

Deciphering eruption history and magmatic processes from tephra in Iceland

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Abstract – *Tephra is the ideal volcanic product for the study of eruption history of Icelandic volcanoes and the underlying magmatic processes. In the last 11 centuries, 2/3 of all eruptions have been explosive, leaving tephra as their only product. Including eruptions of both lava and tephra increases the ratio of tephra producing eruptions to 3/4. Tephra conservation depends on several factors such as eruption intensity, weather conditions and volume of tephra produced as well as the surface on which the tephra is deposited. Vegetation improves conditions for in situ preservation of tephra layers, and once embedded in soil they can be preserved for long periods of time. Holocene eruption history can be reconstructed over the last 6–8 millennia from soil section and further back in time from lacustrine and marine sediment records. Tephra can be used to understand volcanic behaviour over long or short periods, a single eruption mechanism or individual production phases of an eruption. Examples of combined application of chemical analyses and tephra mapping show how (1) tephra layers from the Katla volcano unravel most of its Holocene eruption history and suggest likely increased eruption frequency in the future, (2) a fundamental link between repose time and eruption magnitude is manifested by Hekla tephra, (3) tephra from the Eyjafjallajökull 2010 eruption gives insight into rapidly changing magmatic processes taking place during a single eruption, and (4) variability within tephra grains from the Grímsvötn 2011 eruption reflect different depth of magma storage. These examples illustrate how tephra studies, sensu lato, can reveal magmatic and eruption processes at different temporal and spatial scales that are of relevance for assessment of future eruptive scenarios.*