Hydrothermal systems of North and Central Kuril islands.

E.G.Kalacheva
Institute of volcanology and seismology FEB PAS, Petropavlovsk-Kamchatsky, keg@kscnet.ru

On the Northern and Central Kuril Islands eight of the hydrothermal systems of thermal power from 1200 to 15 000 kcal / sec were allocated. They are located in the interior of volcanoes.

The volcanoes have similar complex construction of the Somma-Vesuvius [Bogoiavlenskay, Gorshkov, 1966], similar to the material composition (two-pyroxene andesites), they are characterized by active solfataric activity in the apical part of the structure and the different types of thermal waters are unloaded on their slopes. Features of the development of volcanic activity, hydrological and geological conditions have led to several differences in the conditions of formation and discharge of the hydrothermal systems of the region.

Surface manifestations of the North Shiashkotan and Ketoy hydrothermal systems occur over 5-8 km on the slopes of the volcanoes and have the classic vertical zonation. Hydrothermal solfataras are located in the area of the main updraft in several thermal areas near the craters of volcanoes. By its chemical composition these are acidic sulfate, aluminum (calcium) waters with total mineralization to 8g / liter and a temperature of 80 ° C. Boiling chloride sodium springs with near-neutral pH values are found at the edge of the sea. Total mineralization is up to 15 g / liter. The heat source for hydrothermal systems are cooling shallow magma bodies (<2-3 km), which bring some of magmatic gases, salts and metals in the circulating hydrothermal system.

In construction of the volcano Ebeko (Paramushir Island) local hydrothermal system is formed. The main water-bearing rock is a complex of Quaternary volcanic. The source of heat supply is shallow intrusions. The dissolution of magmatic gases (mainly HCl and SO_2) in the aeration zone of the groundwater leads to the formation of reservoir of the ultra acid chloride-sulfate brine directly below the crater part of volcano. Climatic conditions in the region provide a constant replenishment of the reservoir by infiltration water. Structural, stratigraphic and topographic features of the volcano Ebeko define a limited drainage from "the lake" in the northwestern part of the volcano. A series of permeable coarse interbedded lavas, exposed in the basin form a hydraulic channel between the underground "lake" and the output of thermal waters in the basin of Yuriev River. Upper-Yurievsky springs - are highly temperature (42-90^{o}C), highly mineralized (up to 14 g / liter), ultra acid (pH <2) waters of chloride-sulfate composition. Ions of aluminum and iron are the main amidst cations.

The problem of the presence and the role of the deep reservoir of chloride-sodium waters in the bowels of the volcano Ebeko remains obscure. The exploration well in the neighbour of Severo-Kurilsk opened the slightly alkaline (pH7.5-8.0), chloride-bicarbonate sodium groundwater with temperatures up to 95^{o}C and total mineralization of 9.5 g / liter. However, the sodium chloride thermal waters outlet have not been marked on surface.

Hydrothermal systems, confined to volcanoes constructions, craters of which are occupied by the calderas filled with lake or sea water (Calder Zavaritsky (Simushir) and Ushishirskaya hydrothermal system), have no opportunity of the formation of ultra-acid sulfate waters due to low hypsometric marks in the crater pert. Upstream of neutral chloride sodium waters discharged directly into the central part of the system in the area of intersection of breaking zones as at the water's surface and on the bottom. On surface areas solfataric grounds with bubbling springs and

steam jets are formed. By the chemical composition they are also chloride sodium, but with more lower pH values from 2.5 to 6. The general model of the formation of such hydrothermal systems can be represented as follows [by Taran et al, 1993]. Downdrafts reach meteoric water heated by magma nidus of zone located at a shallow depth (1-2 km) where the infiltrated water and magmatic gases or the partially neutralized by interaction the rock with the magmatic brine are mixed. Intensive additional source of gas and high temperatures lead to the formation of the steam flow in the lower parts of the reservoir, which rising to the surface is partially condensed by mixing with groundwater and surface water.