

Hydrogeochemistry and origin of cold high pCO₂ waters of Gonjinskoe spa (Primurye, Russia)

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Gonjinskoe is the most explored and popular spa with high pCO₂ groundwaters in the Primurye. This spa is very actively used for treatments of gastrointestinal and heart diseases. In the last decade chemical composition of the spa was changed due to intensive exploitation so the main purpose of our study was to investigate the origin and evolution of the spa. Gonjinskoe spa is located in the Magdagachi area in the Valley of Bezimiannyi River (Amur River basin) within the limits of the Mongolo-Okhotskaya geosynclinal area. Geologically, two rock formations were found of the study area. The oldest of these is Archeozoic metamorphic rocks of the Gonzhinsky horst. This formation essentially is composed of gneisses and marbles and often contains dykes of Early Cretaceous diorite and rhyolite. The tectonic structure of the spa is very complicated as two large regional faults northeast and sub-latitude directions are crossing here.

Groundwater mainly occurs in fractured Upper Cretaceous intrusive rocks of the area. Total area of the spa is 0,9 Km² and three boreholes are actively utilized now. Water samples were collected over a ten-year period; additionally some published data were re-interpreted.

Two types of groundwater were distinguished here: fresh and high pCO₂ ones. Both types of water are very cold, the temperature is 0.5-1.0 °C. Fresh water has very low TDS (up to 0.1 g/l) and belongs to Ca-Mg-Na-HCO₃ type. High pCO₂ groundwaters have TDS up to 3.5 g/l, CO₂dis. – 3.5 g/l and belongs to Ca-Mg-HCO₃ type. pH of waters vary from 5.5 to 7.6.

Our bedrock and groundwater data indicates that both types of groundwater originate from meteoric water, and interactions between the water and these bedrocks have played a dominant role in the development of the chemical composition of the waters. Isotopic data indicates that CO₂ gas in the groundwater is mantle derived and its presence is critical for the development of the high pCO₂ groundwater. This type of groundwater evolves during gas-water-rock interactions only.

Flour content in the groundwater samples of Chahr-Farsakh area, South Khorasan, Iran

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The study area is located about 24 km NW Nehbandan, South Khorasan province, Iran. Chahr -farsakh area was occurred at Iran's East Flysh belt junction with Lut block. This junction is a thin zone of crushed disruption, fault corrosion, extreme drift and metamorphism. Igneous, metamorphic and sedimentary rocks as granodiorite, quartz diorite, andesite, sandstone, shale, conglomerate, gneiss and schist with many other type of altered and crushed rocks from Jurassic to Neogen are the most rock formation in the area. In this study, the concentration of flour in 20 samples of groundwater sources as qanat and spring were determined. The results of analyses show that flour content were determined to range between 0.02-0.84 mg/l, lower than WHO 2008 limits. Temperature of waters distinguished between 19.4-30.6 C. The water PH were detected from 6.68 to 9.37. Flour show positive correlation with Na, Mg, Ca and HCO₃ in the water samples. Sandstone and shale seems to be the main aquifers in the study area. Mineralogical study by XRD shows that quartz is the main mineral in the aquifer and Illite, muscovite, shamosite, albite and calcite are subordinate minerals. Probably illite and muscovite are the main source of flour in the groundwater.