

What causes shallow short-duration low-frequency seismic events on volcanoes?

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Low frequency (or Long Period) seismic events are commonly observed at active volcanoes. They are usually thought to be of long duration and to be related to the presence of magma or gas in sub-surface conduits. Over the past number of years we have installed very high density seismic networks close to the summits on several volcanoes worldwide. We make a new observation, the existence of swarms of very near-summit low-frequency events which are of very short duration (pulses), whenever we have placed seismometers in the summit area. In the absence of extreme damping these events cannot be readily explained by the resonating conduit model. Moment tensor inversion demonstrates that they are likely generated by tensile cracking. Rupture dynamic simulations, damage mechanics modelling and source scaling analysis show that they are consistent with a brittle failure mechanism and do not require the presence of fluids in the source process. We conclude that they may play an important role in bridging our understanding of the relationship between shallow seismicity and deformation. They may also help in the determination of the rheological properties of the uppermost edifice.