Elastic wave velocities of MORB under pressure and temperature conditions of the mantle transition region

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Ultrasonic P- and S-wave velocities of synthetic basalt at around 17 GPa and 1200 C with a MORB composition were measured at pressures up to 17 GPa and temperatures up to 1500 C. The basalt was synthesized in advance from MORB glass, and was found to consist of well-sintered, microcrystalline garnet and stishovite. Ultrasonic measurement, in conjunction with X-ray diffraction and imaging, was carried out in a multi-anvil apparatus (SPEED1500) at BL04B1 in SPring-8. Pressures were determined with the equation of state of gold (Anderson et al., 1989). The X-ray diffraction results show garnet and stishovite peaks in all pressure and temperature conditions, and clinopyroxene was not identified. The P-wave velocities show stronger pressure dependence than the S-wave velocities. The pressure derivatives of P- and S-wave velocities are 0.07 and 0.02 (km/s)/GPa, respectively. Both P- and S-wave velocities of MORB show significantly strong temperature dependence at high temperatures. The P- and S-wave velocities of the MORB were compared with seismological model of ak135 (Kennet et al., 1995). The P- and S-wave velocities of MORB at 460 km depth is comparable or slightly higher than those of ak135 under slab geotherms (900-1200 C), while is markedly lower (up to -3.5%) than those of ak135 at mantle geotherm (around 1400-1600 C). The data suggest that MORB composition (subducted oceanic crust) at mantle geotherms yields low velocity anomaly around the top parts of the mantle transition region.