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Petrological variability between paroxysmal eruptions at Volcán de Fuego, Guatemala, from community-based volcanic ash sampling

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Community-based ash collection programs are an effective solution to the challenges associated with rapid and/or widespread ash sampling. Actively engaging local communities in the volcano monitoring enables far greater sampling frequency and coverage than would otherwise be possible, whilst also strengthening the crucial two-way dialogue between scientists and residents directly affected by volcanic hazards. We have developed such a program for Volcán de Fuego, Guatemala, which has frequent eruptions ('paroxysms') that threaten a population of ~60,000. In February 2016, we installed nine ashmeters in villages around the volcano and trained local volunteers in their use, thereby laying the foundations for a long-term dataset of ash samples spanning a range of volcanic activity. Ash samples collected over a 24-hour period during the 1–2 March 2016 paroxysm represent (1) initial moderate Strombolian activity, (2) sustained lava fountaining, and (3) waning Strombolian activity. Analysis of melt inclusions and matrix glasses shows that the melt varies from 56 to 62 wt% SiO_2, with samples from phases 1–3 showing progressively more evolved glass compositions and microlite textures. The phenocryst assemblage is dominated by plagioclase (~85%) and clinopyroxene (~15%). Plagioclase phenocrysts typically exhibit low-amplitude oscillatory zoning superimposed on approximately linear normal zoning patterns. Cores compositions span a wide range (An65–96) that is broadly correlated with crystal size. The outermost rims of all phenocrysts and microlites share narrow range of An42–47, indicating comparable conditions of final ascent. This compositional range is similar to that seen in the last large (VEI 4) eruption in 1974. By comparing these data to additional samples from eight consecutive paroxysms in 2016, we will test the hypothesis that each paroxysm is driven by a repetitive process of mafic recharge, and that the increasing frequency of paroxysms in recent years reflects an acceleration in the rate of magma supply.