

Formation of sulfate-calcic waters in cave massif

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The caves present the objects suitable for investigating hydrochemical processes which take place in the Earth's crust, Perm University together with Kungur Station of the Ural Branch of RAS carry on complex investigation of Kungur ice cave. The cave of 5.6 km length was formed in gypsum and anhydrite interbedded by thin limestone and dolomite of Lower Permian Kungur stage. It is one of the most visited tourist caves in Russia.

The chemical composition of water in cave massif represents mainly a result of gypsum and anhydrite dissolution. The degree of water metamorphization is indicated by its "sulfateness", that is by the ratio of sulfate ion content to hydrocarbonate ion content (mg/l). Weakly mineralized water recharging the cave massif features low sulfateness: 0.5 - 1.6 snow, 0.5 river water. The sulfateness of atmospheric ice crystals in the cave equals to 0.6 - 0.7. In spite of similar sulfate-calcic composition and high mineralization (1-2 g/l) water and ice in the cave differ on sulfateness index: 10-21 drops, 11-16 karst water, 3-9 underground lakes and stream, 26-38 old ice, 9-10 young ice. Drops and karst water formed in rock fractures (i.e. in a closed system) show higher sulfateness compared to open reservoir, in the latter case water interacts with bottomset beds. Old ice is notable for the highest sulfateness.

Sulfateness is a genetic feature that points out the sources and the centres of karst water recharge, conditions of their formation. The influence of anthropogenic factor causes the increase of mineralization of atmospheric precipitation of above cave area, the appearance of nitrites and nitrates in karst water.