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Chemical and isotope compositions of nitric thermal water of Baikal rift zone

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Three types of hydrotherms (nitric, carbonaceous and methane) are distinguished within the Baikal Rift Zone. The unloading sites of nitric therms are mostly located in the central and north-eastern parts of the Rift. Several chemical types are found among nitric therms (Pinneker, Pisarsky, Lomonosov, 1968; Lomonosov, 1974, etc.). The formation of terms being various in chemical compositions is associated with effect of several factors, i.e. various chemical, mineralogical compositions of rocks, various temperatures, extent of interaction in water-rock system, etc.

The ratio data of water oxygen and hydrogen isotopes of the studied thermal springs indicate that water is largely of meteoric origin. All established ratios of oxygen (δ18OSMOW = -19.5‰ - -17.5‰ and hydrogen (δDSMOW = -155‰ - - 130‰ isotopes are along the line of meteoric waters. Oxygen values from -20‰ to -5‰ are characteristic of the current meteoric and surface waters in the region. The average value equals -16.5‰ in Lake Baikal. By our data, a large group with oxygen lighter isotope composition that corresponds to isotope ratio being specific for glaciers is revealed in fissure-vein waters. Significant shift toward the oxygen getting heavier is observed in some springs. It is mostly observed in the springs that form chemical composition within the area of the intrusive and metamorphic rock distribution. As a result of hydrolysis reaction of alumosilicates, heavy isotope passes from rocks into water molecule, whereas oxygen heavy isotope passes from rocks into solutes during decomposition of carbonates.

High contents of fluoride and sulfate-ions are specific feature of the Baikal Rift Zone most nitric therms. Water is tapped in one of the drill holes, where fluoride-ion dominates in its anion composition (46.7 mg/dm3) and pH reaches 10, 12. The sulphate sulphur isotope composition studies carried out allow to conclude that its heavy isotope (δ34SCDT = +25‰ - +30‰ prevails in the therms. Sulphate-ion enters solution not as a result of sulfide oxidation, but dissolution of sulphate minerals of may be originally sedimentary and magmatic rocks.

Microelement contents in waters depend on total mineralization. In particular, this regulation is clearly observed for rare alkaline and alkaline-earth elements. We established dependence of one microelement concentrations on temperature of solutions (Sc, Al, W) and that of the other ones – on extent of water – rock (Sr, Ba) interaction.

Active use of thermal water for purposes of thermal energetic can contribute to inflow of highly mineralized solutions into water collecting reservoir and result in breakdowns of heat-net work.

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