Crustal transect of the Kuril arc-trench system obtained from the onshore-offshore wide-angle seismic study

Ayako Nakanishi[1], Eiji Kurashimo[2], Seiichi Miura[3], Koichiro Obana[1], Shuichi Kodaira[1], Tetsuro Tsuru[1], Jin-Oh Park[3], Narumi Takahashi[4], Yoshiyuki Kaneda[5], Naoshi Hirata[6], Takaya Iwasaki[7]

[1] IFREE, JAMSTEC, [2] ERI, Univ. of Tokyo, [3] JAMSTEC, IFREE, [4] DSR, JAMSTEC, [5] JAMSTEC,Frontier, [6] ERI, Univ. Tokyo, [7] ERI, Tokyo Univ.

The Kuril Trench is the oblique convergent boundary located in the northwestern margin of the Pacific plate. The Kuril arc collides with the northeastern Japan Island arc northwest of the Kuril Trench. Historic great earthquakes were generated repeatedly along the trench. These events are attributed to the subduction of the Pacific plate beneath the overriding North American plate. To obtain a complete image of the Kuril arc-trench system, an onshore-offshore wide-angle seismic survey was performed from the Kuril Trench to the sea of Okhotsk through the northeastern Hokkaido (the Kuril arc). In particular, to obtain an image of the subduction seismogenic zone, the seismic profile was selected to across the presumed coseismic rupture zone of the 1973 Nemuro-oki earthquake (M7.4).

Data acquisition and the results from the onshore (northeastern Hokkaido) and offshore (the Pacific ocean and the Sea of Okhotsk) surveys were presented at the last meeting, respectively [Kurashimo et al., 2001; Nakanishi et al., 2001a, 2001b]. To sum up, the 6km/s crustal block exists from the Sea of Okhotsk to the northeastern Hokkaido. There is a prominent reflector within the crust, which may be correspond to the geological boundary between the Cretaceous-Tertiary accretionary complex and the Kuril Island arc. Total thickness of the crust is estimated to be about 25km. In the Pacific ocean, the subducting oceanic crust consists of the oceanic layer 2 (5.5-6.0 km/s) and layer 3 (6.7-6.9 km/s). The sedimentary wedge overriding the subducting oceanic crust is almost the same as large as that obtained off the Sanriku area, the Japan Trench. Comparing the rupture zone of the 1973 event with the crustal model, it is obvious that the coseismic rupture had occurred deeper than the Kuril arc upper crust.

We will present the crustal transect of the Kuril arc-trench system obtained from combined onshore-offshore seismic data, i.e., the offshore airgun shots recorded by land stations and OBSs deployed along another side of the offshore profile, and onshore explosives recorded by OBSs. It is necessary to use these data to obtain the crustal structure of the onshore-offshore boundary areas. In particular, several land stations on southern part of land profile show two prominent later phases (9-10s) which can be identified as reflection from the Kuril arc Moho and the oceanic Moho. From this data, the Kuril arc Moho can be estimated to appear from about 30-40km off Nemuro with the depth of about 40km.

Reference:

Kurashimo et al., 2001 Fall meeting of Seismol. Soc. Jpn., Kagoshima, 2001.
Nakanishi et al., 2001 Japan Earth and Planetary Science Joint meeting, Tokyo, 2001a.
Nakanishi et al., 2001 Fall meeting of Seismol. Soc. Jpn., Kagoshima, 2001b.