A velocity structure of Takuyo Daigo seamount; results from a wide-angle seismic experiment

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The Marcus-Wake seamount chain located on the northwest Pacific plate extends ESE to WNW for about 2500 km. Different from seamounts in the Hawaii-Emperor chain and the Louisville chain forming a simple line, those in the Marcus-Wake chain are dispersed widely and complicatedly, and form a band with broader than 400 km width. In this study, to clarify the velocity structure of a seamount and crustal structural transition zone between a seamount and an abyssal plain, a wide-angle seismic experiment was conducted around Takuyo Daigo seamount, which is one of the largest seamounts in the chain. Another objective of this experiment is to evaluate a relationship between an OBS (Ocean Bottom Seismograph) spacing and an accuracy of the resulted structural model, and a validity of reducing a spatial firing interval to improve an S/N ratio of recorded data.

The investigation consists of two sets of experiments. The first seismic experiment was conducted by S/V Shoyo and S/V Takuyo belonging to the Hydrographic and Oceanographic Department, Japan Coast Guard (HODJ) in Oct-Nov, 2003. The second experiment is planning to be conducted on the same track-line to the first experiment in Feb-Mar, 2004. 38 OBSs were deployed at 6 km interval along the 230 km track line crossing Takuyo Daigo seamount from north to south. In the second experiment, OBSs will be set up at middle points between the locations where OBSs were deployed at the first experiment. The seismic source is an array of four, 24.6 liter (1500 in3) air guns (98.3 liter or 6000 in3, total) firing every 200 m spacing with approximate 90 - 100 seconds. We conducted a round trip survey along the track-line and were able to acquire seismic data corresponding to those resulting from a 100 m interval firing experiment.

OBSs on the abyssal plain recorded clear signals of Pn and/or PmP with offsets up to 120 km, however, several OBSs on the top of the seamount did not record clear signals from farther than 30 km offsets. A preliminary P-wave velocity structure along the track-line was derived from these recorded data by using a two-dimensional ray tracing approach. It shows that the Moho depth beneath the seamount (about 15 km depth) is much deeper than that beneath the Pacific Basin (about 12 km depth) and that the crust thickness of the northern basin is approximately 2 km thicker than that of the southern basin. These results are consistent with the gravity anomaly data around this sea area.