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# Sacrificial fragmentation and superheated foaming trigger of explosive volcanism

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The most common occurrence of volcanic activity is at lava domes. Active domes tend to experience near sudden episodes of gas-and-ash explosion on a daily basis and sometimes several times per day. This unpredictable behaviour is an expression of magma forced to undergo fragmentation due to gas overpressure. Here, Examination of dome activity reveals that gas-and-ash explosions are concordant with inflation/deflation cycles that are faster than during simple outgassing episodes. Although frequent, these gas-and-ash explosions usually leave the dome intact as strain is almost entirely accommodated along repeatedly activated marginal faults, as seen at Santiaguito, Guatemala. We present petrological evidence that gas-and-ash eruptions are the product of fragmentation due to "superheated foaming" along fault zones. Textural analysis reveals chemically heterogeneous melt filaments emerging from crystals in the ash generated by fragmentation in these events. The same texture is observed in high-velocity, rotary-shear experiments on Santiaguito dome lava. The frictional melting is experimentally generated after mere centimetres of slip of these lavas, and yields foaming of the interstitial melt adjacent to the slip zone. Rapid and intense local frictional heating can explain both the foaming and the fragmentation cycles of these magmas. Gas-and-ash explosions exhibited in the dome at Santiaguito are hence controlled by the inevitable frictional heating which results from tenacious strain localisation, whereby lava is "sacrificially" fragmented along faults in order to preserve the bulk of the dome. We discuss how this new fragmentation trigger may underline the most common type of explosive activity.