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## Fragmentation of steaming Surtseyan bombs

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A Surtseyan volcanic eruption involves a bulk interaction between water and hot magma, mediated by the return of ejected ash. Surtsey Island, off the coast of Iceland, was born during such an eruption process in the 1940s. Mount Ruapehu in New Zealand also undergoes Surtseyan eruptions, due to its crater lake.

One feature of such eruptions is ejected lava bombs, trailing steam, with evidence that watery slurry was trapped inside them during the ejection process. Simple calculations indicate that the pressures developed due to boiling inside such a bomb should shatter it. Yet intact bombs are routinely discovered in debris piles. In an attempt to crack this problem, and provide a criterion for fragmentation of Surtseyan bombs, a transient mathematical model of the flashing of water to steam inside one of these hot erupted lava balls is developed, with a particular focus on the maximum pressure attained, and how it depends on magma and fluid properties. Numerical and asymptotic solutions provide some answers for volcanologists.