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2-D Crustal Structure Model of the Southwestern Margin of the East Sea from Wide-angle Seismic Data

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2-D crustal structure of the southwestern margin of the East Sea was derived through 2-D traveltime modeling and inversion using OBS refraction and wide-angle reflection data. Although some previous researches on this area have suggested the crustal model of Ulleung Basin which located in the southwestern margin of the East Sea, most of the results were from tau-p method and forward modeling which requires interpreter's interaction such as trial-and-error procedures. In this study, modeling and inversion was carried out using 'rayinvr(Zelt and Smith, 1992)' module and we employed the modeling strategies as those of Colin Zelt's(1999). This method produces fast and well-defined results and also provides quantitative estimates of model parameters.

The structural boundary as well as the velocity was also modeled and inverted. Three steps are introduced for this modeling and inversion procedure. In the pre-modeling consideration step, best initial model was built up to minimize the inversion error and to pick each refraction and reflection mode efficiently. In this first step, 2-D MCS data which acquired at the same survey and the result of traveltime tomography inversion from same OBS data were used as prior information. Reciprocity test was also carried out to check validity of the traveltime data. In the second step, crustal modeling and inversion was conducted in two parts; 1) Only refraction phases were used for sedimentary layers(L2∼L5) and upper crust(L6) modeling, 2) refraction, PcP, and PmP phases were modeled and inverted for lower crust(L7) and Moho(L8). Final velocity and structural model derived from previous step was verified by displaying resolution values and synthetic seismograms are superimposed on the real data for intuitive assessment in the final step.

From the results, the sedimentary layer gradually increases in thickness northeastward and the maximum thickness reaches up to 6 km. Its velocity ranges from 1.5 to 4.5 km/s. The crustal layer is characterized by a high-velocity structure between 5.0 and 7.3 km/s similar to that of a crustal velocity structure typical of oceanic although its thickness of about 8 – 15 km is greater than normal. These results suggest that the southwestern continental margin can be explained by a gradual transition from continental to oceanic crust, exhibiting a remarkable decrease in crustal thickness accompanied by being shallow of Moho over a distance of about 90 km.