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スタグナントスラブのゆくえ：パイロライト及びスラブ物質の密度と弾性波速度からの制約
Fate of stagnant slabs: Constraints from density and sound velocities of pyrolite and subducted slab materials

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Seismological tomography images suggest that some slabs penetrate into the deep lower mantle, while others are trapped around the 660km seismic discontinuity, forming structures referred to as ”megaliths” or ”stagnant slabs”. The latter class of slabs is believed to eventually fall into the lower mantle, because of the instability (flushing or avalanche) caused primarily by the density contrast between the slab and the surrounding mantle. This suggests that all slab material ultimately sinks deep into the lower mantle. Nevertheless, there are some locations where the stagnant slabs seem to spread over a certain distance along the 660km boundary, whose fate is not really understood. Our recent studies on the sound velocity changes in typical subducted slab and mantle lithologies demonstrated that the sound velocities of either pyrolite or piclogite (or eclogite) do not fit seismological models for the bottom part of the mantle transition region (MTR), suggesting that this part of the MTR is made of a layer of harzburgite, which is the major constituent of subducting slabs. Subducted harzburgite is intrinsically less dense than the surrounding pyrolite in the lower mantle, and can be buoyantly trapped at the bottom of MTR when thermally equilibrated with the mantle after stagnation. This would allow such stagnant slabs to stay in this region without flushing into the deeper mantle. Thus, the authors propose that the slabs subducted in the MTR may be classified into three types; 1) directly penetrating deeper into the lower mantle, 2) forming a ”megalith” structure with subsequent flushing into the lower mantle, and 3) spreading horizontally over a certain distance until some thermal turbulences (either upward or downward convective motions) destroy the layered structure. The third class of the subducted slabs, mainly composed of harzburgite, may contribute to the relatively high sound velocities observed in the bottom region of the MTR.

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