

The 2011 unrest at Katla volcano: seismicity and geological context

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Abstract — *Katla is one of the most active volcanoes in Iceland and is characterised by persistent seismicity. It is partly covered by the Mýrdalsjökull glacier and its historic activity is dominated by phreatomagmatic eruptions within the caldera associated with catastrophic glacial floods. In July 2011 a sudden jökulhlaup was released from the glacier, associated with tremor, elevated seismicity inside the caldera and a new cluster of seismicity on the south flank. This was likely caused by a hydrothermal or magmatic event, possibly a small subglacial eruption. Similar unrests occurred in 1955 and 1999. We have identified changes of the seismicity pattern coinciding with the 2011 unrest, suggesting a modification in the volcanic system. It may be speculated that if the persistent seismicity at Katla is an indication of a pressurized magma system ready to erupt, small events like those of 1955, 1999 and 2011 may trigger larger eruptions in the future. We have also conducted a pilot study of the geology of the southern flank, where the new seismicity is recorded, and identified sources for flank eruptions in the recent eruptive history of Katla. These include rhyolitic domes and surtseyan craters. Therefore, a wide range of volcanic processes have to be taken into account as possible source for the new seismicity and volcanic hazard.*

Keywords: Katla volcano, volcano seismicity, long-period earthquakes, silicic domes, flank activity

INTRODUCTION

The study of subglacial volcanoes is crucial, as magma-ice interaction can produce highly explosive eruptions and jökulhlaups (glacial floods; Major and Newhall, 1989, Guðmundsson *et al.*, 2008), but problematic, because the ice cover prevents direct observations and complicates the understanding of geophysical signals. The Katla volcanic system, in south Iceland, is a prime example. Katla hosts a large caldera covered by the Mýrdalsjökull ice cap (Figure 1) and is a peculiar volcano for its persistent seismicity also

during periods of volcanic quiescence (Einarsson, 1991). It is one of the most active volcanoes in Iceland and its volcanic activity is dominated by explosive, phreatomagmatic eruptions (Óladóttir *et al.*, 2008). The last eruption to break the ice surface occurred in 1918 and the current repose time is the longest known in history (Larsen, 2000).

After the eruption of Eyjafjallajökull in 2010, scientists' attention was pointed to Katla, as several previous eruptions of Eyjafjallajökull were swiftly followed by eruptions at neighbouring Katla (Einarsson and Hjartardóttir, 2015). However, no visible eruption