Geochemistry of volcanic rocks from Jeju Island, South Korea: Implications for petrogenesis and mantle source

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Volcanic rocks distributed in Jeju Island, South Korea are dominantly alkaline suites with small amounts of interlayered association of tholeiitic (TH) basalts. The alkaline suites can be subdivided into two sub-suites: high-Al alkaline (HAA) and low-Al alkaline (LAA). We have determined major and trace element abundances, and Sr-Nd-Pb-Mg isotopic compositions for sixty samples from boreholes and outcrop to better understand the petrogenesis and mantle source characteristics. The whole-rock $^{40}Ar/^{39}Ar$ ages range from ca. 968 to 24 Ka. The HAA suite began to form slightly earlier than the other suites. On a primitive mantle-normalized trace element distribution diagram, Jeju basaltic rocks exhibit typical oceanic island basalt-like LILE enrichments without significant depletion in Nb-Ta. However, they show negative anomalies in K, Rb and Sm, implying K-richterite as a residual phase in the source. Some samples, especially the TH and HAA suites, exhibit positive anomalies in Eu and Sr, indicating an important role of plagioclase in the genesis. Also note that the basaltic rocks have fractionated Nb/Ta and Zr/Hf ratios with negative Ti anomalies. The Sr-Nd-Pb isotopic compositions display a good linear array between depleted mid-ocean-ridge basalt (MORB) mantle and enriched mantle type 2 (EM2). There are no discernible isotopic differences in the three suites. The isotopic enrichments are coupled with elevated incompatible trace element ratios such as Th/La and Th/Nb. The Mg isotopic compositions have a range of $\delta^{26}Mg$ values from -0.53 to -0.20‰, extending to much lower values than normal mantle ($\delta^{26}Mg$ = -0.25 ± 0.07‰). These observations suggest the presence of rutile-bearing carbonated recycled oceanic gabbro and sedimentary components in the mantle source of Jeju volcanic rocks together with peridotite component.