



Geometry of magmatic conduits at Piton de la Fournaise

Y. Fukushima and V. Cayol

Laboratoire Magmas et Volcans, Univ. B. Pascal, CNRS UMR 6524, France
(yofukushima@opgc.univ-bpclermont.fr, v.cayol@opgc.univ-bpclermont.fr)

At Piton de la Fournaise volcano (Réunion Island), seismic swarms occur before each eruption. They typically start one hour before the eruption onset, and are located between 2500 m and a several hundred meters beneath the summit. These swarms are most probably associated with magma transfer from the source reservoir to the ground. The conduit geometry can either be a fracture (dyke) created for each eruption, or a cylindrical pipe filled with molten magma shared by several eruptions. In most eruptions, tilt changes are detected almost simultaneously as the preeruption seismic swarms. Modelling shows that a cylindrical conduit of plausible radii cannot create such tilt changes, whereas a dyke-type conduit can. It is also observed that locations of seismic swarms slightly differ from one eruption to another, which is another argument in favor of magma transfer in a dyke-type conduit rather than in a pipe conduit at the beginning of eruptions. Coeruptive displacements recorded by SAR interferograms, for the period between 1998 and 2000, are consistent with laterally-elongated dykes above the seismic swarms, and do not indicate deep vertical dyke-type conduits. This suggests that (1) the vertical dyke-type conduits close when the overpressure at the reservoir is relaxed, and (2) at shallower depths, dykes propagate laterally and solidify without closing. These observations are consistent with a level of neutral buoyancy at a few hundred meters beneath the ground. An eruption localizes to a vent typically a few hours after its onset, and may continue for weeks to months. At this later stage, a pipe conduit is probably developed beneath the ground. A model of magma flow in a cylindrical pipe shows that such conduits must have radii of the order of one meter, which is too narrow to be detected by geodetic measurements and thus is consistent with the interferograms.