

S.A. Khubunaya, L.I. Gontovaya, S.V. Moskalyova

Institute of Volcanology and Seismology FEB RAS

A.V. Sobolev, V.G. Batanova

V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry SB RAS

D.V. Kuzmin, O.B. Kuzmina

V.S. Sobolev Institute of Geology and Mineralogy RAS

About the peripheral magma chamber of the Klyuchevskoi Volcano

From September 7 till October 2, 1994, there was a powerful apical eruption of the Klyuchevskoi Volcano. The most significant characteristics of this eruption are the absence of the abyssal seismic preparation before its beginning and the powerful Plinian stage at the end of the eruption. The composition of the volcanic products was greatly differentiated. The eruption began with the ejecting of the scoria lapilli of the andesite-basalts ($\text{SiO}_2=55-56\%$) and it ended with the effusion of the pyroclastic flows of the basalts ($\text{SiO}_2=52-53\%$). Such extent of differentiation within single apical eruption of the Klyuchevskoi Volcano is reported for the first time.

The natural quenched glasses of the melt inclusions in the olivines of the scoria lapilli also show highly differentiated composition: from high-aluminous basalts to andesites. The concentrations of the volatiles (S and Cl) in the inclusions drastically diminish with the increase of SiO_2 .

Massive study of the basalts and andesite-basalts of the initial and final stages of the 1994 eruption revealed significant differences in composition of their phenocrysts. The lavas and scoriae of the initial stage are typical high-aluminous andesite-basalts characteristic for all the apical eruptions of the volcano with low-magnesium clinopyroxenes and olivines (Fo79-65), with inclusions of the titanomagnetites. The blocks and fragments of the lavas of the pyroclastic flows of the final stage of the eruption as well as the described high-aluminous andesite-basalts contain homogeneous inclusions of the plagioclase and magnetite accumulative rocks and high-magnesium phenocrysts of pyroxenes and olivines (Fo 91-85) with the inclusions of chromium spinel.

Reported here results suggest that there can be a layered magma chamber under the cone of the volcano. In the beginning of the eruption the magma came through from the upper apical part of the chamber. In the final, Plinian phase of the eruption the magma from the lower part of the peripheral intermediate chamber was taken as a result of a powerful explosion.

The reported data on the existence of a magma chamber under the cone of the Klyuchevskoi Volcano conform to the results of seismological and gravimetric structure studies. Accordingly, in the velocity model constructed with the seismic tomography method under the Klyuchevskoi group of volcanoes, a down warping of the foundation with the low values of V_p and V_s in the depths interval of 0-7 km has been discovered. The anomaly of V_p within the limits of this zone may reach 15%. The obtained seismic data do not contradict the possibility of the presence of a peripheral chamber within the limits of the discovered area.

As a result of the gravitational modeling carried out on the Klyuchevskoi Volcano under its cone in the 90s at the depth of 0-5 km a zone of low density ($2,5 \text{ g/cm}^3$) has been marked out that can also be connected to the peripheral magma chamber with the diameter of about 10 km.