Geophysical Research Abstracts, Vol. 7, 03456, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03456

1 The influence of chemical composition of magmatic melt on the eruption dynamics, lava flows structure and petrophysical properties - data from the Great Tolbachik Fissure Eruption, Kamchatka

2 V. Ladygin (1), V. Okrugin (2), J. Frolova (1)

1. Geological Department of Moscow State University, Russia, (2) Institute of Volcanology and Seismology, Far East Division RAS, Russia (skalka@geol.msu.ru)

Tolbachik represents basaltic volcano, which belongs to Klyuchevskaya volcano group (Kamchatka Peninsula, Far East, Russia). The 1975-76 Tolbachik fissure eruption was the largest basaltic eruption in Kuril-Kamchatka Arc in historical period (The Great Tolbachik Fissure Eruption) (Fedotov et.al, 1984). During a short period there were formed different lava-flows, which gave rise to various types of basaltic rocks. Among these rocks are magnesia moderate-alkali basalts (North fissure eruption), transitional basalts (last portions of North fissure eruption), high-alumina subalkali basalts (South fissure eruption). Average chemical compositions are following: SiO_2-49.6-50.3-50.8 ; TiO_2-1.32-1.55-1.74; Al_2O_3-13.45-16.37-16.77; Fe_2O_3-3.55-3.57-3.79; FeO-6.3-6.74-6.8; MnO-0.16-0.17-0.15; MgO-10.02-6.41-4.78; CaO-11.72-9.2-8.55; Na_2O-2.41-3.25-3.57; K_2O-1.00-1.89-2.15; viscosity -10^{5-7}–6*10^4-10^{4-5} Poise, respectively.

386 samples of basalts were collected during field works for petrophysical analysis (North fissure – 197, South fissure – 189). Lava flows were tested and sampled in detail along and across extension. Samples were taken from the upper, middle and base parts of lava flows. Petrophysical analysis included thin section studying and lab

measurements of physical and mechanical properties including density, porosity, sonic velocity, uniaxial strength and magnetic susceptibility.

The following results are obtained.

1. Chemically different magmatic melts give rise to structurally different lava flows. Properties of basalts composing these lava flows are differed significantly.
2. The dynamic of properties change during eruption is determined. Properties change is the result of chemical and gas-content alterations.
3. Lava flows (even small size) are characterized by chemical differentiation and structural and petrophysical heterogeneity.
4. The microfractures network is assumed of contraction origin is discovered in basalts which results in extremely low sonic velocity (V_p) values. V_p values are independent of density and porosity. Basically, due to intensive development of microfractures network V_p values decrease from the edge to middle part of lava flows. Massive high-alumina basalts are characterized by the highest intensity of microfractures network.
5. Strength of South fissure basalts is controlled by density. Relationship strength-density of North fissure basalts is more complicate.
6. Maximum values of magnetic susceptibility are typical: South fissure - for middle part of lava flows; North fissure - for middle and base parts. Small thickness lava flows (< 1 m) are homogenous by magnetic characteristics.
7. Thick lava flows are composed of crystalline basalts in contract to glassy thin lava flows. They are characterized by strong and rigid contacts, slight development of microfractures that is results in high strength and V_p values.

The work is financially supported by Russian Foundations for Basic Research (project 03-05-64842).

References

1. Fedotov S., Chirkov A., Razina A. The Great Tolbachik Fissure Eruption, 1984, 637 p.