

Preliminary report of petrology and mineralogy of Mid-Ocean Ridge Basalts from the slow-spreading Knipovich Ridge

Hiroshi Sato[1], K2K onboard scientific team Kensaku Tamaki

[1] Ocean Floor Geotec., Ocean Res. Inst., Univ. Tokyo

Arctic ridge provides an opportunity to study mantle processes under its lowest range of spreading rate. Only sparse samples have been recovered, and significant variations along the Knipovich and Gakkel ridges have not been known. To understand the along and/or across axis variations of MORB and its relations to tectonics in the Knipovich ridge, nine rock sampling operations were performed during the Knipovich 2000 Cruise.

Preliminary results of analysis of glass show that they are tholeiite series basalts. They show different variations for TiO₂ contents even in similar Mg-number, suggesting mantle source heterogeneity. Compositions of olivine show several chemical trends on Mg#-NiO contents diagram.

Arctic ridge north of Iceland (Kolbeinsey, Mohns, Knipovich, and Gakkel ridges) provides an opportunity to study mantle processes under its lowest range of spreading rate. Enough samples have been recovered along southern part of the Arctic ridge (i.e., Kolbeinsey and Mohns ridges) and geochemical and isotopic characteristics of them have been discussed. However, only sparse samples have been recovered, and significant variations along ridge have not been known at the northern part of the Arctic ridge (i.e., Knipovich and Gakkel ridges). In order to understand the along and/or across axis variations of MORB and its relations to tectonics in the Knipovich ridge, nine rock sampling operations were performed during the Knipovich 2000 Cruise by R/V Professor Logachev.

The sites generally concentrate in two areas. One is the northern part of the north Knipovich ridge, and another is "Logachev Mountain" site at the middle part of the northern Knipovich ridge. Other operations were performed in the southern terminal of the northern Knipovich Ridge and in the southern Knipovich Ridge.

At the central valley of the north Knipovich ridge, nearly 40 kg of irregular fragments, pillow basalts fragments and individual smaller flows were recovered from the depth around 2650 m. Basalts were mainly represented by homogenous aphyric to rarely plagioclase-porphiric varieties. Phenocrysts content do not exceed 3 vol. %. They were found both as separate rare plagioclase crystals of tabular form up to 1.5 cm in size and, more frequently, as smaller phenocrysts with a length of not more than 0.5 cm. Olivine phenocrysts are scattered in all samples as rare microphenocrysts. At the western wall of the northern Knipovich ridge, fragments of highly weathered phyric basalts and relatively large, massive, coarsely phyric basalts with metamorphic contact with sedimentary rocks were recovered.

At the central valley of the "Logachev Mountain" site, glomero plagioclase porphyric basalts composed of 60% of the recovered material, and aphyric rare Pl-porphyric basalts occupy approximately 40 vol. % of recovered rock samples. The former includes plagioclase both with irregular oscillatory zoning (small amount) and with reverse zoning (dominant). Rare olivine in the former type of basalts shows relatively primitive compositions (Mg number=91-89, NiO=0.2-0.4 wt%).

At the southern terminal of the northern Knipovich Ridge, fresh aphyric to scarcely phyric basalts with basaltic glass were recovered. On the thin section scale, small phenocryst of olivine and plagioclase are scattered.

At the southern Knipovich ridge, relatively fresh massive basalts were recovered. They are phyric and small olivine and plagioclase in size and volume are scattered on the thin section scale.

Preliminary results of geochemical analysis of glass indicate that they are tholeiite series basalts. They show different variations for TiO₂ contents even in similar Mg-number, suggesting mantle source heterogeneity. This is also supported by chemical compositions of olivine, for which there are several chemical trends on Mg number-NiO contents diagram. In the presentation, more detail petrological and mineralogical characteristics of these MORB will be discussed with tectonics in this area.