

PECULIARITIES OF CHEMICAL COMPOSITION OF KLYUCHEVSKOY VOLCANO MELTS - INSIGHT FROM MELT INCLUSIONS STUDY IN OLIVINES

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In order to characterize composition and evolution of parental melts of Kluchevskoy volcano, melt inclusions in olivine phenocrysts (Fo_{91-67}) were studied. The olivines were picked from well dated lava samples of old cones Bulochka and Luchitskogo (2500-4000 y.a.), Ochki (1500-2000 y.a.) and of historic eruptions Tuyla (1932 y.), Apakhonchich (1946), Bylinkinoy (1951), Vernadskogo (1953) and Piipa (1966). Samples represent all geochemical varieties of Kluchevskoy volcano rocks: Bulochka and Luchitskogo lavas ($\text{MgO}=11.2-12.1$ wt.%) are high magnesian basalts, Ochki and Tuyla lavas ($\text{MgO}=8.7-8.8$ wt.%) are magnesian basalts, Apakhonchich, Bylinkinoy, Vernadskogo and Piipa lavas ($\text{MgO}=4.4-5.9$ wt.%, $\text{Al}_2\text{O}_3=16.6-18.1$ wt.%) are high alumina basalts (fig.1,2) (rock types as in [1]). The data obtained provide comprehensive information about melts existed at Kluchevskoy volcano over the recent 4000 years of its volcanic activity.

Partially recrystallised melt inclusions (most of melt inclusions studied) were experimentally rehomogenised. For this purpose heating stage with visual control of Sobolev-Slutsky construction [2] was used. The heating occurred in atmosphere of pure He under atmospheric pressure. The inclusions were partially homogenized (melt + fluid phase) and quenched. Glasses of such inclusions and glasses of naturally quenched melt inclusions were analyzed by microprobe.

The peculiarity of the melt inclusion compositions is low FeO content. We suggest this is due to the process of Fe-loss from inclusions after their entrapment. In order to recover the initial melt compositions, special calculation method developed by L. Danyushevsky [3] was used. This method allows to take into account the effect of Fe-loss and restore initial melt composition. Initial FeO content in melt was assumed to be 8.5 wt.% This value was taken from the average FeO content of Kluchevskoy volcano rocks. It is important to note that unlike other oxides FeO content is rather constant in different types of Kluchevskoy volcano rocks. This makes our assumption acceptable for all melts studied.

The most of the melts obtained from the melt inclusions composition show significantly lower SiO_2 and higher CaO, Al_2O_3 compared to the composition of host rocks at given MgO (fig.1,2).

Fig.1. Composition of melts (m) and rocks (r) of Kluchevskoy volcano. Pre-historic eruptions (age 1500-4000 years): 1-Luchitskogo, 2-Bulochka, 3-Ochki. Rocks-all Kluchevskoy rocks.

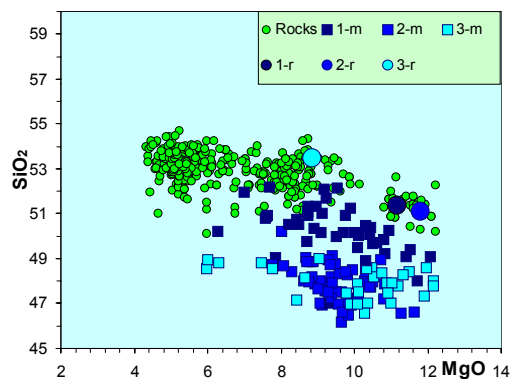
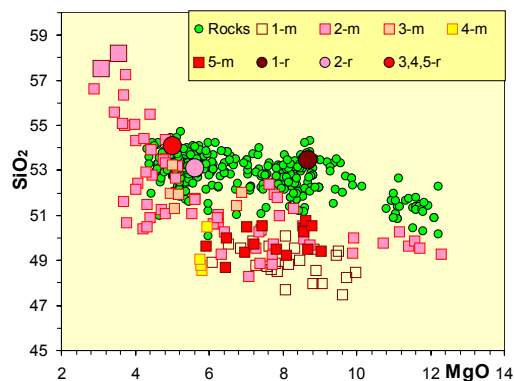
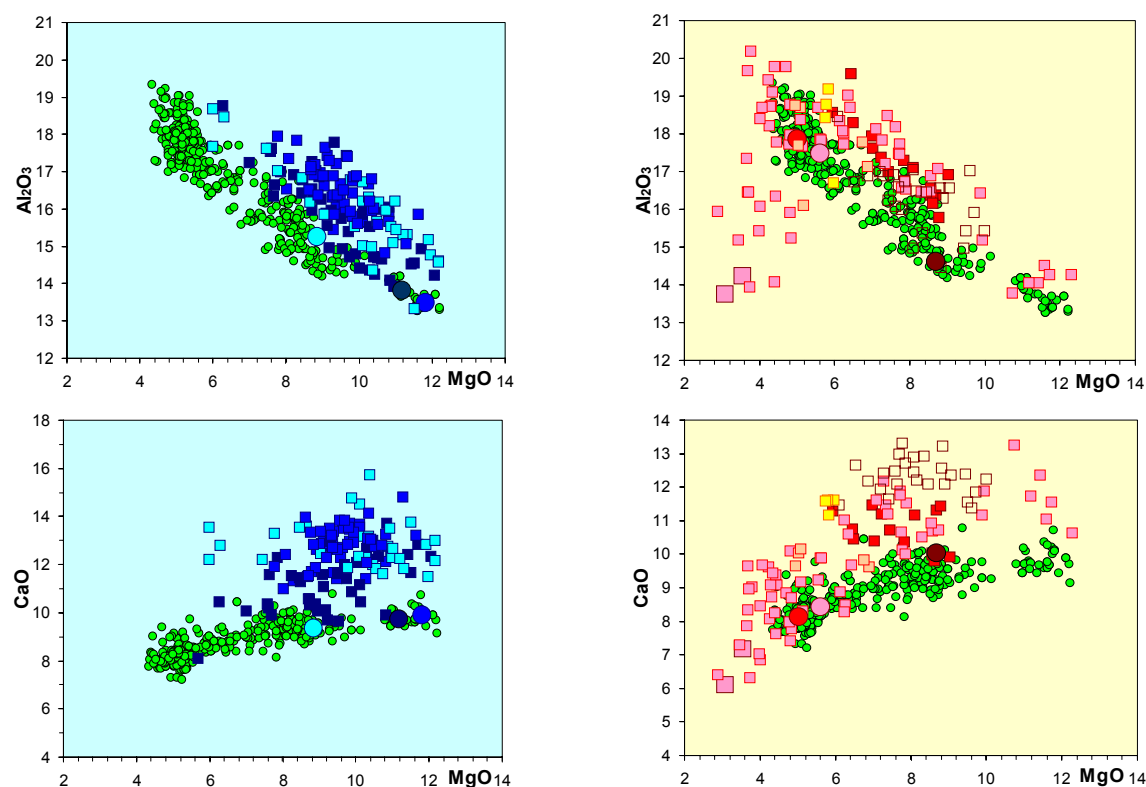


Fig.2. Composition of melts (m) and rocks (r) of Kluchevskoy volcano. Historic eruptions (after 1932): 1-Tuyla, 2-Apakhonchich, 3-Bylinkinoy, 4-Vernadskogo, 5-Piipa. Rocks - all Kluchevskoy rocks.





Large statistics of melt compositions (more than 270) and their representativity for entire interval of crystallization gives a good reason to suppose that there were no parental melts in nature similar in composition to Klyuchevskoy volcano rocks. Melt inclusions, trapped by olivines on the early stages of crystallization provide true information about the composition of such melts. Rocks compositions on the contrary differ from melts due to complex processes of fractionation and are determined by various proportions of phenocrysts in evolved ground mass. Alternative explanation of melts and rocks compositional discrepancy could be exceptionally selective entrapment of melt inclusions by olivine phenocrysts. It means that there were trapped only those melts which were quite different from rocks. However, none example of such a process was published to date and possible reasons for such selectivity are not clear.

The data obtained showing the difference in composition of parental melts and rocks give a good reason to overview the existing models of Klyuchevskoy volcano rocks formation [1, 4, 5]

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