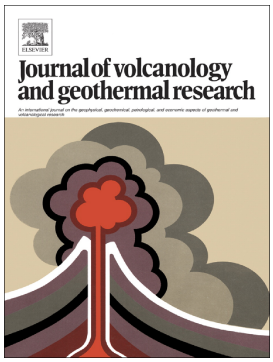

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Large explosive basaltic eruptions at Katla volcano, Iceland: Fragmentation, grain size and eruption dynamics

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Abstract

Katla volcano in Iceland produces hazardous large explosive basaltic eruptions on a regular basis, but very little quantitative data for future hazard assessments exist. Here details on fragmentation mechanism and eruption dynamics are presented for the first time. We show that magma/water interaction is important in the ash generation process, but to a variable extend.
By investigating the large explosive basaltic eruptions from 1755 and 1625, we document that eruptions of similar size and magma geochemistry can have very different fragmentation dynamics. Our models show that fragmentation in the 1755 eruption was a combination of magmatic degassing and magma/water-interaction with the most magma/water-interaction at the beginning of the eruption. The fragmentation of the 1625 eruption was initially also a combination of both magmatic and phreatomagmatic processes, but magma/water-interaction diminished progressively during the next stages of the eruption. However, intense magma/water interaction was reintroduced during the final stages of the eruption dominating the fine fragmentation at the end.
This detailed study of fragmentation changes documents that subglacial eruptions have highly variable interaction with the melt water showing that the amount and access to melt water changes significantly during eruptions.
Our study is based on a detailed deposit stratigraphy, granulometric modeling, componentry and the new quantitative regularity index model of fragmentation mechanism. While it is often difficult to reconstruct the progression of eruptions that have no quantitative observational record, this study shows that integrating field observations and granulometry with the new regularity index can form a coherent model of eruption evolution.