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Relative evolution of adjacent OCCs and segment boundaries at 13°N on the Mid-Atlantic Ridge

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We present the results of a geophysical study of crustal structure variation and evolution along an ∼200 km-long profile that crosses four adjacent oceanic core complexes (OCC) on the Mid-Atlantic Ridge (MAR), and two small fracture zones (FZs) that bound the ridge segment to the south and juxtapose crust of different ages (2 Myr vs. 10 Myr). Heading northwards lineated (magmatic) and detachment faulted (amagmatic and containing OCCs) seafloors reveal an independent pattern of lithospheric evolution. Wide-angle seismic data acquired contemporaneously with shipborne gravity and magnetics, have been modelled to reveal a magmatically-accreted crustal structure both to the north and south of the OCCs and between FZs. The crust between the FZs is also ∼2 km thicker than elsewhere along profile. The profile crosses the corrugated sections of three OCCs (Ashadze complex and 13°30'N), and reveals relatively high seismic velocities at shallower depth, and crosses the chaotic seafloor adjacent to the 13°20'N OCC which, in addition to a magmatically-accreted crustal structure, shows evidence for a thinner underlying crust. The absence of Moho reflections along much of the profile to the north of the FZs, suggests the existence of a transition zone between crust and mantle, with a scale in the order of the seismic wavelength at that crustal depth. Gravity modelling along the profile confirms the presence of shallower denser rocks beneath the corrugated surfaces, than elsewhere. Both velocity- and density-depth models, when taken in combination with the magnetic anomaly pattern and seafloor morphology, suggest though that the Ashadze complex, 13°20'N and 13°30'N OCCs have evolved independently.