



Shallow orthogonal dike emplacement at Stromboli (Italy): the case of the 2002-2003 eruption

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Understanding how shallow magma is emplaced within volcanoes is crucial for hazard assessment. The 2002-2003 Stromboli eruption provides the opportunity to investigate shallow magma emplacement and its possible effects. Stromboli erupted in 2002-2003, when effusive activity replaced Strombolian activity. On December 28 2002, a NE-SW fissure propagated from the lava-filled northernmost summit crater. On December 29, a NW-SE fissure propagated north of the craters, feeding NW-SE aligned vents. On December 30, this area collapsed, reaching the sea and generating a tsunami. In mid February 2003, the NW-SE fissure vanished, while the NE-SW effusive fissure continued until July. A model for shallow magma emplacement is proposed. The 2002 inflation triggered the lateral propagation of a NE-SW dike from the northernmost crater. Below, a NW-SE dike, propagating from the magma-filled NE tip of the NE-SW elongated conduit, fed the NW-SE aligned vents. In February 2003, the magma supply decrease froze the conduit periphery and the NW-SE dike, focusing the rise of magma below the craters. This fed the NE-SW fissure until the supply decreased further (July), returning to the ordinary level sustaining Strombolian activity. Orthogonal dike emplacement followed the non-radial trajectories of the maximum (gravitational) stress σ_1 , controlled by the irregular topography of the uppermost edifice. The emplacement of orthogonal dikes in a limited area is in fact feasible at non-perfectly conical active volcanoes, where the maximum gravitational stress may show significant variations from a purely radial path.