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Plinian eruption of the Middle Pleistocene Irind volcano, Armenia

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Large (VEI= 4-6) Quaternary explosive eruptions have repeatedly occurred in Armenia and the neighboring territories. Worth noting are the Plinian eruptions of Aragats stratovolcano (4096m), located in the vicinity of the Armenian capital city Yerevan (pop. >1 million) and producing lava flows variable in composition and size, pyroclastic density currents (PDCs) and fallout deposits (Connor et al., 2011; Gevorgyan et al., 2020). The youngest lavas from Aragats are 0.52 million years (myr) old and the youngest ignimbrites are 0.65 myr old. (Connor et al., 2011, Gevorgyan et al., 2020).

Here we present some features of a violent explosive Plinian eruption (VEI=4) from the relatively small, subsidiary Irind vent on the slopes of Aragats stratovolcano. We report results from newly mapped thick pumice fall deposits and pumice-rich welded lapilli-tuff and vitrophyres. Formation of up to ~10 m thick pumice fall deposits is related to a sustained Plinian eruption, while the formation of overlaying pumice tuffs (age= 0.490±0.028 M.yrs, Connor et al., 2011) and vitrophyre cover is interpreted as result of collapse of the eruption column due to a decrease of the magma supply.

Following the pyroclastic eruption, a voluminous (2.9-3.6 km^3) effusive eruption of Irind created up to 120 m thick trachydacite lava flows that extended 18 km from the vent. Such long and thick lava flows are not typical for viscous felsic lavas. The Irind eruption products are characterized by a plagioclase-two pyroxene mineral association that is atypical for Aragats. The Irind magmas are trachydacitic (SiO_2= 66 wt; MgO= 0.7 wt%) with high- K_2O contents (5.2 wt%) and enrichments in U, Th, LILE and LREE compared to Aragats. Geothermobarometry and hygrometry based on detailed textural analysis and mineral chemistry (Cpx, Opx, plagioclase, glass) reveals that Irind magmas also have elevated H_2O, increased alkalinity and high T (~970 °C)- all features capable to generate magmas with much lower viscosity (4.2–4.5 log η Pa·s) in respect to typical dacites.

Our results support the view that often small eruptive vents (Irind) on the slopes of large coeval

stratovolcanoes (Aragats) are not necessarily tapping their voluminous magma mushes underneath and are capable to deliver independent Plinian eruptions. We speculate that these are triggered by intrusions of hot, volatile-rich, alkaline felsic magmas, presumably emplaced fast, similar to the Chaiten eruption in 2008, and did not mix well with the otherwise dominant and older magmatic system under Aragats.

References

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