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The Surtseyan experiment - fragmenting basaltic melts.

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The fragmentation of porous natural melts has been the main focus of the experimental volcanology group of the LMU Munich. The rapid decompression experiments helped to quantify the dynamics of explosive eruptions. In the recent year a new experiment has been designed and tested to analyse the fragmentation of basalt during surtseyan eruptions. During this shallow water - eruptions quench fragmentation is thought to increasing the heat transfer to the surrounding water, driving steam explosions and amplifying the eruption energy. Particular attention will be paid to study the mechanism, introduced by Larry Mastin, termed “turbulent shedding”, that can generate fine hydro-magmatic basaltic ash by removal of quenched glassy rinds on clasts surfaces that are rapidly deforming within turbulent transport. In the experiment 300 ml basaltic melt is generated in an internally heated autoclave at temperatures of up to 1300 °C and ejected via gas pressure into a low pressure tank. The autoclave can be pressurized to 50 MPa and is designed to eject the melt directly into water, wet sediments or water spray the later being a technique used by powder metallurgists to produce micron-sized fragments of metallic glass, with cooling rates above a million degrees per second. Two molybdenum furnaces are used to heat the melt while a third Cantal or Molybdenum furnace is used to control the temperature at the ejection orifice. 6 thermocouples are used to control the furnaces and to record the thermal gradient through the setup. Pressure transducers in the high and low pressure section will allow to record the expansion volume due thermal interaction. The autoclave is equipped with a shutter to prevent water form entering the high temperature zone. The new experiment will allow to study the process of turbulent mixing by changing the

flow rate or the orifice diameter and thus give insight into effect of relative proportions of magma and water during surtseyan eruptions. First experiments resulted in Pelee's hairs and tears showing the high strain rates during the melt ejection. Following the experiments grain size and surface area analysis of the produced hydromagmatic tephras will be performed to quantify the possible thermal interaction area to quantify the influence of the turbulence intensity and heat transfer rate in magma-water mixing.