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Physical and chemical variations of volcanic rocks from historical eruptions of Klyuchevskoy volcano, Kamchatka

Bergal-Kuvikas O.V.[1,2], Churikova T.G.[1,3], Gordeychik B.N.[3,4], Ladygin V.M.[5], Kronz A.[4], Wörner G.[4]

[1]Institute of Volcanology and Seismology FEB RAS, Petropavlovsk-Kamchatsky kuvikas@mail.ru, tchurikova@mail.ru; [2]Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry, Moscow; [3]Geowissenschaftliches Zentrum Göttingen, Abteilung Geochemie, Universität Göttingen, Göttingen gwoerne@gwdg.de, akronz@gwdg.de; [4]Institute of Experimental Mineralogy Russian Academy of Sciences, Chernogolovka gordei@mail.ru; [5]Geological Faculty, Lomonosov Moscow State University, Moscow skalka_1@mail.ru

Changing of physical parameters (density, buoyancy, viscosity) and geochemical compositions (SiO_2, volatiles) of magmas are triggers or inhibitors of volcanic eruptions (e.g. Corsaro, Pompillo, 2004). Density and viscosity variations are related with magma compositions and water content (Richet et al., 2000; Sparks, Huppert, 1984). In order to examine process of magma ascent and residence in the crust we combine geochemical and isotopic studies (Bergal-Kuvikas et al., 2017; Dorendorf et al., 2000), microprobe analyses of the olivines and estimate physical properties of the magmas (Ladygin, Frolova, 2002). Observed data of physical properties of erupted lavas at Klyuchevskoy volcano show good correlations between densities and magma compositions. More dense magmas (2.8–2.9 g/cm^3) have more primitive compositions (~6–9 wt.% MgO) and erupt from vents at the lower slopes (~500–700 m) of the volcano with large, voluminous lava flows. In contrast, more differentiated lavas (~4–6 wt.% MgO) are less dense (1.8–2.3 g/cm^3) and dominate eruptions on from the summit crater at ~4500 m. Fractional crystallization is a driving volatile-enrichment and compositional changes in the magma system and this controls ascent and the elevation of vents via changing density and buoyancy. This also explains the higher explosivity with ultra-strombolian eruption style of volatile-rich, low-density lavas from the summit crater whereas volatile-poorer and denser lavas erupt from vents lower down on the flanks of the volcano.

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