Crustal magmatic processes beneath Askja volcano, situated at the eastern part of Iceland, are investigated by petrological and geochemical approaches. Iceland is located on which a mantle plume underlies the Mid-Atlantic Ridge. Because of the characteristic geologic setting, Iceland has been studied extensively for many kinds of objects, including the origin of the mantle plume, the mechanism of melt transport, and the evolution of the crust. Although magmatic processes beneath Iceland have been investigated especially for silicic magmas, detailed investigations for basaltic magmas have not yet been done. This is important for extraction of geochemical information of the deep level from erupted materials, by evaluating the effect of geochemical modification resulting from the magmatic processes within the crust.

Recent activity of Askja volcano consists of explosive eruption of rhyolitic products in 1875, followed by basaltic fissure eruptions in 1921, 1922-26, 1929, and 1961. Samples used in the present study are mainly from 1921, 1922, and 1961 lavas. Whole-rock compositions of these samples are mostly 49.9-50.4 wt.% in SiO₂, but some rocks have more evolved compositions (Fig. 1). The whole-rock SiO₂ content of 1875 rhyolite is up to 71 wt.% and the samples from 1875 to 1961 ejecta are on smooth composition trend. The samples of 1921, 1922, and 1961 lavas can be discriminated clearly in the variation diagram (Inset of Fig. 1). By utilizing techniques of highly precise analysis, significant variation of $^{206}\text{Pb}^{207}\text{Pb}$ ratio is detected in the basaltic samples. In addition, the ratio tends to increase gradually from basaltic to rhyolitic compositions (Fig. 2). Basaltic rocks scarcely have phenocrysts, and the assemblage is either plagioclase + augite + titanomagnetite or solely plagioclase. Phenocrysts commonly have textures showing evidence of rapid growth.

One plausible origin of the rhyolitic magma is a product of crustal melting probably by heating by basaltic magmatism. This may be supported by the distinctive $^{206}\text{Pb}^{207}\text{Pb}$ ratio from that of basaltic rocks. In this case, however, the samples of intermediate compositions should have been produced by mixing between basaltic and rhyolitic magmas. This model of two component magma mixing is negated by the observation that composition trends for some elements show curvature (Fig. 1). Instead, the basaltic – rhyolitic magmas is considered to have been produced in a series of magmatic differentiation with contemporaneous crustal assimilation. This can explain well the variations of the isotopic composition and whole-rock compositions from basaltic to rhyolitic rocks. In spite of the narrow range in SiO₂ content, the variation of the $^{206}\text{Pb}^{207}\text{Pb}$ ratio of basaltic magmas is significant and mostly compares to the difference between basaltic and rhyolitic magmas (Fig. 2). This is likely to have resulted from extensive assimilation of fusified crustal materials relative to crystal fractionation processes for hot basaltic magmas. The rapid growth of phenocrysts in basaltic rocks might reflect large heat flux from basaltic magma to the surrounding crust.