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Helium isotope constraints on the mantle source of OIB-type Na-alkaline magmatism in Southern Mediterranea

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The source of OIB-type intra-plate alkaline basaltic magmatism occurring in pure continental environment at the African-European collision plate boundary in Southern Mediterranea remains enigmatic. Here we report new helium isotope data for three volcanoes of this magmatic province: Pantelleria, Linosa and Ustica islands. Homogenous $^{3}He/^{4}He$ ratios (range: 7.1-7.8 Ra, mean: 7.5$\pm$0.2 Ra) in 0.03-1 Ma olivine-bearing basalts-hawaiites from the three islands, as well as in present-day Pantelleria volcanic gases, point to a common and constant magmatic end-member. Together with previous data for alkaline volcanism at Mount Etna (6.7-7.5 Ra) and Monti Iblei (7.3$\pm$0.2 Ra) in Sicily mainland, our results contribute to delineate a $\sim$250 km wide magmatic province whose $^{3}He/^{4}He$ ratio is uniform and higher than any other Plio-Quaternary volcanic series further north in Italy and continental Europe. In particular, Ustica (7.6$\pm$0.2 Ra) clearly differs from nearby Aeolian island arc volcanoes ($\leq$6.5 Ra), despite its location on the Tyrrhenian side of the plate boundary. The He-Pb isotopic signature of this province is consistent with its feeding by diapiring of mixed European Sub-Continental Mantle (6.1$\pm$0.9 Ra) and MORB-like ($\sim$8 Ra) asthenosphere, in broad agreement with seismic imaging. Even though deeper supply of heat and some material from below the 660 km transition zone cannot be excluded, our results leave little room, if any, for the contribution of ^{3}He from the lower mantle.