippine Sea plate at the Izu?Bonin arc, and interpreted it as chrysotile, which is a low-temperature phase of serpentine. On the other hand, other refraction surveys carried out at the Izu-Bonin trench (e.g., Takahashi et al., 2009) suggest the existence of the thickened (15-20 km) fore-arc crust rather than the normal oceanic crust underlain by the serpentinized mantle.
Nakajima and Hasegawa (2010) revealed the existence of a wedge-shaped low-velocity zone at the easternmost portion of the Philippine Sea slab beneath Kanto. Seismic velocities of this zone are less than 6.5 km/s for P waves and 3.5 km/s for S waves, with Vp/Vs values of 1.8?2.0, which can be interpreted as the thickened fore-arc crust or the normal oceanic crust and the serpentinized mantle. However, the maximum thickness of the low-velocity zone exceeds 30 km and it is probably difficult to attribute the low-velocity zone only to the thickened crust. We therefore consider that the wedge-shaped low-velocity zone is caused by serpentinized mantle that had formed before the subduction. Ductility of serpentine distributed above the plate interface can promote stable slips along the plate interface, resulting in the absence of large interplate earthquakes.