Crustal structure model of the Ogasawara Plateau colliding with the Philippine Sea Plate

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The Ogasawara Plateau, located at the western end of the Marcus-Wake seamount chain on the north-west Pacific Basin, collides with the Philippine Sea plate at 26 N and parts the Izu-Ogasawara Trench and the Mariana Trench, which are known as non-accretionary convergent plate margin system. In 1990, a multi-channel reflection profile across the Ogasawara Plateau and the Ogasawara Ridge was acquired by the Metal Mining Agency of Japan and the Japan National Oil Corporation, however, it does not show clear medium-to-deep crustal structure around the collision area and subduction zone. It might be caused by the existence of the forearc serpentine seamount, Hahajima Seamount, at the edge of the Philippine Sea plate, attnuating seismic wave propagation severely.

To construct a crustal structure model at the Ogasawara Plateau collision area and acquire information of an influence of collision of the plateau against the Philippine Sea plate and the Ogasawara Ridge, a wide-angle seismic experiment was conducted by the Hydrographic and Oceanographic Department, Japan Coast Guard, in Nov. 2004, as a part of the Continental Shelf Survey. Two intersecting track lines were set in the experiment; OGr3 and OGr5. OGr3 is about 600 km long east-west line cutting across the south Izu-Ogasawara Arc and collision area and OGr5 is about 400 km long north-south line cutting across the Ogasawara Plateau. A seismic source is 8040 cubic inch (132 litter) tuned clustered airgun array (composed of 36 airguns), firing at every 200 m spacing (90-100 sec). OBSs (Ocean Bottom Seismograph) were deployed along these lines with about 5 km interval and retreated after airgun shooting, without any loss.

In data recorded by OBSs set near the Hahajima Seamount, signals of Pn and PmP propagating over 20 – 30 km offset are not recognized clearly. Data recorded in other OBSs show clear signals of Pn and/or PmP with offsets of up to 150 - 250 km.

As first step for constructing velocity models, first arrival travel times of P wave were picked from the record sections. Then, by using the two-dimensional tomographic inversion of these travel time data, provisional seismic velocity structure models were established along OGr3 and OGr5 track line. From these models, crustal thickness of both the south Izu-Ogasawara Ridge and the Ogasawara Plateau are estimated as thicker than 20 km, and a P wave velocity structure untill 10 km below the Hahajima Seamount is slow (less than 6km/s) with respect to the structures below other seamounts on the same track line.