



## **Constraints on mantle source and interactions from helium-strontium isotope variations in Italian volcanism**

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Helium isotope ratios of olivine and pyroxene from Plio-Quaternary volcanic rocks from Southern Italy (each of the seven Eolian Islands, Mt. Vulture, Etna, Ustica, Pantelleria), range from 2.3 to 7.1  $R_a$ . A good correlation emerges with the  $^3\text{He}/^4\text{He}$  of fumarolic fluids. Importantly the phenocryst  $^3\text{He}/^4\text{He}$  correlate with whole rock Sr isotopes (0.70309-0.70711) reflecting the mixing of two sources. Crustal contamination of magmatic He isotopes is recorded only occasionally (e.g., pyroxenes from Vulcano). The He isotope values of Pantelleria, Etna, Iblei, Ustica, Alicudi and Filicudi ( $7.0 \pm 0.6 R_a$ ) define the mantle composition least affected by subduction. That these characterise volcanoes from a variety of tectonic regimes (subduction-related, intraplate, rifting) suggest a common origin of geochemical features and are consistent with a HIMU-type mantle that is either younger than the Cook-Austral island end-member, or one with lower  $^{238}\text{U}/^{204}\text{Pb}$ . When merged with data from the Roman Comagmatic Province (Latium and Campania), a remarkably strong He-Sr isotope correlation is apparent. The general northward decrease in  $^3\text{He}/^4\text{He}$  corresponds to an increase in  $^{87}\text{Sr}/^{86}\text{Sr}$  and decrease in  $^{143}\text{Nd}/^{144}\text{Nd}$  and  $^{206}\text{Pb}/^{204}\text{Pb}$  that is due to increasing metasomatic enrichment of the mantle wedge via subduction of the Ionian Adriatic plate since 30 Ma. Calculations based on the ingrowth of  $^4\text{He}$  in the wedge and on the  $^4\text{He}$  content of the subducting crust show that mechanisms of enrichment in radiogenic He are effective only if the wedge is strongly depleted in He relative to

best estimates of the depleted mantle.