Geophysical Research Abstracts
Vol. 13, EGU2011-2638, 2011
EGU General Assembly 2011

Monitoring the state of the magmatic structures of Elbrus volcano based on observation of lithospheric deformations

Vadim Milyukov and Andrey Myasnikov
Moscow University, Sternberg Astronomical Institute, Moscow, Russian Federation (milyukov@sai.msu.ru, +7 495 9328841)

The Elbrus volcanic center is located on the northern slope of the main ridge of the Greater Caucasus. It includes Mount Elbrus, a double-top stratovolcano, and a number of small volcanic centers concentrated on its western flank. The modern geological investigations of the Elbrus volcano, in particular, isotope K-Ar dating of explosion products, have proved that catastrophic explosions have occurred repeatedly during a long time (about 1 million years). Elbrus is classified as an active volcano with clearly dated historical eruptions in the Holocene. According to present understandings, the Elbrus volcano falls into the category of the so-called dormant volcanoes that become reactivated. It is a typical volcano of a continental type.

During a number of years to study magmatic structures of the Elbrus volcano, their resonant properties and dynamics the new resonant method has been used. The idea of method is simple enough. Magmatic structures, being a resonator, upon incidence of a broadband powerful seismic signal generate the secondary seismic waves, having a set of resonant modes and containing information about physical and mechanical properties of structure inhomogeneities. These resonant modes are determined by geometrical parameters and elastic properties of the magma chamber as well as by magma properties.

Estimation of the resonant parameters is based on the analysis of lithosphere deformations recorded by the wide-band Baksan laser interferometer-strainmeter with a 75-m armlength which is installed in the underground tunnel of the Baksan Neutrino Observatory, 20 km apart from Mt. Elbrus. We analyzed the teleseismic signals excited by large number of global and regional earthquakes (about 400 events) and recorded by the Baksan laser interferometer-strainmeter during 2003-2010 years. The resonance parameters (frequencies and Q-factors of the resonant modes) we have found were interpreted in the framework of contemporary models of magma resonators. We estimated the depth and dimensions of the shallow magma chamber, as well as the properties of the magma fluid which are corroborated by available geological and geophysical evidence. The absence of noticeable seismicity near the volcano shows that the volcano seems to be far from the pre-eruptive phase, i. e. Elbrus is a dormant volcano. Nevertheless, our interpretation of observational materials suggests that the intrachamber pressure seems to be rising owing to the advent of new portions of hot lava from a deep magma source.

The stated approach provides a window to volcano dynamics and lays a foundation of the new “resonant” method for monitoring the state of volcano.

This work is supported by the Russian Foundation for Basic Research.