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Origin of He and CO_2 in the gas manifestations of Greece

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In the period from 2004 to 2017, more than 350 samples of free and dissolved gases were collected along the whole Hellenic area. Some literature data have also been taken into consideration (Rizzo et al., 2016). Samples have been analysed for their chemical and isotope composition. The concentrations range from 0.10 to 3370 μmol/mol for He, 600 to 995,000 μmol/mol for N_2, 0.60 to 915,000 μmol/mol for CH_4 and 17 to 1,002,000 μmol/mol for CO_2, whereas the isotope values range from 0.01 to 7.10 for R/R_A and -29.91 to +6.00 for $\delta^{13}C - CO_2$. Considering the R/RA and $^4He/^{20}Ne$ ratios the atmospheric, mantle and crustal contributions for He have been calculated (Sano and Wakita, 1985). The highest mantle contribution (50 to 90%) is found in the South Aegean Active Volcanic Arc (SAAVA), whereas the lowest in continental Greece (0-20%). Atmospheric contribution is mostly negligible. Taking into consideration the geographical distribution of the gases, it is evident that the R/R_A increases in areas characterized by: i) thin crust; ii) elevated heat flow values; iii) recent (Pleistocene-Quaternary) volcanic activity; and iv) deep routed extensional or transtensional regional faults. The highest values are therefore found along the SAAVA and the lowest in the western part of Greece. Furthermore, based on the $CO_2/^3He$ and $\delta^{13}C$-CO_2 values (Sano and Marty, 1995), the contribution of Sediment, Mantle and Limestone end-members for CO_2 was determined. The majority of the collected samples present a prevailing limestone C component and only few samples have a prevailing mantle C component. However, with the present data, it is not possible to distinguish CO_2 deriving from crustal and slab-related limestones. Additionally, due to the complex geodynamic history, the mantle C isotopic composition could be affected by subduction-related metasomatism and, similarly to the nearby Italian area (Martelli et al., 2008), the C isotope composition could be more positive. In this case, the mantle contribution is probably underestimated.

Martelli et al., 2008. Gcubed, 9, Q02001
Rizzo et al., 2016. Scientific Reports 6, 28013
Sano and Marty, 1995. Chem. Geol. 119, 265-274.
Sano and Wakita, 1985. J. Geophys. Res. 90, 8729–8741