Regularities of thermostimulated acoustic emission activity

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One of the topical problems of Earth physics today is the study of volcanic seismicity. It is closely related to the processes of crack formation caused by magma movements occurring under volcanoes. For a better understanding of these processes, field and model-laboratory studies are actively carried out.

In this work a comparative analysis of the features of the process of thermally stimulated destruction of rocks of different origin was conducted, based on the statistics of thermally stimulated acoustic emission (TAE) pulses in laboratory experiments with specimens of igneous rocks of intrusive (granites) and effusive (basalts) classes. The experiments with rock samples were carried out on a heating installation; the parameters of TAE pulses were determined by the "A-Line 32D" recording system. The maximum temperature of heating was 700°C and the heating rate was about 2-3°C/min. The studied samples were cylindrical rock fragments with a height of 6 cm with and a base diameter of 3 cm. Since basalts are characteristic material of volcanic structures, and granites are ones of seismogenic zones, experiments with samples of rocks of these classes are of greatest interest.

To analyze the development of destruction in general, such statistical parameters as the activity of acoustic emission and the parameter b of the Gutenberg-Richter law (b-value) were considered. The b-value was estimated by linear regression and maximum likelihood methods. To identify the local stages of destruction, the maximum energy class of the TAE event and the intensity of energy release were considered. Additionally, it was made an assessment of the thermal energy density and thermomechanical stresses in the samples under study.

The analysis of the experimental data showed different patterns of the change in the activity of acoustic emission with time and in the dependence on temperature for different specimens. In accordance to the type of thermally stimulated acoustic emission activity the experiments were systemized in order to compare the results. The analysis of the local stages of the experiments revealed the presence of episodes of activation of destruction processes. Parameter b was recalculated for the comparison with seismological data. Regularity was noticed: b-value for specimens with high acoustic emission activity is lower. For the explanation of the revealed patterns of b-value change, an interpretation of the results within the framework of the avalanche-type unstable crack formation model (IPE) is proposed. The general behavior of the discussed parameters for the specimens under investigation does not show the dependence on the type of rock and the type of acoustic emission activity.

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