Intensive hydration of the wedge mantle at the Kuril arc – NE Japan arc junction: implications from mafic lavas from Usu Volcano, northern Japan

TAKESHI KURITANI[1], MAYUMI TANAKA[2], TETSUYA YOKOYAMA[3], MITSUHIRO NAKAGAWA[1], AKIKO MATSUMOTO[1]

[1] Graduate School of Science, Hokkaido University, Sapporo, 060-0810, Japan
[2] Kyoto City Office, Kyoto, 604-8571, Japan
[3] Graduate School of Science and Engineering, Tokyo Institute of Technology, Tokyo, 152-8551, Japan

The southwestern part of Hokkaido, northern Japan, is located at the junction of the NE Japan arc and the Kuril arc. The subducting Pacific plate beneath this region shows a hinge-like shape due to the dip change of the subducting plate along the trench. Because of the interest in this unique tectonic setting, this arc-arc junction has been the focus of extensive geophysical studies (e.g. Wang & Zhao, 2005; Nakajima et al., 2006; Kita *et al*., 2010, Wada *et al*., 2015). This region is also known as an area in which magmatism has been intense (e.g. Tamura *et al*., 2002); there are many active volcanoes such as Usu, Tarumae, and Komagatake, and large calderas including Toya, Shikotsu, and Kuttara. In this region, the temporal and spatial evolution of the volcanism and the chemical compositions of the volcanic rocks are well characterized (e.g. Nakagawa, 1992). However, the generation conditions of magmas have not been estimated for these volcanoes, probably because of the scarcity of basaltic products. Therefore, it remains unclear whether the intensive magmatism of this region is linked to the unique tectonic setting of the arc-arc junction. In this research, we carried out a petrological and geochemical study on mafic lavas (49.6–51.3 wt.% SiO_2) from Usu Volcano, and estimated the conditions under which the magmas were generated. The water content of the basalt magma was determined to be ~4.8 wt.% using a plagioclase-melt thermodynamic equilibrium. Using this information and the olivine maximum fractionation model (Tatsumi *et al*., 1983), the water content of the primary Usu magma was estimated to be ~3.9 wt.%. Analyses of multicomponent thermodynamics results suggest that the primary magma was generated by 23.1% melting of the source mantle with 0.94 wt.% H_2O at ~1300ºC and ~1.4 GPa. The 0.94 wt.% water content of the source mantle is significantly higher than those beneath volcanoes in the main NE Japan arc (generally <0.7 wt.% H_2O); this implies that the wedge mantle at the arc–arc junction is intensively hydrated.