Insights into the pre-eruptive spatiotemporal magma dynamic of the last eruption of Kizimen (Kamchatka)

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The eruptions of arc volcanoes are often highly variable in terms of eruption style, recurrence, petrology, and the chemical composition of the magmas involved. The evolution of volcanic activity can take place over long periods of time, for example during the evolution of the magma in the so-called "magma mush" zone, (mainly composed of crystals but also liquid and volatile elements. distributed heterogeneously in space and time during the resting period of the volcano. This evolution is mainly recorded by petrology and the compositions of the eruptive products or short times (months to seconds) during unrest and eruption detected by monitoring signals or mineral reactions, vesiculation. The association of monitoring signals with detailed petrological studies can therefore be considered to interpret the active magmatic systems of arc volcanoes.

The Kizimen volcano (Kamchatka) studied here experienced its last historical magmatic eruption in 2010-2013, with 0.4 km^3 DRE (Dense Rock Equivalent) of magma with the extrusion of a lava dome that gradually formed a very thick lava flow. A rapid mixing of different magmas in a probably stratified reservoir would be at the origin of the eruption that started in November 2010 ejecting a badly mixed magma attested by the abundance of andesites and banded dacites.

We propose here the first elements on the spatial and temporal dynamics of the magma before this eruption, which has the advantage of having been monitored by Russian monitoring systems, which will eventually allow to correlate the signals recorded by the monitoring networks with the petrological data. By the systematic analysis of the compositions of the orthopryroxenes (Crystal System Analysis approach) we constrain the pre-eruptive dynamics of the deep magmas, in particular the magma mixing. By the intracrystalline diffusion method (Fe-Mg in orthopyroxenes), the timescales of magma remobilization before eruption are constrained.

Mots-Clés : Magma mixing ; timescales, diffusion chronometry ; Kizimen (Kamchatka) ; Crystal System Analysis ; Orthopyroxenes