

Seismic attenuation around Mt. Fuji and Mt. Hakone: Implication for magma chambers

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Mt. Fuji and Mt. Hakone are located in a unique tectonic field close to the triple junction of the North American, Eurasian and Philippine Sea plates. In petrological studies on Mt. Fuji (e.g., Kaneko et al., 2010), at least two magma chambers are supposed to exist at depths shallower than 10 km and deeper than 20 km. However, the shallower magma chamber has not been detected by geophysical studies. On the other hand, on Mt. Hakone, several studies have shown that there is a magma chamber, but the inferred depth of the magma chamber is different among previous studies. So, the magma plumbing system toward Mt. Hakone is poorly understood. In this study, we try to detect magma chambers beneath each volcano by using seismic attenuation imaging.

First, we calculate a spectral amplitude ratio of P-wave (A_{obs}) for each waveform by dividing the mean amplitude in a high-frequency band of 12-16 Hz by that in a low-frequency band of 1-4 Hz. We also calculate theoretical amplitude ratio (A_{cal}) for any source-station pairs with a stress drop of 3 MPa and Q of 500 using the same frequency bands as the observations. We then define " $A_{\text{rat}} = A_{\text{obs}}/A_{\text{cal}}$ " as a new indicator which quantitatively characterizes the degree of seismic attenuation. After calculating " A_{rat} " of each waveform, we divide the target area into small blocks (~5 km by ~5 km by 5 km) and estimate seismic attenuation in each block.

The obtained results show that

1. There are highly attenuated zones beneath Mt. Fuji at depths greater than 20 km and around Mt. Hakone at depths of 0-5 km. They correspond to low-velocity anomalies that were detected in several previous studies.
2. There are highly attenuated zones that can be interpreted as magma chambers beneath Mt. Fuji at depths of 0-5 km and beneath Mt. Hakone at depths of 5-10 km.

Keywords: seismic attenuation, magma chamber