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Crustal Structure of a Propagating Ridge Segment from Seismic Refraction and Wide-angle Data

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The Mid-Atlantic Ridge at 21.5° N shows a very clear structure of a propagating ridge segment in both bathymetric and satellite altimetry-based gravity. This active ridge system in a median valley environment started its southwards propagation roughly five million years ago, after a stable transform fault had existed there for several million years. A linear slightly asymmetric v-shaped wake has been formed by a propagation rate of approx. 16 mm/y with an average half-spreading rate of approx. 13 mm/y. The experiment comprises five active seismic profiles, with ocean bottom hydrophones deployed at 80 stations, shot during the cruise M60-2 in 2003/2004. One profile has been placed along the ridge axis while the other profiles cross the ridge segment in its different zones to estimate the velocity structures for these areas. Results from the active part of the experiment indicate a strong variation in the crustal thickness along the ridge. While the crust has unusual thinning towards the north in the deeper region, it becomes thicker at the doomed ridge. The small scale seismic activity, recorded by a temporal NOAA/PMEL hydrophone network, is confined to the northern deeper region, where mantle rocks outcrop at the seafloor. The segment centre with its dome-like topography and the south of the segment, the ridge-tip, correlate with gaps in seismic activity. The aseismic zone of the ridge at the topographical high hints at a thin lithosphere at the centre in contrast to a thicker lithosphere beneath the basin with minimal volcanism. The model along the ridge axis corresponds to the idea of focussed melt supply and lateral redistribution at crustal levels which results in a thick crust at

the segment centre with thinning towards the segment ends. In the process of segment propagation apparently a fraction of the melts rising at the centre of the segment are redistributed laterally before emplacement. However, upto 8 km thick crust in the segment centre suggest that a major part is used locally for crustal formation, while crust at the segment ends is 5 to 6 km thick.