EGU21-7462
https://doi.org/10.5194/egusphere-egu21-7462
EGU General Assembly 2021

Minerals of Bolshoi Semiachik geothermal fields (Central Kamchatka, Russia)

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The volcanic complex Bolshoi Semiachik is characterized by intensive hydrothermal activity which is expressed by presence of thermal fields with gas-steam jets (T up to ~ 140 ºC), boiling pots (T up to ~ 100 ºC), warm lakes (T up to ~ 90 ºC) and ground (T up to ~ 97 ºC) . The circulating hydrothermal solution is rich in ammonium, sulfate and locally in carbonate. To date, little is known about surface mineralogy that occurs at the geothermal fields of the volcanic complex Bolshoi Semiachik. The major geological expeditions were carried out there in the 1960`s, and there was also some additional research carried out in the 1980`s. The study of minerals occurring at the surface of geothermal fields is relevant for planetary science since similar minerals are suggested for Mars and Europa (Jupiter moon) and geochemistry since such environments of mineral formation are very specific.

In the summer 2020 the expedition of the Institute of volcanology and seismology has been organized in order to monitor thermal fields and to conduct mineral and water samples for study. Here we report the first data on mineral identification of processed samples (at about 50). At that moment, minerals have been identified by powder X-ray diffraction and electron-microprobe analyses.

The surface of Bolshoi Semiachik geothermal fields is covered by clay minerals with montmorillonite that is rich in disseminated pyrite being the most abundant. Among salt minerals the common phases are sulfates: halotrichite-, copiapite and voltaite-group minerals, alunogen, gypsum and native sulphur. The SiO_2 polymorphs: tridymite, cristobalite are also found at the geothermal field surface. In the zone called Central Crater chalcantite has been found in association with rhomboclase and tridymite. Some samples with zeolite-group mineral - laumontite were also found, which at the moment is identified less reliably. The central (high temperature) part of deposits around steam-gas jet is composed of dickite in association with sulphur and quartz covered by alunogen and halotrichite efflorescent. The rim (at about 1 meter from the center) is composed of smectites, marcasite and natroalunite. This zonation is likely caused by pH which is lower at the central part where the steam unloads and increases at the peripheral area around the steam-gas jet.

Acknowledgment. The study has been supported by RFBR project # 20-35-70008. We are grateful to Volcanoes of Kamchatka for letting us to conduct the field works at Bolshoi Semiachik thermal fields. Experimental works on mineral identification have been carried out using Analytical Centre of IViS and Research Park of SPbU.