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Reinterpretation of the lithospheric structure beneath the Hidaka collisionzone, Hokkaido, Japan 2 Biratori-Obihiro Line

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The Hidaka region in the central part of Hokkaido Island, Japan is known as an arc-arc collision zone where the Kuril Arc (southern part of eastern Hokkaido) has been collided against the NE Japan Arc (western Hokkaido) since the middle Miocene. This collision is a controlling factor for the formation of the Hidaka Mountains, the westward obduction of the middle/upper part of lower crustal rocks of the Kuril Arc (the Hidaka Metamorphic Belt) and the development of the foreland fold-and-thrust belt. A series of seismic reflection/refraction surveys from 1994 to 2000 revealed the collision and deformation processes occurring in this region (e.g. Arita et al., 1998; Tsumura et al., 1999; Ito et al., 2002). As indicated by Tsumura et al. (2013, this symposium), the high quality of these data sets has large potentiality to provide more clear collision image and new geological finding with the use of more advanced processing and interpretation techniques including CRS/MDRS method.

This paper focus on the reanalysis for the data sets from ”the Hokkaido Transect Project from 1998 to 2000”, which was multidisciplinary effort intended to clarify the structural deformation process associated with the arc-arc collision. The element of the active source experiment in this project was composed of a 227-km seismic refraction/wide-angle reflection profile running middle part of Hokkaido and three seismic reflection lines from the hinterland to the foreland (Biratori-Obihiro) crossing the Hidaka Mountains.

The previous study for these data sets, mainly based on the forward modelling by the ray-tracing technique, revealed the collision structure in the upper and middle crustal levels beneath the Hidaka Mountains, and a thick sedimentary package developed beneath the fold-and-thrust belt (Iwasaki et al., 2004).

Generally, refraction/wide-angle reflection method and near-vertical reflection profiling are complimentary to each other. Therefore, simultaneous evaluation for these two kinds of data set is expected to yield significant improvement for structural modelling and its geophysical/geological interpretation. In the present analysis, seismic tomography analysis was applied to a combined set of a large amount of near vertical reflection data and the refraction data. This analysis was mainly undertaken to confirm the validity of the upper 20-km crustal structure deduced from the previous result (Iwasaki et al. 2004) and quantitatively evaluate the resolving power of the data sets and the reliability of the structure model. The obtained image is well consistent with the previous result, showing a thick (4-5 km) undulated sediments in the hinterland, the outcrop of crystalline crust beneath the Hidaka Metamorphic Belt with higher Vp and Vp/Vs, probably expressing the obduction of the middle/lower crustal materials, and an enormously thick (>8 km) sedimentary package beneath the foreland. The CRS /MDRS processing for the reflection data provided clearer images of the base of the obducting lower crustal part of the Kuril Arc and shallow structural packages within the fold-and-thrust belt. Furthermore, it succeeded in imaging eastward dipping events around 25-35 km depth beneath the Hidaka Mountains. These reflectors, which were not imaged by the previous conventional CDP processing, are situated below the offscrapped and thrust-up part of the Kuril Arc crust, probably representing the lower crustal part and uppermantle of the NE Japan Arc. In several record sections of the wide-angle data, we can recognize weak later phases at a rather distant offsets (> 80-100 km). Their travel times are explained fairly well by the eastward dipping lower crust and Moho of the NE Japan Arc as indicated by the CRS/MDRS imaging.

Keywords: Hidaka Collision Zone, Kuril Arc, Delamination, NE Japan Arc