



## **Eruptive activity of the summit cone of Piton de la Fournaise volcano (La Réunion island): a historical and geological review.**

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Summit explosive activity and collapses represent major volcanic hazards on a dominantly effusive and frequently active volcano like Piton de la Fournaise. Only three summit collapse events (1986, 2002 and 2007) have been recorded since the foundation of the Piton de la Fournaise volcano observatory (OVPF) in 1979 and two of them (1986 and 2007) were associated with weak phreatic activity. Except during these three events, most eruptions consist in short short-lived (< 3 hours) and mild (< 20 m-high) lava fountains quickly evolving into strombolian activity. Based on a comprehensive literature review and a high-resolution image analysis of surface outcrops and summit caldera walls, we reconstructed the time distribution of recent explosive events and their link with summit collapses and lateral effusive eruptions. In historical times (post-1640 AD), we recognize two main clusters of explosive events. Frequent and violent phreatomagmatic to phreatic explosions occurred during the oldest cluster (1708-1878) characterized by long-lasting summit effusive activity. On the contrary, weak and scarce explosions occurred during the youngest cluster (1897-2012), in which discrete and often short-lived effusive eruptions represent the main eruptive dynamics. Historical summit collapses (pit craters to caldera), all localized at the top of the summit cone, were related to voluminous lateral eruptions and were followed by a significant decrease in eruptive rate. However, many lateral eruptions were not associated with summit collapses or explosions. The long-lasting occurrence of magma at very shallow depth represents thus a critical condition to produce summit explosive activity. The pre-historic building of Piton de la Fournaise summit cone results from a long-lasting to continuous activity centered below its western side (Bory crater/lava lakes). Frequent and large lava fountains and long-lasting lava lakes represented an important dynamics in this recent past. In this perspective, the last century of activity of Piton de la Fournaise can be considered as a lull, in spite of its high frequency (1 eruption / 9 months on average).