Geothermometry of northern Tien Shan thermal waters (Issik-Kul Lake basin).

CHELNOKOV G.A.[1], LAVRUSHIN V.Y.[1], BRAGIN I.V.[1,2], AIDARKOZHINA A.S.[1], ABDULLAEV A.U.[3], KHARITONOVA N.A.[4,2]

[1] Geological institute Rassian Academy of Sciences, Pyzhevsky lane 7, bld. 1. Moscow 119017, geowater@mail.ru

[2] Far East Geological Institute FEB RAS, Prospect 100-letya 159, 690022, bragin_ivan@mail.ru

[3] Institute of Seismology, Al-Farabi, 75A, Almaty, Kazakhstan, 050060, u.abdullaev@mail.ru

[4] Lomonosov Moscow State University, GSP-1, Leninskie Gory, Moscow, 119991, tchenat@mail.ru

Twenty geothermal manifestations of Issyk-Kul Lake region were sampled during the august of 2019. The area of the investigation is located within the northern Tien Shan orogenic belt: the Terskei Ridge in the south, the Kungei Ridge in the north, the Santash pass in the east, and the Karatash sill in the west. Studied thermal waters are characterized by discharge temperature from 20 to 51,5°C, and TDS vary from 0.4 to 14.9 g/l. The main associated gases are nitrogen (13 samples) and CO_2 (7 samples).

Based on water chemistry, composition of associated gases and assuming that thermal waters are equilibrated with Na-K-Mg-phases of the host rock, temperatures of geothermal reservoir were calculated. Only few geothermal areas demonstrate full equilibrium with silicate minerals: the Djete-Ogus, the Kajisai, the Keremetsu, the Kary-Oi and the Alamedin. CO_2-N_2-Ar ratios of associated gases demontrate that most of all geothermal areas have air component, and the rest of them are presented by air saturated waters. There are no samples with metamorphic or volcanic gas ratios. The gas and water geochemistry suggests that subsurface temperatures estimated by silica geothermometers lie in the range of 90-114°C. The Na-K geothermometers indicate considerably higher temperature than both quartz equilibrium and evaluated aquifer temperatures. Obtained results demonstrate that temperature of the most studied fluids reflects the regional geothermal gradient not influenced by magmatic or metamorphic processes. It is considered likely that the Na/K ratios of these waters are controlled by stoichiometric rock leaching and not equilibration with secondary alkali-feldspars. Such physical processes like mixing with cold water and residence time affect water-rock equilibria and can result in unreliable temperature predictions. This work was supported by grants from Russian Science Foundation, project № 18-17-00245.