

Vp/Vs and mineralogical composition of the mantle

Hideyuki Fujisawa[1]

[1] non

Purpose of this research is to determine mineral composition of the earth's mantle. Petrological or geochemical study has given very important knowledges about mineral composition of the mantle, but those methods can not treat directly the deeper part of the mantle.

On the other hand, seismic wave can freely travel any part of the deep interior of the mantle, and potentially seismic wave has many information about the deeper part of the mantle. Purpose of this research is to interpret this hidden information contained in the seismic waves.

Seismologist show us the information of the mantle as the seismic wave velocity distribution model. The value of seismic wave at each depth is the reflection of material, pressure, and temperature at the depth. To decode these hidden informations the author first try to estimate reliable Vp/Vs ratio in the mantle. There are many seismic wave velocity models. We must, however, be careful to choose a couple of Vp and Vs models to derive a reliable Vp/Vs ratio.

The author can derive two kind of Vp/Vs models for the stable continent and the tectonic region.

In the upper mantle shallower than 410km, the Vp/Vs ratio increase monotonically with depth. This suggests existence of a large amount olivine in this region, and agrees with many evidences of existence of peridotite suggested from petrological research.

On the other hand, the region between 410km and 660km (the transition layer) the Vp/Vs ratio is kept nearly constant. This agrees very well with the behavior of garnets.

Existence of a large amount of garnet type minerals is required. This suggests a majorite composition in the transition layer.

Li et al. (2001) showed the phase change model for the mantle transition layer, based on the above mentioned Vp/Vs independent comparison method.

The author derived the majorite transition layer using the same data of Li et al. (2001). As mentioned above, resolution of the Vp/Vs independent comparison method is not enough.

In the lower mantle, the value of the Vp/Vs ratio is very small compared to those in the upper mantle. This suggest existence of a very hard material in the lower mantle.