

# **Small-Scale Seismic Heterogeneity and Mantle Structure**

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Small-scale seismic heterogeneity exists at different levels in the lower mantle, and is detected by methods that analyze scattered – not direct – energy from natural and artificial sources. Its vertical distribution, association with subduction, and its  $\leq 10$  km characteristic scale length strongly suggest that the heterogeneity is chemical/petrological in nature and originally created by melting and differentiation during mid-ocean ridge formation. With this stimulus, old ideas that the mantle is heterogeneous in structure, rather than stratified, are reinterpreted and a simple, end-member model for the heterogeneity structure is proposed. The volumetrically largest components in the model are recycled oceanic crust, which contains the heat-producing elements, and mantle depleted of these and other incompatible trace elements, plus a minor amount of ancient recycled oceanic crust. About 10% of the mantle's mass is made up of recycled oceanic crust, which is associated with the observed small-scale seismic heterogeneity. The way this heterogeneity is distributed is in convectively stretched and thinned bodies ranging downwards in size from 10 km. More array-based studies of the seismic structure of the mantle will provide further constraints on the provenance and size distribution of heterogeneity in the mantle.