Geochemistry of Cenozoic basalts in northern Kyushu

KITAGAWA, H.[1], SAKAGUCHI, C.[1], TOKESHI, S. 1*, AND NAKAMURA, E.[1]

[1] PML, ISEI, Okayama University, Misasa, Tottori, Japan

[*] Present address: Japan Agency for Marine-Earth Science and Technology [JAMSTEC], 2-15, Natsushima-cho, Yokosuka, Japan

Late Cenozoic intraplate basalts are widely distributed in east Asia, including northeastern China, Korean Peninsula, and southwestern Japan [1]. The lavas occur in the regions above the toes or gaps of the stagnant slab of Pacific Plate in the mantle transition zone (MTZ) [2]. Geochemical studies suggested the derivation of magma sources from MTZ [3, 4].

This study presents geochemical analyses on Cenozoic lavas from northern Kyushu, SW Japan. The magmatic activity was dominated by eruption of alkaline basalt (ALK). Three districts are recoginzed as type locality; Kita-Matsuura (10–6 Ma), Higashi-Matsuura (3 Ma), and Fukuoka (4–1 Ma) [5]. The asthenospheric origin of magma sources is supported by high *P-T* condition of melting (3 GPa, 1500 ˚C) estimated on primitive ALK. The Sr-Nd-Hf-Pb isotopic compositions fall within the range observed in Cenozoic basalts from east Asia. Three end-member components, recognized mainly based on Pb-isotope compositions, contributed differently to magmas in each district. The source prominent in Kita-Matsuura ALK is characterized by higher $^{208}Pb/^{204}Pb$ at a given $^{206}Pb/^{204}Pb$, such a feature is also found in ALK from Ulleung and Dokdo islands [6]. The EM1-like source, also found in NE China [3], contributed largely to Higashi-Matsuura ALK. The Fukuoka ALK defines the most radiogenic Pb-isotopic source. The origins of these sources are attributed to deep-subducted slab and sediment, based on boron-isotopic compositions.

The seismic gap on the stagnant slab, interpreted as slab tear [7], is located beneath northern Kyushu, Ulleung, and Dokdo. The spatial coincidence with lava geochemistry suggests that the upwelling mantle ingested dehydrated crustal sections of the stagnant slab. The numerical experiment demonstrates that the vigorous upwelling could rise at the toe or gap on the stagnant slab [8], a conclusion seemingly consistent with our model based largely on geochemical data.

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