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Structure of Puy de Dôme volcano (Chaîne des Puys, France): towards a revised model

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The project TOMUVOL, aimed at developing a method for muonic tomography of volcanic edifices, has chosen the Puy de Dôme as an experimental test site. In fact, this volcano with a simple external shape has a complex internal structure that may allow testing the performances of this new method.
The Puy de Dôme is a composite lava dome, about 11 ka old. It is composed of two distinct morphological units. The first one would consist of a classic bristled lava-dome whereas the second one would be a dome erected on the eastern flank of the first one, after a large flank collapse. However, between 2004 and 2011, fresh outcrops revealed by the building of touristic facilities on the summit and at the basis of the mountain, afforded the collection of new data inducing new questions. The field was then more systematically explored and the results of a LiDAR survey centred on the Puy de Dôme and recorded in March 2011 were examined.

As a result, the following key-points were set to the forth.

(i) The volcanic sequence was initiated by a small explosion which perforated the geological basement.
(ii) The slopes of the eastern edifice display long and thick (up to ~6 m) lava slabs which can be considered as true lava flows, not included in the simple dome model. Also, the amount of accumulated ash and blocks at the eastern foot of the volcano is too small to fit the wide flank-collapse hypothesis.
(iii) Alteration of the dome by fumaroles and/or hydrothermal processes was previously underestimated. Actually, not only the summit of the volcano is deeply affected by colored alteration and silicification, sometimes connected with marked fissures, but the hydrothermal system, localised below the dome, is suspected to have triggered a late small eruption through an open vent atop the volcano.

Now, the challenge consists in establishing a new model able to account for these new data. In this perspective, the geophysical investigation, including muon tomography, should play a prominent role.

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