3.5.P03

Nitrogen isotopic composition of bubbling gases from some thermal springs at Jalisco Block, Mexico: Evidence of a ^{15}N-enriched source

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The Jalisco Block (JB) is a distinct crustal unit bounded toward the mainland by rifting and toward the Pacific ocean by the NW section of the Mid-America trench, a contact between the subducting Rivera plate and the continent. Therefore JB can be considered as a large geologically and tectonically complex for-arc region. Thermal springs and groups of springs are widely distributed over JB. Bubbling gas from seven groups of thermal springs located within different tectonic settings of the JB was analyzed for He, Ne and N_2 concentrations, $^3He/^4He$ and $\delta^{15}N$. All gases are N_2-dominant (>84%) except only one sample (La Purificacion) with a significant CH_4 content (>50%). All collected gas samples are relatively high in He, up to 1500 ppmvol, and with $^3He/^4He$ values ranging from 0.6 to 4.5Ra, where Ra is the air $^3He/^4He$ value. The highest He ratios were measured in springs of the Colima rift (2.6 and 4.5Ra).

The N_2 excess with respect to air computed on the basis of N_2/Ne ratios ranged from 21 to 95% indicating a N_2-rich source. A good correlation was observed between $\delta^{15}N$ and the excess of N_2 with $\delta^{15}N$~5‰ for the maximal N_2 excess of ~100%. Such a positive value reflects the contribution of sediment-derived nitrogen ($\delta^{15}N$= +2 ÷ 7.7) [1, 2, 3].

A mixing in different proportions of fluids coming from the mantle, shallow crustal sediments and subducted oceanic sediments has been highlighted coupling $^3He/^4He$ and $\delta^{15}N$ isotope values.

The existence of a heavy N-enriched endmember ($\delta^{15}N$= +4.7±0.2), probably derived from recycled crustal material involved into the subduction process beneath the Jalisco Block has been suggested.

References

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3.5.P04

Alkali chloride-carbonate mantle component in the uniquely fresh Udachnaya pipe kimberlites

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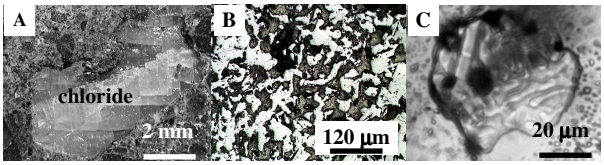
We report evidence for extreme enrichment of mantle-derived melts in CO_2 and Cl, based on the study of exceptionally fresh Late Devonian Udachnaya pipe kimberlites (Siberia) and their olivine hosted melt inclusions. Kimberlite groundmass, in addition to euhedral olivine (55 wt%) and calcite (20 wt%), contains 7-11 wt% of water soluble chlorides, carbonates and sulphates of Na and K (ratio 5:3:1, Figs. A-B). Some other Cl-bearing minerals (sodalite, djerfisherite) are also present. A primary origin of alkali chlorides and carbonates is confirmed by the study of Sr isotopes in the water- and dilute acid-leachates of the groundmass ($^{87}Sr/^{86}Sr$ - 0.7069 and 0.7050), that contrast with the isotope composition of the platform carbonates/evaporites (0.7080-0.7095) and Udachnaya mine site brines (0.7089).

Melt inclusions in zoned groundmass olivine (Fo_{86-93}) were used to determine the composition of the kimberlite melt prior to emplacement. Olivine cores and their clinopyroxene inclusions, formed at significant depth (40-50 kb), and olivine rims contain melt inclusions, composed of halite, sylvite, Na-K-Ca carbonates, phlogopite, olivine and CO_2 fluid. Two major components of melt inclusions, chloride and carbonate, show liquid immiscibility at T<600°C (Fig. C) in heating stage experiments. Similar immiscible phases are still preserved in the segregations in the groundmass (Fig. B; white – carbonates, gray - chlorides).



Although Cl in the groundmass is high (up to 4 wt%), it could have been even higher in the kimberlite melt (up to 22 wt%) before chloride-carbonate melt immiscibility occurred in solidifying magma, and chlorides were partly flushed out. Chlorine excess by a factor of >9 over elements of similar incompatibility (e.g. Nb, La) possibly implies that the source mantle of kimberlites was significantly enriched in Cl.