Monitoring of the state of Elbrus volcano magmatic structures based on the resonant method.

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The northern part of the Great Caucasus Ridge is one of the most geodynamically active Russian regions. From the standpoint of state-of-the-art geodynamics, this region is a representative example of collision tectonics characterized by the accumulation of compressive deformations in the submeridional direction and by the elevation of the Great Caucasus mountain system, which is still taking place. Here is a convergence of two large geological structures – Eurasian and Arabian collision zones, therefore as a whole this region is characterized by a complex system of faults. The Elbrus volcanic center is located on the northern slope of the main ridge of the Great Caucasus. It includes Mount Elbrus, a double-top polygenic stratovolcano, and a number of small volcanic centers concentrated on its western flank. According to present understandings, the Elbrus volcano falls into the category of a "class A" active volcano, and the resumption of its activity is possible.

The complex monitoring of geodynamical processes of this region is provided by a laser interferometer–strainmeter with a 75-m armlength, which records lithosphere deformations over a wide frequency range, and the GPS/GLONASS satellite navigation system. The monitoring includes also the high precision gravimetric survey carried out by ZLS-Burris gravity meters.

The new method for a control of the state of magmatic structures of the Elbrus volcano was developed. The method is based on revealing resonant modes, exited by the magmatic resonant structures upon incidence of a broadband teleseismic signals. An analysis of the teleseismic signals exited by the large number of global earthquakes and recorded by the Baksan laser interferometer-strainmeter during several years revealed a set of the local resonant modes. The resonance parameters we have found - periods, ranging from 40s t0 70 s, and Q-factors, spanning the values of 250-350, were interpreted in the framework of modern models of magma resonators. Such an interpretation relates revealed resonant modes to the shallow magmatic chamber of the Elbrus volcano with the characteristic size of about 9 km and setting down on the depth of 1-7 km. Acoustic properties of magmatic fluids of this magmatic chamber are defined by the rich gas components, the order of 30-70 %, i.e. magma is gas-liquid foam with density 1500-2000 kg/m^3. The sound speed of such magma is 150-250 km/s. The absence of noticeable seismicity near the volcano is shown. This apparently testifies, that the state of the volcano is far from the pre-eruptive phase, when magmatic struc-

tures and the movement of magmatic fluids are capable to generate seismic events, i.e. Elbrus is a "dormant" volcano. Nevertheless, slight temporal changes of the Q-factors (with the rate of approximately 5 per month) may certainly indicate changes of magma state, it can be suggested that the intrachamber pressure is rising owing to the advent of new portions of hot lava from a deep-seated chamber. Such an approach provides a window to volcano dynamics and lays a foundation of the new “resonant” method for monitoring the preparation of volcano eruptions.

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