Oxygen isotope ratios in alkaline basites from Kuznetsky Alatau ridge (South Siberia)

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Introduction

Alkaline basites investigated by us are located in the northern part of the Kuznetsky Alatau ridge (South Siberia). This rocks form a lot of minor multiple intrusions and can be classified in four major groups: middle-alkaline gabbro, theralites and feldspar-bearing foidolites, foidolites (urtites and ijolites), nepheline syenites. According to our data veins of comagmatic calcite carbonatites are established in the one of such intrusions.

Results

We studied an isotopic composition of oxygen in rock-forming clinopyroxenes, plagioclases, nephelines (40 mineral fractions) and whole-rock (22 samples) from some alkaline basic massifs (MI 1201V mass spectrometer, standard deviation ±0,2 ‰ relative to SMOW, analyst is B.G. Pokrovsky, IGEM RAS, Moscow). Mean ^{18}O values in whole-rock samples consistently increased from 8,4‰ in more ancient gabbro to 9,6‰ in theralites and foidolites and to 10,5 ‰ in more young nepheline syenites. The similar trend to range mean ^{18} values is revealed for clinopyroxenes in the sequence from gabbro (7,2‰), to theralites and feldspar-bearing foidolites (8,9‰) and to foidolites (9,3‰) except one data (8,2‰) measured in nepheline syenites. Plagioclases and feldspars have a tendency to increase of oxygen isotopic parameters also (from 8,6‰ in basic rocks to 10,6‰ in nepheline syenite). The rock-forming nepheline is characterized by similar ^{18}O values (10,0-10,7‰). Nevertheless a sharp violation of isotopic equilibrium between minerals isn't observed in spite of enough high level of total contamination in rocks. In this case the crustal material seems to enter in the magmatic system during the liquid stage. The fractionation of oxygen isotopes (^{18}O) between co-existing clinopyroxenes and plagioclases (0,8-2,4) or clinopyroxenes and nephelines (0,5-1,9) is assumed a conservation of oxygen isotope system by wide-range temperature from 870-890°C to 360-410°C.

Conclusion

Results of these researches can show a progressive crust contamination of parental mantle alkaline basic magma during its uplifting and differentiation. For our example, this processes was caused a transformation of not only oxygen but also Rb-Sr-isotopic system in rocks. Most effect of contamination is observed in carbonatites (I_{Sr}=0,7057-0,7065; ^{18}O=11,8-15,5 ‰) associated with alkaline rocks. According to our preliminary data parameters of Sm-Nd isotopic system in studied alkaline rocks and carbonatites (Nd_T=5,0-7,2) unlike oxygen and stroncium aren't alterated and can show a depleted mantle source of parental magma.