Signals of Subduction and Subducted Slabs in the Mid-Mantle

Anna M. Courtier (cour0090@umn.edu) and Justin Revenaugh (justinr@umn.edu)
Department of Geology & Geophysics, University of Minnesota, Minneapolis MN 55455

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An extensive analysis of multiple *ScS* reverberation datasets sampling two regions of active or recent subduction reveals evidence of mid-mantle reflections apparently stemming directly from fragments of subducted slabs or from the interaction between subducted slabs and the surrounding mantle. Sub-transition zone reflectors are detected beneath the southwest Pacific Ocean with mean depths of ~850 and 1110 km in the majority of source-receiver corridors crossing the study area. The observations are spatially coherent beneath the Coral and Tasman Seas, though variations in the depths of the reflections suggest the reflectors themselves may not be continuous features. Coincident observations of the two reflectors along most seismic corridors suggests (but doesn't mandate) the existence of two distinct reflectors rather than bimodal depth distribution of a single reflector or distributed scatterers. Beneath North America, reflectors at depths of ~1380 and 1530 km are seen in the mid-continent region; further east, the reflections are shallower, with depths near 940 and 1130 km. Unlike the observations in the southwest Pacific, these reflectors are not paired in any of the individual source-receiver corridors. This and the depth variability of the observations indicate that the reflector (or reflectors) is (are) fragmented from west to east, transecting source-receiver corridors. The impedance contrasts of these features rival that of the 660-km discontinuity, suggesting that individual fragments of the reflecting surfaces must be relatively continuous and flat north to south, along individual corridors, to maintain a strong apparent impedance contrast. The reflections in both study areas are unlikely to be the result of slabs interacting with a chemical boundary layer within the mid-mantle. The reflectors are seen over broad geographic regions, and the topography that would be required along that boundary to maintain isostatic equilibrium to compensate for regions where slabs are and are not present is not consistent with the observations. More likely these reflectors result from a pressure-dependent phase transition within the slab and some related effect on the surrounding subduction-modified mantle.