Petrological and geochemical features of gabbros and relatively primitive basalts from Nikoro Group, Tokoro belt, eastern Hokkaido: Implications for the geodynamic setting

*Toru Yamasaki[1], Futoshi Nanayama[1]

1. Geol. Survey of Japan (AIST)

The Tokoro belt is a subduction complex located in eastern Hokkaido, Japan. The Tokoro belt was formed by the subduction of Kula plate during the Late Cretaceous and consists of three stratigraphic units: the Nikoro, Yubetsu, and Saroma groups. The Nikoro Group is composed mainly of Late Jurassic to Early Cretaceous igneous rocks intercalated with bedded (or lenticular) chert and limestone. Igneous rocks are made up of basaltic and trachytic pillow lavas, hyaloclastites, dolerite, trachyte dikes, and ultramafic-mafic cumulates. Based on their geological characteristics, whole-rock (WR) major and minor elements, and clinopyroxene (Cpx) major element (MJ) geochemistry, these rocks are presumably derived from fragments of seamounts. In this study, we re-evaluate geochemical features of igneous rocks from the Nikoro Group based on WR and Cpx geochemistry, including trace elements (TEs).

Gabbros show ophitic texture and contain fresh, large oikocrystic Cpx. TE composition of Cpx from gabbros and WR geochemistry of gabbroic rocks are almost identical to the Cpx microphenocrysts of basalts and the WR geochemistry of basalts, respectively. This evidence suggests Cpx-melt partition coefficients for TE remained constant with almost no modification and the gabbroic rocks represent the melt composition. Although these rocks are slightly evolved (Mg# = 0.63), their compositions are among the most primitive rock compositions previously reported from this area. Whole rock TEs show ocean island basalt (OIB) type patterns as well as ‘garnet signatures’ (e.g., $[Sm/Yb]_N > 1$). These geochemical features support seamount origin. In further detail, gabbros and the relatively primitive basalts show rather flat TE patterns compared to the ‘typical’ OIB. After correcting the gabbros and basalts (MgO>7 wt%) for the fractionation effect to Mg# = 0.72, composition X_{72} suggests a significantly shallow lithosphere–asthenosphere boundary depth of ~0 km. WR $[Sm/Yb]_N$ ratios also show the same results. These geochemical results constrain the geodynamic setting of the Nikoro Group; the OIBs erupted through very thin lithosphere. Such a tectonic setting is limited to the ridge–hotspot interaction area.

Keywords: Tokoro belt, Nikoro Group, Ocean island basalt (OIB)

