Two far-reaching historical eruptions from Katla volcano, Iceland: Fragmentation mechanism of the basaltic tephras

Johanne Schmith[1], Ármann Höskuldsson[2], Gudrun Larsen[2], Paul M. Holm[3]

[1]Nordic Volcanological Center, Institute of Earth Science, University of Iceland, Iceland, [2]Institute of Earth Science, University of Iceland, Iceland, [3]Department of Geosciences and Natural Resource Management, University of Copenhagen, Denmark

E-mail: johasch@hi.is

Do volcanic eruption plumes from Iceland pose a significant hazard to the European society? Yes is the obvious answer after the 2010 Eyjafjallajökull and 2011 Grimsvötn events. This has long been recognized from the deposits of silicic eruption plumes found all over Scandinavia and Great Britain. However, even more interestingly the Grimsvötn 2011 eruption also showed the world that the hazard potential of basaltic explosive eruptions from Iceland is significant.

Why are the basaltic explosive eruptions in Iceland so potent? Is it the sheer volume of basalt erupted at high eruption rates or has it to do with the ubiquitous glaciers on top of the central volcanoes? How much influence does melt water-magma interactions have on the fragmentation process of far-reaching basaltic eruption plumes from Iceland?

Here we present results from investigations of the basaltic Katla 1755 and 1625 eruption deposits. Katla is one of the glacier covered central volcanoes in the Eastern Volcanic Zone in Iceland. More than 300 basaltic and 20 silicic explosive eruptions are recorded from the Katla volcano in the Holocene time. Some of the silicic tephra layers are found in the European tephra record. Historical documents report that both of the studied tephra layers reached well outside of Icelandic borders. Mapping of the tephra has revealed that the layers from both events have an east-northeast directed thickness axis propagating from an eruption site within the caldera of Katla. The duration of the two Katla eruptions have been documented by historical records as 120 days for the 1755 and 13 days for the 1625 eruption, respectively.

The two tephra layers were sampled and described at median to distal localities with emphasis on the fine portion of the deposits. The grain size distributions were obtained by hand sieving and the fine portion analysed with a SediGraph 5120 instrument. Special attention was given to the sample portion smaller than 125 microns and the grain morphology and shape parameters defined with Particle Insight Dynamic Image Analyser. Selected samples were then analysed by SEM. At the meeting we will present our results and discuss the role of glacier/melt water in magma fragmentation and fine tephra formation in these two eruptions. Further we will discuss the fragmentation mechanism's effect on the ability of tephra to be carried thousands of kilometers from source.