To investigate the standard electrical conductivity profile beneath a continent, we conducted a magnetotelluric (MT) observation with long dipole span near Alice Springs, central Australia. We utilized geomagnetic data acquired at the Alice Springs geomagnetic observatory operated by Geoscience Australia. Using the BIRRP processing code (Chave and Thomson, 2004), we estimated the MT and GDS (geomagnetic depth sounding) transfer functions for periods from 100 to 10 to 6 sec. The MT-compatible response functions converted from GDS response functions are resistive compared to the Canadian Shield (Chave et al., 1993) for periods around 10 to 5 sec. The calculated MT responses also have generally high apparent resistivity values over the entire period range. We inverted the average MT responses into a one-dimensional conductivity profile using Occam inversion (Constable et al., 1987). The resultant conductivity profile is extremely resistive (0.001 to 0.0001 S/m) down to the mantle transition zone.

We compared this one-dimensional structure with electrical conductivity profiles predicted from compositional models of the earth's upper mantle by calculating phase diagrams in the CFMAS (CaO-FeO-MgO-Al2O3-SiO2) system. The on-craton and off-craton chemical composition models (Rudnick et al., 1998) were adopted for the continental lithosphere (tectosphere). The Perple_X (e.g. Connolly, 2005) programs were used to obtain mineral proportions and compositions with depth. The calculated conductivity profiles with on- and off-craton models show significantly larger magnitude than the observed. The result suggests the tectosphere beneath Australia is extremely dry and its temperature profile is cooler than that used in the calculation.