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Interactive comment on “Evaluation of the initial stage of the reactivated Cotopaxi volcano – analysis of the first ejected fine-grained material” by T. Toulkeridis et al.

Anonymous Referee #2

Received and published: 6 January 2016

General comments

The main goal of this manuscript is to describe the first eruptive products of the ongoing eruption of Cotopaxi volcano (Ecuador). This goal is relevant and the authors provide a rapid although preliminary study, which is, a potential source of information for hazard assessment purposes. However, I find several major flaws, which I summarize as follows:

* Unfortunately, the authors did not follow the standard methodology for this kind of study. Usually, samples are sieved and a componentry analysis is done on several selected fractions. Then, the selected samples are cleaned by immersion in ultrasonic

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baths. This step allows us to remove the fine particles that rest obtain grains without the very small particles that come to rest on the fragment's surface (cf. Fig. 6 and 7). I recommend referring to the classical papers on this field (for instance, Cioni et al., JVGR, 1992, 2008).

* Given that, no componentry analyse has been done, I did not understand the meaning of the compositions yielded by EDS. In addition, I recommend being very cautious concerning these element concentrations, especially at low concentrations (< 5 wt.%). Please provide the analytical conditions, limit of detection, errors, etc.

* A rigorous componentry analysis is very important in this kind of study, because if juvenile magma has been incorporated in a “vent clearing” activity, the vol.% of juvenile fragments are usually very low and can be easily misinterpreted. A typical case of study was the study of the first ash samples emitted in March 1980 by Mount Saint Helens (i.e. two months before the paroxysm). These explosions were misinterpreted as phreatic events, however a careful analyse of these samples showed the presence of a small percentage of juvenile material (Cashman and Hoblitt, Geology, 2004). In fact, I regret that the authors did not compare their data with other similar events around the world.

* An additional point concerns the last conclusion of the manuscript, which does refer to the fact that a major explosive, lahar-triggering eruption is excluded. I consider that this statement is an over interpretation of their data. Even if the absence of juvenile material and the amount of hydrothermally altered fragments are confirmed, these data only suggest that the initial phase of Cotopaxi 2015 activity display a phreatic origin. In any case, the study of the initial eruptive products tells us about the forthcoming eruptive activity. This kind of assertion is controversial from a scientific point of view, and is extremely dangerous for the management of a volcanic crisis.

* Lastly, the text needs to be revised by a native-english speaker.

Based on this evaluation, I cannot recommend the publication of this manuscript in

a high standing international journal such as the Natural Hazards and Earth System Sciences.

Specific comments

P6948

L2. Change “volcanic samples” by ash samples.

L4-9. Please revise writing.

L10 (and throughout the text). The term “erupted” must be preferred that “expelled”. At least that is the usage of the volcanological community.

L13-17. Please revise writing.

L25-26. I do not agree with the assertion that tephra emission and fallout was an underestimated volcanic hazard.

P6949

L2. Please avoid tabloid-like terms such as lethal, loss of life, etc.

L5-6. The text is plenty of this kind of general assessment. Please be more precise, explain the mechanism of lahar formation.

L10-14. Please, say some words of the methods, the authors will apply to discriminate between these two hypotheses.

L16. In this context, what is the meaning of the word “classic”?

L18. What is the source for this estimate (250 volcanoes)? You need probably to contrast with previous works, such us those of Hall et al. (2008), which mention that the Ecuadorian volcanic arc has around 50-60 volcanic centres of Pleistocene-Holocene age ...

L23-24. The subduction angle is not oblique, you probably refer to the direction of



convergence ...

L26. This reference is not appropriate. There are many references that are lacking concerning the geodynamical and geological setting. I recommend referring the original sources.

P6950

L6-8. This reference list is not exhaustive. In fact many of the most important works dealing with the Cotopaxi's geology and hazards are lacking! I think for instance to the papers of the IG-EPN local group or the papers of the Geneve's group.

L10-11. How do you obtain this value? Some explanations are needed. What is the database used?

L13-14. Again, many important references are lacking.

L19 and 26. How do you obtain these estimates? Based on historical data or by modeling?

L23-24. Please provide references.

P6951

L4-5. This kind of probabilistic assessment needs a careful treatment. What is the database used to obtain this value? What is the used methodology? What is the time window used for this analyze?

L6 and following. I am surprised that the authors do not include any reference of local scientific group (IG-EPN) in charge of the monitoring of the Ecuadorian volcanoes.

L13. "Cotopaxi showed ups and downs". Please be more precise.

L17. Please provide the source of this information.

P6953



L14-16. The authors need to say that, before the sudden August 14th event, the IG-EPN emitted several scientific reports.

L13. The main event section. I suggest to describe in detail the phenomenology of this event avoiding any subjective statement.

L14-21. I do not understand the meaning of this phrase, and the references included at the phrase's end are not in accord with its content.

L25. This kind of subjective assertions must be avoided. A scientific work must be objective.

P6954

L10-13. Again, subjective assertions must be avoided.

P6955

L10-11. How do you determine the compositions (and-dac-rhyodac) of ash particles?

L11. How do you determine that the particles are “hydroclast”? I recommend, first to describe these particles and then interpret its origin.

L13. How do you constraint the plagioclase composition? Usually, plagioclase crystals in intermediary magmas are solid solutions of Ab-An end-members . . .

L19-21. Given that the authors studied the initial volcanic products of Cotopaxi unrest, the juvenile material, if existed, must be at very low contents . . .

L27. Given that ash samples are extremely heterogeneous, I do not understand the meaning of these chemical data. In fact, I expected, first, a componentry analyses before proceed to quantify the chemical composition of individual grains of each previously defined categories

P6956

L1. Why do you average 100 spectra? Given the extreme heterogeneity of these

samples, I guess that these analyses area meaningless.

L7-8. The authors have to consider that EDS is a semi-quantitative method, which can be used to determine, for instance the silica content, but you will be very cautious for other elements such as Mn, Mg, Ti, K . . .

P6957

L25. Given the problems in sample treatment previously described, I consider that the term “categorically” is quite exaggerated.

P6958

L6-9. This is a huge over interpretation of data. Even if the absence of juvenile material is confirmed, these data only suggest that the initial phase of Cotopaxi 2015 activity display a phreatic origin. There are lots of examples of explosive events that initiated with a phreatic phase.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 6947, 2015.

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