# Using IRIS Digital Data to Determine the Radial Attenuation Structure of the Lower Mantle

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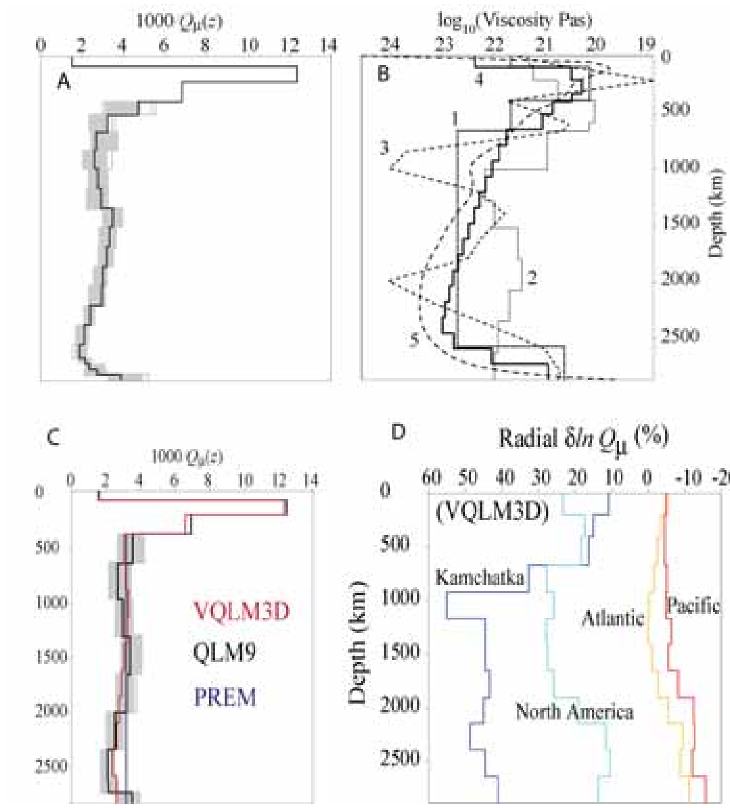
We employed a niching genetic algorithm to invert ~30,000 differential ScS/S attenuation values for a new spherically-symmetric radial model of shear quality factor (Q$\mu$) with high sensitivity to the lower mantle. The data were obtained from all broadband shear waves available from the IRIS DMC after 1990. The new radial Q$\mu$ model, QLM9, possesses greater sensitivity to Q$\mu$ at large mantle depths than previous studies. Differential ScS-S attenuation as a function of event-to-station distance provides an excellent mechanism for determining lower mantle quality factor structure regardless of upper mantle structure. This model is robust for both shallow and deep event data sets. On average, lower mantle Q$\mu$ increases slightly with depth, which supports models of increasing viscosity with depth. QLM9, when compared to viscosity and temperature (with significant caveats), is in agreement with geodynamic expectations. There are two higher-Q$\mu$ regions at ~1000 and ~2500 km depth, which roughly correspond to high-viscosity regions observed by Forte and Mitrovica. There is a lower-Q$\mu$ layer at the core-mantle boundary, as expected based upon the presence of the lowermost mantle thermal boundary layer. There is also a relatively low-Q$\mu$ region in the mid-lower mantle. However, as three-dimensional tomographic modeling of shear wave attenuation shows, there is tremendous lateral variation in the shear-wave attenuation of the lower mantle, so a radial model of Q$\mu$ may be of some general use for geodynamics applications, but it is important to remember that it is averaging over huge lateral variations. As such, it is interesting how nearly-constant the vertical profile is across the lower mantle. The slight increase in Q$\mu$ in the mid-lower-mantle may be suggesting that descending subducted lithosphere doesn't spend a lot of time in the mid-lower mantle.




A. The lower mantle radial Q model QLM18 of Lawrence and Wysession (2005). Gray shading shows the range of other low-cost models from the genetic algorithm search. B. Mantle viscosity models: 1. Hager and Richards (1989); 2. Forte and Mitrovica (1996); 3. Forte and Mitrovica (2001); 4. Steinberger and Calderwood (2001); 5. McNamara et al. (2003). C. Comparison of the PREM and QLM9 models with the laterally averaged radial model from the 3D mantle model VQLM3D (Lawrence and Wysession, 2004). D. Radial profiles for VQLM3D from 4 different geographic regions.

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