P-P reflectivity mapping and the seismicity in the Japan Trench subduction zone.

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In the Japan Trench area, many destructive earthquakes, as well as microearthquakes, have occurred. The Pacific plate is subducting beneath the Japanese island arc at this Trench. It is considered that most of the earthquakes are caused by plate subduction motion. Therefore, it is extremely important to clearly characterize the physical state of the plate boundary in order to understand the seismic activity in this region.

In this subduction zone, there is a low seismic region with 100km-long and 30km-wide south of latitude 39 degrees N, and we conducted seismic refraction and reflection experiments there. We discovered an interesting feature that implies that the P-P reflectivity of the plate boundary correlates with seismicity: we observed distinct large amplitude reflected waves from the aseismic plate boundary located around 13km deep from the oceanic surface. This intense reflection implies the presence of low velocity materials along the subduction plate boundary.

There is another low seismic region to the north of latitude 39 degrees N. This low seismic region is narrower than the one to the south. We placed a dense Ocean Bottom Seismometers(OBSs) with two dimensional array: Twenty-seven OBSs were deployed in a 10km x 40km area with 5km spacing. This dense OBS network enabled us to image the reflection phase from the plate boundary in 2D space.

First, we obtained a P-wave velocity structure by a traveltime inversion method using traveltimes of the first arrival and several reflection phases. Then, we computed the theoretical travel times and the reflection points of reflected waves from the plate boundary.. Using these values, we created a Moved-out Record Section to image the plate boundary reflected waves similar to the Normal Move Out(NMO) method often used in conventional MCS analysis.

In this presentation, we will show the seismic record sections of the plate boundary. Although the reflections from the northern low seismic region are not as intense as the southern region, we cab identify clear reflected phases from the northern low seismic region in these sections. This result also suggests that seismicity correlates well with seismic impedance contrast and the physical causes to create such impedance contrast at the plate boundary.