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Seismic attenuation in the upper mantle beneath the Ontong Java plateau

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We investigate attenuation structure in the upper mantle beneath the Ontong Java plateau (OJP) to identify the origin of this largest LIPs (Large Igneous Provinces) in the globe. Previous studies have shown that S-wave velocities in the upper mantle beneath the OJP are slower than those in the surrounding regions (Richardson et al., 2000). On the other hand, only a few studies have been performed on the attenuation beneath the OJP. Gomer and Okal (2003) showed that ScS-waves traveling beneath the OJP exhibit weaker attenuation than those traveling in the surrounding regions, from which they suggested that the slow velocities in the upper mantle beneath the OJP are not of thermal origin. However, the attenuation of the ScS waves represents average attenuation in the entire mantle beneath the OJP, not in the upper mantle. We need to determine the attenuation in the upper mantle to compare with the slow velocity anomalies in the upper mantle beneath the OJP.

We analyzed teleseismic broadband waveforms of transverse component from deep earthquakes beneath the Solomon Islands subduction zone. Spectral ratios of the sS and S waves were computed to extract information of the attenuation in the upper mantle beneath the OJP. We made correction for crustal structure in and around the OJP, since the sS waveforms are sensitive to the crustal structure at the surface bounce points. Qs values were estimated to be 30-50 for the sS waves of which bounce points are located in the OJP and 40-100 for the sS waves traveling out of the OJP. The Qs values beneath the OJP are well lower than those estimated in other back-arc regions (70-90; Flanagan and Wiens, 1994). The Qs values outside the OJP are close to those in back-arc region. Differential travel time residuals of sS-S are also measured. The differential residuals are well correlated with attenuation pattern: sS waves bouncing at the OJP travel slower by 3 sec than those outside the OJP, which is consistent with the previous studies (e.g., Richardson et al., 2000). These results suggest that the slow velocity anomalies in the upper mantle beneath the OJP are caused mainly by thermal effects.

Keywords: Ontong Java plateau, Seismic attenuation