

The Dynamics of Quiescent Volcanoes

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Forecasting the awakening of dormant volcanoes is of paramount importance for the reduction of volcanic risk. To better achieve this accomplishment it is necessary to know in great detail both the volcanological history of a volcano and its episodic unrest that may help to unravel the hidden internal dynamics of magma ascent and storage.

We present several examples drawn by the past activity and quiescence of several volcanoes (Mount St Helens, Vesuvius) to illustrate these concepts.

In a regime of open path, the magma ascent results in episodic eruptions of small volume (in the order of a few million m³ of magma). Partial obstruction of the ascent path may result in shallow level accumulation of magma and its possible eruption for periods lasting also years.

We show that even during quiescent periods, the normal dynamics of a volcano is characterized by episodic arrivals of isolated magma batches from mantle or mid-crustal magma chambers into the shallow crust.

Substantial obstruction of the ascent path results in intrusion in the shallow crust. The possibility of formation of a shallow magma chamber is a function of the volume and shape of the intruding batch, of the recurrence time of intrusion, and its depth.

We use this concept to clarify the current unrest phenomena of Campi Flegrei within the larger picture of the history of unrest and eruptions of the volcano.