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Influence of hydrothermal processes on changes of volcanic rocks (data of physical modelling)

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Due to active development of geothermal energy, in middle of the last century have begun papers devoted to experiments, directed on study of transformations of minerals [4] and rocks [1, 2, 5] under action of geothermal processes. But any researcher did not estimate thus change of their physical and physico-mechanical properties.
The purpose of job - to study character and dynamics changes of volcanic rocks (to simulate conditions of geothermal transformations).
Tasks: creation of the whole series of experiments in autoclavs at various temperatures, pressure and composition of solutions, preparation of samples, study of chemical and mineral composition, structure and properties of rocks and solutions before and after experiments.
In 2006 the first similar experiments were begun [3].
Researched rocks basalts, hyaloclasites and obsidian, selected from Iceland and tuffs Payzhetka Geothermal Field, Southern Kamchatka, Russia.
Were used autoclavs, consisting from titanic of an alloy -8, volume 116-119 , in each of which was located from 2 up to 4 samples of rocks of the investigated structure and properties. The heating was made in OVEN -10 with accuracy + 1 º, the constancy of temperature was supervised by thermocouples.
15 experiences (temperature 200, 300 and 450 º; pressure 16, 86 and 1000 bars accordingly now are carried out; 4 solutions (1 alkaline and 3 acid); duration 14, 15, 30 and 60 days).
All four groups of the investigated rocks appreciablly react under geothermal influence. The changes are observed in colour of samples (brighten in acid solutions), their microstructure, that for basalts is visible only in raster electronic microscope, and in education of new mineral phases, is especially active in a acid solution, the X-Ray analysis (has executed by Dr. Krupskaya V.V., apparatuses - DRON- UM1) has shown, that 94,2 % is smectite, 3,5 % - kaolinite, 1,2 % - crisrobalite, 1,1 % - diopside (?), in others pores fills chlorite, and in an alkaline solution amorphous silicon.
The most appreciable changes of meanings parameters of properties are observed in velocity of longitudinal waves, which for basalts and hyaloclasites raise in both solutions at 300 º, and at 450 º, but in tuffs were lowered, as they has cracked, and majority even were disorganized, in a course of experiment; and meanings of a magnetic susceptibility, which for basalts and tuffs raises at influence of an alkaline solution and falls in acid. For obsidian the speed of passage of elastic waves after influence of an alkaline solution is reduced, that is connected to processing of a volcanic glass from a surface and education rind, which thickness for 15 day has 1-2 mm, and for 30 - 2-3 mm. Thus the greatest decrease of velocity of waves occurs on the party with (smallest at samples), where a layer of changes glass greatest concerning length of a sample. If for 30 day Vp decrease on the party a practically no, on c - 0,95 km/sec (18 %), and Vs accordingly 0,55 km/sec (18 %) and 1,25 km/sec (45 %).
Changes of a magnetic susceptibility in obsidian to trace practically is not possible, as is primary only tenth shares *10-3 units SI and varies on similar sizes.
For hyaloclasites it is difficult to speak about the unequivocal general tendencies because of features of their composition, structure and origin; at the given stage of study it is possible to note, what after a presence in a sour solution during 30 day at 300 goes increase of speeds of passage of longitudinal waves on 0,35-0,50 km/sec (24-25 %), and the magnetic susceptibility does not change. After an alkaline solution at equality of other parameters - increase of velocity on 0,10-0,40 km/sec (6-22 %), and magnetic susceptibility on 0,3-0,4*10-3 . SI.
In tuffs the velocity of longitudinal waves decrease (from 0,35 km/sec (14 days, initial solution with pH 4,4) up to 0,54-0,55 km/sec (in a solution with pH 1 or with pH 4,4 after 60 days)). The sizes small, but as initial in the

tuffs low (1,55-2,10 km/sec), in the percentage attitude they fall on 18-34 of %. It occurs because of decrease of density and increase of porosity. The magnetic susceptibility practically in all cases is reduced (the average on 0,35-0,70*10-3 . SI (9-13,4 %)).

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