# Role of hydrothermal clays in the formation of geological structure of modern hydrothermal systems on volcanic structures.

Belousov V.I.[(1)(a)], Padilla E.K.[(2)(b)]; Khubaeva O.R.[(1)(c)], Rychagov S.N[(1)(d)]., Melnikov D.V.[(1)(e)]

(1) Institute of Volcanology and Seismology of the FEB RAS, Petropavlovsk-Kamchatsky, Russia. E-mail: (a) bvi36@yandex.ru; (c) grifon03@yandex.ru; (d) rychsn@kscnet.ru; (e) dvm@kscnet.ru.

Aquifer of hydrothermal systems consists of lava-pyroclast formations from which originate pleistocene volcanoes structures. They determine the structure and character of eruptions from long living volcanic centers which have a long development prehistory. A particular feature of Pleistocene-Holocene volcanoes is the dispersion of andesit-basaltic eruption centers within the structure.

In the last development stages of these structures, dacite extrusions occur. Frequently this process coincides with the presence of intrusion glaciers, perennial snowfields and fogs. Interaction of thawing waters and humid fogs with magmatic fumaroles gases leads the formation of acid thermal waters heated by geothermal steam and gas. They alter magmatic rocks and clays opal-alunite and opal-kaolinite rocks. Clays saturated with water expand and fill the fractures. Near surface original, cap rock is formed. This horizon prevents the contact of the stream and meteoric fresh ground waters into the depths of volcanic structure near the extrusion. Besides, it serves as a heat insulator which creates conditions for heat accumulation in the depths of volcanic structure.

The Kamchatka high temperature systems were investigated by Belousov V.I. (Belousov, 1978) proposing the Koshelevsky type as a classification for geological structures of hydrothermal systems.

In andesite volcanoes a significant part of stream and gas mixture consists of hydrogen. The presence of hydrogen in the magmatic emanations composition (Giggenbach, 1976; Taran et al.,1995) can be determined in some cases by its accumulation under the top of the cap rocks. Gradual increasing of the clay horizon thickness may lead the elevation of hydrogen concentration under it as well as the temperature of thermal waters heated by the steam. Because of the high solubility of gases such as $H_2S$ and $SO_2$, the relative content of $H_2$ and $CO_2$ in the gas phase increases. When the temperature of thermal waters increases, the temperature of the gas phase, containing $H_2$ and $CO_2$, also increases. As a result of this process conditions are created for boiling and separation of the gas which may result in hydrothermal explosions due to overheating of thermal waters. Explosion becomes more powerful due to $CO_2$ transition into the gas phase and due to the chemical reaction $2H_2 + O_2 = 2H_2O$ («detonating gas»). Presence of $CO_2$ in the high temperature waters is observed in approximately 2 km depth. As a result, the formation of steam and gas phase decreases leading the inflow of air to the zone of influence of phreatic explosion. This process is provoke to of more powerful explosions along eruption canals. These explosions produce the erosion of canal's walls, crushing of rocks and diatrem formation. Sediments of such eruptions are lacked in magmatic material.

Thus, clays formation on volcanic structures can lead to the formation and activity of high temperature hydrothermal systems and phreatic zone close to the surface. Geological structures of this type (Koshelevsky type) in the modern hydrothermal systems of Kamchatka are widely spread on active volcanoes such as Koshelevsky, Kambalny, Mutnovsky, Kihpinich and Burlyachyi (Big Semyachic volcanic block).

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