5.3.P02

He-Sr isotope constraints on the mantle beneath the Monte Vulture volcano, southern Italy

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The Monte Vulture volcanic complex, southern Italy (<1Ma) is composed of dominantly silica undersaturated ultrabasic to intermediate lavas and pyroclastic flows. It is located east of the main axis of the Appennine chain, on the Adria plate margin. We have undertaken a He isotope study of olivine and pyroxene in lavas and pyroclastic flows from the major episodes of volcanism at Monte Vulture. Together with whole-rock and pyroxene $^{87}Sr/^{86}Sr$ and major and trace element chemistry we define the geochemical characteristics of the region, clarify the magmatic evolution and shed light on the relation between Vulture volcanism and the closely related Roman Magmatic Province (RMP).

In vacuo crushing of olivine phenocrysts yields $^{3}He/^{4}He$ ranging from 6.0 R_a in the youngest deposits (c. 130 ka) to 4.4 R_a in the older samples (440-500 ka). This range is between the RMP (5.2 - 0.4 R_a: Martelli et al., submitted) and Etna (6.7 ± 0.4 R_a: Marty et al., 1994), suggesting a mantle source with HIMU affinities. Pyroxenes yield consistently lower $^{3}He/^{4}He$ than co-existing olivines. This is either due to crustal contamination or radiogenic He ingrowth in the magma. Strontium isotopes ratios ($^{87}Sr/^{86}Sr$ =0. 7056) are more radiogenic than Etna ($^{87}Sr/^{86}Sr$= 0.7035).

These results agree well with the enrichment of incompatible elements, displaying LILE/HFSE ratios lower than the RMP and intermediate between intraplate and subduction-related compositions (Peccerillo & Panza, 1999). Furthermore, in $^{143}Nd/^{144}Nd$-$^{87}Sr/^{86}Sr$ space, Monte Vulture volcanics fall between Vesuvius and Etna. Together with the other Italian volcanics the geodynamical meaning of Monte Vulture are discussed.

In comparison with the RMP and Etna, the He and Sr isotopes suggest that the Monte Vulture volcanism was dominantly sourced in a asthenosphere mantle with HIMU affinities. However, the low $^{3}He/^{4}He$ and high $^{87}Sr/^{86}Sr$ relative to Etna imply that the parental magma has a small contribution of mantle that has been metasomatically-enriched during subduction of the Adriatic plate.

5.3.P03

Subduction-related metasomatic signature in noble gases in mantle derived xenoliths from Cheju Island, Korea

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Cheju Island, a shield volcano composed of Quaternary alkaline basalt to trachyte, is located 90 km south of the Korean Peninsula. Ultramafic xenoliths are observed in lava flows of the alkaline basalts. Spinel lherzolites are the major constituent of the ultramafic xenoliths, and are derived from the subcontinental lithospheric mantle (SCLM) [1]. The maximum CO_2 density of fluid inclusions in the xenoliths determined by micro-Raman densimeter is 1.10 g/cm^3 for clinopyroxene, which corresponds to the depth of 31-35 km assuming temperature of 880-1040°C. Although the depth is shallower than that determined by mineralogical geobarometer (45-90 km) [1], probably resulting from plastic deformation during ascent of xenoliths with surrounding hot magma, it is deeper than the thickness of continental crust at this region (30 km) assuring mantle origin of the volatiles in the fluid inclusions.

Noble gas isotopic compositions of minerals (olivine, orthopyroxene, and clinopyroxene) separated from the xenoliths were determined using both crushing and stepwise heating extraction methods. Except for high $^{3}He/^{4}He$ ratios observed at low temperature of the stepwise heating due to post-eruptive addition of cosmogenic ^{3}He, all the samples showed uniform $^{3}He/^{4}He$ ratio of 6.51 ± 0.05 R_A independently with the extraction method. The 3He/4He ratio lower than the MORB value (8 ± 1 R_A) indicates higher $(U+Th)/^{3}He$ ratio of the SCLM than that of the MORB source mantle. The highest $^{40}Ar/^{36}Ar$ ratio was 5500, which is significantly lower than that of the MORB source mantle (>28000). Noble gas concentration of inclusion-rich olivines was one order of magnitude higher than the other samples, indicating that the fluid inclusions are trapping site of noble gases. Considering a rough correlation between mantle-derived ^{3}He and atmospheric ^{36}Ar, the low $^{3}He/^{4}He$ and $^{40}Ar/^{36}Ar$ ratios of the SCLM beneath Cheju Island are explained in terms of metasomatism by a slab-derived component, which subducted at the southeastern end of the continental margin of the Eurasian plate from Late Jurassic to Paleocene.

Reference

[1] Choi S.H., Jwa Y.-J., and Lee H.Y. (2001) *The Island Arc* **10,** 175-193.