Pre-eruptive magmatic processes associated with the 2016-2018 explosive activity of Sabancaya volcano (Perù)

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Sabancaya volcano is one of the most active Central Andes Volcanoes. Historical records reveal an eruptive activity in 1750-1784 AD and more recently in 1990-1998 AD. The most recent eruptive activity of Sabancaya started in November 2013 and is still ongoing (May 2018). This new period of activity has been divided into two stages: the first stage started in 2013 with increased fumarolic activity, and the second stage began on November 6th 2016, characterized by violent explosions of ash and juvenile lava blocks, and generated ash plumes rising up to 5-6 km. The erupted juvenile ballistic material consists of andesites (59.8-60.2 wt.% SiO_2), including plagioclase, hornblende, orthopyroxene, clinopyroxene, biotite, and Fe-Ti oxides. Detailed mineralogical studies show two different groups of plagioclase: subhedral phenocrysts with normal zoning (An_{37-30}); and subhedral phenocrysts with a sieve texture and overgrowth rims, showing oscillatory ($An_{29-60-49}$) and reverse (An_{54-57}) zoning patterns. We have also identified two different populations of amphibole: the first population corresponds to subhedral phenocrysts with low Al compositions (6-8 wt.% Al_2O_3) and the second population is composed of phenocrysts and microlites with rims of high Al concentrations (9-11 wt.% Al_2O_3), displaying increasing amounts of Mg# (72-74) toward their rims. We also observe a few orthopyroxene (En_{72} Fs_{24} Wo_4) cores surrounded by clinopyroxene (En_{42} Fs_{16} Wo_{42}) rims and rare anhedral quartz crystals. Based on thermo- barometric analyses, using the geothermometer of Ridolfi et al. (2010), the temperature is estimated at 915 ± 60 °C and the crystallization pressure at 265 ± 19 MPa, corresponding to a depth range between 9 and 11 km, where the magma reservoir would be located. These disequilibrium textures identified in the phenocrysts could suggest a mixing process due to the intrusion of a hotter magma in the reservoir, which was also suggested for the last eruption (Gerbe and Thouret, 2004).