

## ***Interactive comment on “Integrating field, textural and geochemical monitoring to track eruption triggers and dynamics: a case-study from Piton de la Fournaise” by Lucia Gurioli et al.***

**Lucia Gurioli et al.**

lucia.gurioli@uca.fr

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Please find here our detailed list of responses. A few explanations are reported in Amanda and Madison responses. Attached is the manuscript with all the corrections and the new figures

“the eruption was triggered by pressurization due to bubble accumulation in a shallow magma reservoir, as opposed to magma chamber cooling or a new batch of magma flux into the reservoir. In general, the outcomes of this study are not transparent with regards to the questions addressed in Lines 99-105. It seems that the paper includes a number of hypotheses while the validity of those are inadequately presented. I suggest

C1

either rephrasing parts of the manuscript as applicable or provide some quantitative analysis in support of some of the conclusions. Also, I find a number of parameters in the figures are not defined properly in the text or in figure captions, making it difficult to follow at places. I hope the authors will find the following specific comments useful for further improvements. “

We added more explanations and data to support our hypothesis and we corrected all the Figures and captions

“Lines 801-807: Following my general remark, several possible scenarios have been proposed here without a reasonable justification. For example, “we found that this kind of eruption can be triggered solely by bubble accumulation and source pressurization” – The relationship of bubbles, pressure build-up and its extent for eruption triggering have not been demonstrated in this study. “

We explained all of this in Amanda and Madison responses, and we added the explanation in the text

“Lines 798-799: It seems like the hypotheses of a shallow magma reservoir and its pressurization are mostly driven by the weak and short geophysical precursors, which is not the focus of this study. In other words, the contribution of geochemical/petrological monitoring independent of geophysical signals – for tracking eruption triggers and dynamics are not transparent. “

As you can see from the previous explanations, the integration of the geophysical and the geochemical/petrological data allowed us to obtain the whole picture. Based on our findings we propose a scenario in which the trigger mechanisms of 2014 activity are both internal and external in the sense that the small shallow reservoir hosting cooled magmas permitted to create the conditions favourable to a second boiling. The second boiling was likely triggered by an almost undetectable stress field change, and was favoured by the shallow storage pressure of the magma (Fig. 12c) that promotes fast water exsolution and rapid magma response to external triggers. See the new

C2

discussion and conclusions.

“Title: The title is too broad. Although it is catchy, but based on the previous two comments, neither the trigger nor the dynamics are adequately addressed in this study.”

We completely disagree and we leave this title, if the editor and the other authors agree.

“Lines 636-640 and 683-689: Isolated vesicles, also mentioned in some other parts of the manuscript, could simply be a result of post-coalescence surface tension forces, especially for low viscosity magmas due to relatively smaller viscous forces. Therefore it may not represent the low rate of deformation, and can even get overprinted during cooling of the pyroclasts. On the other hand, the presence of micro-crystals increase viscosity preserving the coalesced textures (see Moitra et al. 2013, Relating vesicle shapes in pyroclasts to eruption styles, Bull Volc, for a discussion), and therefore if syneruptive, it may not represent cooled magma and longer residence times. Therefore the implications/conclusions need to be more convincing, or a discussion on the various possibilities is required, also insightful, at the least.”

Rapid re-annealing of pore throats between connected bubbles can happen due to short melt relaxation times (Lindoo et al; 2016). This phenomenology can explain the high amount of isolated vesicles in the fountaining samples. However, if you look at the vesicle distributions, they are almost perfect Gaussian curves, so it seems that if the relaxation process happens it just merged perfectly with the expected vesicle distribution. In contrast, you know well that secondary processes like coalescence and/or expansion (as we observe in the spiny) do not fit the curve. In the isolated vesicle rich samples, because of their high permeability, their high vesicularity and mostly their high number of vesicles, we do affirm that we have preserved the signature of the conduit before the explosion. We added this part in the discussion (from line 884)

“Figure 5c: There is no discussion on circularity? What about any other shape factor? What do they mean? “ We removed these data

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“Figure 6d: There are a number of solid lines drawn without a proper caption. Which diagonal line (and therefore the samples) represents equality and what are those various percentages? “ We added explanation

Technical corrections:

“Line 75: space between grain and size” Done

“Line 81: weird spacing” Done “Line 189: Mm3 could be defined in line 188, where million m3 is first introduced, for better” clarity. Done

“Figure 1c caption: locations instead of location “ Done

“Figure 4 caption: %cry and not %Cry to be consistent “ Done

“Figure 9 – ‘T’ in FeOT should be in subscript “ Done

“The name/expression “Piton de la Fournaise” is not consistent in the manuscript: ‘La’ is often used instead of ‘la’” Corrected in captions text and references

“Figure subplots are sometimes labeled by capital letters, sometimes by small letters” Corrected

Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2017-99/se-2017-99-AC3-supplement.pdf>

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2017-99>, 2017.

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