論文の内容の要旨

Imaging slabs in the Earth's mantle transition zone and D″ layer beneath Central America and its vicinity using waveform inversion

（波形インバージョンによる中央アメリカおよびその近傍下のマントル遷移層と最下部マントルにおける沈み込んだスラブのイメージング）

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The mantle transition zone (MTZ; between ~410–660 km depth) and the D″ region (from the core-mantle boundary to ~400 km above it), the two boundary layers in the Earth's mantle, play a major role in governing the modality of convection in the mantle. Previous work using travel-time tomography reported large variability of convection modality of slabs in and near the MTZ. Also, the length scale of velocity anomalies in the D″ region, and thus of convection if a thermal origin is assumed, is still being debated. In order to improve our understanding of how slabs interact with the 660 km discontinuity and the thermal boundary layer in the D″ region, I use waveform inversion to image the detailed 3-D S-velocity structure in the D″ region and MTZ beneath Central America and vicinity. The region beneath Central America is of particular geodynamical interest, since the paleo- and present Pacific plates have been subducting beneath the western margin of Pangaea since ~250 Ma, which implies that paleoslabs could have reached the lowermost mantle and are still present in the MTZ. I obtain high-resolution images because of the dense sampling by seismic waves due to the full deployment of the USArray broadband seismic stations in the conterminous US during 2004–2015. In the D″ region, I find evidence for two distinct paleoslabs possibly corresponding to the Farallon slab, and remnants from intra-oceanic subduction, and for chemically distinct denser material just above the core-mantle boundary. In the transition zone, I find complex subduction modality of the Cocos slab, possibly due to the thermal structure of the Cocos slab, and its interaction with a lower-mantle plume, suggesting the importance of properties of the slab itself on the convection modality in and near the MTZ, and of the current state of convection in the lower-mantle. This work favors whole mantle convection (at least in the study region) with slabs sinking to the CMB possibly creating iron-rich heterogeneities by chemical differentiation, and triggering upwelling flow of hot material that could in turn interact with younger slabs in the MTZ.