The characteristics of high-FeTi alkali basalt from Fukuoka area, SW Japan

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Back arc region of southwest Japan has been a locus of basalt volcanism since Miocene. Activity in northwest Kyushu and Abu areas was vigorous, and volumetric basaltic magma erupted. Fukuoka area is located between these two areas. In this area relatively small but many sites of basaltic lava are scattered along the Japan Sea coastal line. Erupted ages of the lavas range from 5Ma to 2Ma (Matsumoto et al.,1992). Despite of the wide range of space and time, most of these lavas have common chemical characteristics (high Fe and Ti contents and low SiO2 content) and are well distinguished from basalts from other areas. The characteristic chemical compositions may reflect the nature of source region, and Fukuoka lavas may yeild significant information to constraint on the mantle processes beneath southwest Japan. In this study we aimed to clarify the source region and the petrogenesis of Fukuoka lavas.

Fukuoka lavas have SiO2 contents from 43 to 51wt% and (Na2O+K2O) contents from 3.7 to 5.2 wt% and are classified into the alkali basalt of Cox et al.(1979). Most of them are nepheline normative. Incompatible element concentration patterns of the lavas are similar to those of ocean island alkali basalts. Phenocryst abundances are up to 10 vol.%. The majority is olivine for rocks of SiO2 less than 47.5 wt.% and clinopyroxene + olivine + opacited amphibole for SiO2 more than 47.5 wt.%. Plagioclase phenocryst is not found. MgO contents are from 4.5 to 7.5 wt.% and are too low for primitive melt. The remarkable characteristics of the lavas are high-Fe2O3*(total Fe as Ferric) and TiO2 contents, up to 17 wt.% and 3.8 wt.%, respectively. The Fe2O3* contents are highest in Japan. CaO contents are more than 9 wt.% and are similar to those of primitive basalts from southwest Japan. Al2O3 contents are 14- 17 wt.% and are slightly lower than basalts from northwest Kyushu. Trace element concentrations are as follows ; Rb = 10-25ppm, Ba = 220-380ppm, Nb = 20-40ppm, Sr = 670-1100ppm, Zr = 190-230ppm, Y = 20-40ppm. Rb/Sr ratio is N-MORB like value of 0.017-0.03.

N-MORB like Rb/Sr ratios and low SiO2 contents indicate that crustal assimilation was not significant. The moderately low MgO contents are considered to be due to crystal fractionation. Absence of plagioclase phenocryst and relatively high CaO contents indicate that clinopyroxene and plagioclase was not fractionated. The dominant fractionated phase was olivine. It is difficult to enrich Fe2O3* to 17 wt.% by olivine fractionation from a level of primitive melt derived from primitive peridotitic mantle. This implies that the primitive magma of the lavas were eniriched in Fe2O3* and were derived from the Fe-rich source region.

The lavas are thought to preserve the trace element characteristics of their source because of absence of crustal assimilation and relatively simple differentiation history. N-MORB like LILE (Large Ion Lithophile element) /Nb ratio indicate that contribution of metasomatic fluid was minimum. Nb/Zr ratio is relatively constant through partial melting process and reflect the nature of the source. The lavas show relatively high Nb/Zr ratio of 0.1-0.2. It is difficult to produce the concentrations of Nb and Zr and relatively high Nb/Zr ratio from primitive mantle or recycled MORB. The source was thought to be enriched in HFSE(High Field Strength Element) compared to primitive mantle.

These Fe and HFSE-rich source region was considered to be scattered beneath this area. We will further report the other trace element characteristics of the lavas.