He, Ne, Ar isotope systematics of Seblyavr massif rocks, Kola Peninsula

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The Seblyavr ultramafic–alkaline–carbonatite massif is one of the largest (4×5 km) Paleozoic complexes intruding Archean gneisses of the Kola Shield. The complex has a concentrically zoned structure. The inner zone consists of olivinites, clinopyroxenites, ijolites, phoscorites and carbonatites, surrounded by wide fenite aureole. All magmatic rocks were largely transformed by CO_2-rich alkaline fluids derived from later carbonatite injections. To better understand the sources and evolution of fluid phases we performed noble gas isotope analyses in monomineralic separates from pyroxenites, ijolite and carbonatites extracting gases by stepwise crushing. The samples were collected from different drill sites, with depths ranging from 40 to 65 meters.

The data show typical plums-like $^4He/^3He$ ratios [1,2] in initial crushing steps of pyroxenes, garnet and magnetite, and more radiogenic values with prolonged crushing. Calcites from all magmatic series are characterized by a ^3He content which is three orders of magnitude lower than in silicate minerals, and crustal-like $^4He/^3He$ ratios due to release of *in situ* radiogenic ^4He. The much lower He content in carbonatites has been previously attributed to postmagmatic loss [3]. Neon isotopic data of initial crushing steps of most samples are consistent with a mixing line close to Loihi samples. Data of a calcite from amphibole-carbonatite form a mixing line right to the Réunion line, thus showing a more nucleogenic $^{21}Ne/^{22}Ne$ mantle endmember of 0.0426±0.0019 (at $^{20}Ne/^{22}Ne$ = 12.5) as well as $^{40}Ar/^{36}Ar$ mantle component of 4579±342 (1 σ). Data of the other samples converge at a value of ~4000 which is consistent with the value of 5000±1000 reported by [2].

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