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Monitoring the state of the Elbrus volcano based on observations of lithosphere strains

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The Elbrus volcano situated on the northern slope of the Caucasus is classified as a “class A” active volcano. 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 to 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 structures 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.

Monitoring the state of the Elbrus volcano is also provided by crustal movement observations based on the GPS/GLONASS satellite system.

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