# Seismic velocity structure of the Australian-Antarctic Discordance (AAD), segment B4, by OBS-airgun experiment

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The Australian-Antarctic Discordance (AAD) is a part of the Southeast Indian Ridge and has an anomalously depth and chaotic morphology. In addition, the AAD has rift valleys in spite of its spreading rate (74 mm/yr). These characteristics are considered to be caused by a low temperature mantle. The AAD is divided into five segments, B1 to B5 from east to west. The area between B3 east and B5 has anomalous seafloor topography.

A seismic structure of uppermost mantle and crust beneath the ridge area is essential to consider the tectonic of the AAD. However, no seismic survey has been performed in the B4 segment. From January 31 to February 3, 2002, we carried out seismic survey with airguns, Ocean Bottom Seismometers (OBSs) and multi-channel hydrophone streamer in the B4 segment to obtain the structure of the uppermost mantle and crust by using the R/V Hakuho-maru, the University of Tokyo. Five OBSs were deployed at an interval of 20km on a line perpendicular to the ridge axis. Two airguns with total capacity of 37-liter were used as controlled sources. The airguns were shot every 60 seconds on the main profile Line1 which ran over the five OBSs and were shot every 20 seconds on the other six profiles.

Apparent velocities of first arrivals in the OBS records vary with offset distances corresponding to complicated geographical features. First the 1-D P-wave velocity structure beneath the OBS on the ridge axis is derived from the data of the line along the ridge axis using the tau-p method and the ray tracing method due to relatively smooth topography beneath the line. The uppermost layer has a P-wave velocity of about 2.0 km/s and is very thin. Below the uppermost layer, P-wave velocity gradually increases with depths from 3.5 km/s to 7.4 km/s. At the depth of about 3.6 km from the sea floor, P-wave velocity reaches 7.4 km/s. This structure was used as an initial data for 2-D modeling. Next, the 2-D velocity structure beneath the main profile was derived using the ray tracing method and the inversion method using the first arrivals. In almost all the region under the profile, there is no velocity jump that is considered as a Moho interface and the deep region has P-wave velocities of more than 7.4 km/s. The region under the shallow part, where a megamullion structure is estimated, has large P-wave velocity compared with other regions. This is consistent with the megamullion is formed by detachment fault and consists of material from lower crust and mantle. In addition, the P-wave velocity change at the ridge axis suggests the detachment fault. Variations in crustal thickness perpendicular to the ridge axis indicate that the melt production in the B4 segment have changed in a cycle of about 0.5 m.y. during last 1.5 m.y.