Destruction of stressed rocks under a shock wave

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It has been established early, that the surface of the rock evaporates with the emission of the excited positively charged ions and electrons under the action of shock waves. What is the role of mechanical stresses in the evaporation? To answer this question, we have designed and built 2 installations. The first allows you to record the luminescence spectra of rocks under the action of shock waves. The second one registered of the time dependences of the luminescence of uniaxially compressed rock samples with a time interval of 2 ns. The samples were prepared from quartz, Alaskit, Plagiogranite and Gabbro-diabase. Each of them was a parallelepiped with edge sizes of 4x4x6 cm. Inside it is a groove cut into which copper electrodes are attached, connected to a capacitor. When it was discharged, an arc appeared between the electrodes. Its appearance caused the formation of a shock wave in the air and after that in the sample. When a wave in the sample reached the surface opposite to the discharge, a jet of plasma, emitted from electronically excited, positively charged ions and electrons, begun to fly out of it. It is known that crystals contain dislocations that can move along slip planes. At the intersection of the planes, barriers are created that prevent dislocation movement. There are strong distortions of the crystal lattice to arise in that places, which can cause transitions between the levels of the ground and excited electronic states and the decay of bonds between atoms into positively charged ions. The shock wave "carries" distorted portions of the crystal lattices to the surface, which allows the excited ions to fly out of it. We were interested in the question: how will the compressive stress affect the jets of ions? It turned out that when their stress value is less than (0.92 - 0.95) of the sample strength, the number and intensity of the ion jets decrease with increasing presses. This effect is explained to compressive stresses interfere with the movement and intersection of dislocations, as well as their annihilation. When the magnitude of the stresses approached the strength of the sample and a breaking crack appeared in it, the intensity and number of jets of ions increased sharply. Probably, stresses at the crack tip cause the formation of new dislocation clusters, which leads to an increase in the rate of destruction of the surface of the investigated samples. In this case, the crack plays the role of a trigger, causing a sharp increase in the intensity of evaporation of ions from the surface of rocks.