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Mantle degassing in South Korea

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In East Asia, including Korea, widespread intraplate volcanism has appeared during the late Cenozoic. The origin of magmatism has been suggested by various hypotheses such as stagnant Pacific plate or mantle corner flow beneath East Asia. Here we provide a new perspective on the Cenozoic East Asian magmatism using geochemistry of volatiles. In order for this, $^{3}He/^{4}He$ (1 Ra = 1.38 x 10^{-6}) ratios and $\delta^{13}C\text{-}CO_2$ (vs. VPDB) values of Korean Cenozoic basalts and spring gases were measured. The maximum $^{3}He/^{4}He$ ratio (7.3 Ra) of the basalts appears within the range of the depleted MORB mantle (8 ± 1 Ra). In addition, the spring gases have the maximum $^{3}He/^{4}He$ ratio (6.8 Ra) corresponding to the lithospheric mantle range (6.1 ± 0.9 Ra). Moreover, spring gases show high carbon dioxide concentrations (up to 99 vol.%), and the $\delta^{13}C\text{-}CO_2$ values mainly indicate the mantle origin (-6.5±2.5‰). Overall, gases containing mantle-derived volatiles are discharged to the surface adjacent to the Cenozoic volcanic rocks, which shows that it is largely consistent with the recently reported distribution of low velocity zones beneath the Korean Peninsula. Therefore, we propose that the asthenospheric mantle upwelling can explain the Cenozoic intraplate magmatism in Korea, releasing volatiles of the mantle origin.