Reviewed research article

Grain characteristics of tephra from the sub-glacial SILK-LN Katla eruption ∼3400 years ago and the sub-aerial Hekla eruption in 1947

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Abstract — *Chemical composition of the tephra from the Katla and Hekla volcanoes is similar but the eruption environment is quite different, the Katla volcano is ice-covered whereas the Hekla volcano is ice-free. The ∼3400 years old Katla SILK-LN and the Hekla 1947 tephra layers were studied with respect to spatial and temporal changes in grain size and their grain characteristics with main focus on the finer fraction of the tephra grains. The results show obvious difference both in mean grain size and the fraction of finest particles from the two volcanoes. The Hekla 1947 tephra has significantly higher mean grain size and much lower content of material finer than ≤4 Φ (0.063 mm). The grains from the Katla tephra are elongated and are even needle shaped, but the grains from the Hekla tephra are more equant. The silicic Katla eruptions produce greater quantities of ash ≤4Φ than Hekla eruptions with similar magma composition and are therefore more likely to affect the human environment, including health of people and aviation.*

INTRODUCTION

The recent eruptions in Eyjafjallajökull 2010 and Grímsvötn 2011 (Gudmundsson *et al.*, 2012; Hreinsdóttir *et al.*, 2014) have increased interest in the transport of fine-grained tephra and the proportion of particles 0.063 mm and smaller generated by different types of explosive eruptions. The fine-grained tephra particles tend to stay in the air for a long time and can be transported very far. Fine particles from an explosive eruption may cause critical engine failure if an airplane encounters an ash cloud. Serious disturbances in flight transportations can therefore occur during an explosive eruption (e.g. Þorkelsson, 2012). Furthermore, wind-blown tephra can cause trouble in the area around the volcano for a long time after the eruption has ended. Example of such wind-blown material is the fine tephra from the Eyjafjallajökull 2010 and Grímsvötn 2011 eruptions which has reached Reykjavík on a number of occasions (Nicholson *et al.*, 2014).

The project described in the following chapters is part of a larger project aimed at the characterization of tephra from different types of explosive Icelandic eruptions through analysis of grain sizes and grain shapes. This paper deals with tephra of similar chemical composition from two eruptions occurring in different environmental settings, the ice-covered Katla volcano and the ice-free Hekla volcano.

The main objective is to investigate whether the effect of the eruption environment is discernible in the grain characteristics of the tephra from these two eruptions. Spatial and temporal changes in the proportion of tephra 0.063 mm and smaller are of particular interest. Also, will the tephra grains reflect the different eruption environment and can difference in grain shape affect the long-range transport?