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Noble gases signature of mantle beneath Stromboli (Aeolian Islands, Italy), as inferred from fluid inclusions investigation in mafic phenocrysts from HP-LP products and from ultramafic xenoliths

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We present a study of noble gases abundances (He, Ne, Ar) and isotopic ratios (He, Ar) in olivine- and clinopyroxene-hosted fluid inclusions from basaltic Low Porphyritic (hereafter LP) pumices and High Porphyritic (hereafter HP) scorias, respectively of paroxysms and mild explosions of the Stromboli present activity and from ultramafic xenoliths retained in the ∼2 ka ago San Bartolo lavas. New petrologic studies on such ultramafic xenoliths show that they are mostly wherlites (subordinately lherzolites), with slightly protogranular to porphyroclastic texture. New thermo-barometric estimates on the mineralogical assemblage indicate that ultramafic xenoliths equilibrated at depth close to the crust-mantle transition of Stromboli.

While Ar isotopes are dominated by a clear atmospheric signature in all the samples, $^3He/^4He$ from LP pumices and S. Bartolo ultramafic xenoliths converge to a value of 4.2-4.7 Ra, with relatively high gas content. Conversely, the low gas content of the HP scorias allowed us to measure chemical concentrations but not their $^3He/^4He$ ratio. Inferences found out from gas content are therefore in full agreement with previous knowledge about differences in volatile content between HP and LP magmas. The $^3He/^4He$ measured values are much lower than those of most primitive mantle terms of the Sicilian volcanism (7±0.6 Ra), due to contamination at mantle level beneath Stromboli, operated by the Ionian subducting slab.

On the basis of the measured $^3He/^4He$ in the LP pumices and ultramafic xenoliths, helium in thermal waters from the Stromboli basal aquifer is a mixing of a mantle-derived and an atmospheric term. The $^3He/^4He$ values measured in the rocks constitute the upper limit that should be expected in thermal fluids in case of effusions and/or paroxysms.