

## **New data on isotopic signature of the thermal groundwaters from Kuldur spa (Russia)**

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The research is based on the results of field works that was conducted in the period 2014-2015 and 2018-2019.

The purpose of this work is to study the isotopic signature of nitric thermal groundwaters from Kuldur spa and characterize their circulation processes. For solving this task, multiple isotopes  $\delta D$ ,  $\delta^{18}O$ ,  $^3H$ ,  $^3He/^4He$ ,  $^4He/^{20}Ne$ ,  $\delta^{13}C$ ,  $^{234}U/^{238}U$  together with geothermometer calculation were utilized.

The thermal waters were sampled for isotopic analysis. Samples for  $^{18}O$ ,  $D$ ,  $^{13}C$ ,  $^{234}U/^{238}U$ ,  $^{15}N$  analysis were not filtered and placed in a special dish. The sample volume isotope  $^{234}U/^{238}U$  was 1,5 liters, for  $^{13}C$  5 liters. In the samples for analysis of isotope  $^{13}C$ , the  $Ba(OH)_2$  was added for precipitating  $BaCO_3$  for its further analysis.

The  $\delta^{18}O$  and  $\delta D$  are parallel with GMWL showing that the recharge source of thermal water is local meteoric precipitation. Value of  $^3H$  are very low up to 0.7 TE which indicate the long circulation time and also confirm no dilution of deep thermal waters with shallow cold water.

The obtained data on the isotopic composition of  $^3He/^4He$  and  $^4He/^{20}Ne$  of dissolved gases let assume that the helium refers to the crustal origin ( $^3He/^4He$  from  $2.86 \times 10^{-7}$  for the well 3-87 and  $4.12 \times 10^{-7}$  for the well 2-87).

The  $\delta^{13}C_{DIC}$  values vary from -30 to -18.1 ‰ and testify on the biogenic origin of carbonate specimens.

In 2018, samples were taken for the isotope  $^{15}N$  to determine the genesis of nitrogen. According to the data obtained from the well 1-87  $\delta^{15}N = 0.1\text{‰}$ , which indicates the air origin of nitrogen in thermal waters.

The  $^{234}U/^{238}U$  dating, the circulation time of the studied thermal groundwater is at about 400,000 years.

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