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Interactive comment on “Can vesicle size distributions predict eruption intensity during volcanic activity?” by A. LaRue et al.

Anonymous Referee #2

Received and published: 23 July 2013

This study presents new and interesting data on vesicle-size distributions from Eyjafjallajökull tephra and comparison with VSD's from experimental clasts produced during active vesiculation with and without quenching by water. I think the new data are worthy of publication, but I have some comments about both the methodology and the general premise of the paper.

Most significantly, the title and the last few sentences of the paper suggest that determining vesicle size distributions can be a method of predicting eruptive activity. I can't imagine how VSD's can predict future behavior, nor do the authors explain this. I suggest they change the word “predict” to “quantify” in the title of the paper, and change the wording on p. 792 (lines 3-7) and p. 799 (lines 22-24) to emphasize quantification rather than prediction.

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The authors should add a few sentences to the Discussion section considering the limits of application of these results. At Kilauea, one can collect fist-sized clots of lava near the ocean entry that have deformed through turbulent mixing with water while still fluid. Those clots have odd vesicle shapes, and any measure of bubble (or void) size distribution would show clear influence of water. The degree of influence should be related to the length scales of mixing and the time of mixing relative to vesiculation.

Some other, more specific comments are below. Overall I think the paper is worthy of publication with minor changes.

Specific comments:

p. 793, line 6: perhaps use the term “glass containing dissolved water” rather than “hydrated glass”. “Hydrated” generally means glass that has absorbed meteoric water at low temperature after solidification, whereas you are heating it to magmatic temperature under high pressure, and allowing the water to dissolve into a liquid melt.

p. 793, line 8: what does “hydrous environment present during the Eyjafjallajökull eruption” mean? The water content of the magma chamber before ascent? The wet crater environment through which magma erupted?

Page 794, lines 5-6. Is there any way to say at what stage of vesiculation the clasts in the Argonne experiments were quenched? Can you rule out the possibility of ripening or other modification?

Page 795, line 16. If there was 1.7-4.1 wt% water dissolved in these melts, why was their vesicularity only 48+/-26%? Did the melt quench before it fully vesiculated?

Page 795, line 22. It's interesting that the experimental VSD's at high vesicularities are similar to those in the natural scoria, given the 10x to 100x differences in VND's (Table 1).

p. 798, line 13-14, “The similar power law exponents . . . suggest the operation of similar mechanisms in the magma reservoirs and/or conduits.” Can you be more

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specific than “similar mechanisms”. Mangan and Cashman for example inferred that similar bubble number densities corresponded to similar decompression rates in the conduit.

p. 799, lines 17-19. “We interpret VSDs in the scoriae . . . to reflect gas-melt withdrawal from an open-conduit shallow reservoir steadily supplied with deeper magma.” How did the gas/melt withdraw if magma was being resupplied? Did it withdraw upwards?

Interactive comment on Solid Earth Discuss., 5, 789, 2013.

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