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Increased Eruption Frequency in Volcanoes below the Vatnajökull Ice Cap, Iceland, predicted by Tephrochronology

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Through the ages, the 8300 km^2 Vatnajökull ice cap in SE-Iceland was a little known, remote and inaccessible area. Documentation of volcanic eruptions within the ice cap was therefore patchy, especially prior to 1600 AD. Vatnajökull covers a large part of the Grímsvötn-Laki volcanic system, including the central volcano Grímsvötn where eruption frequency is highest. Two other volcanic systems, partly covered by Vatnajökull and active during the last millennium, are Bárdarbunga-Veidivötn and Öræfajökull.

Grímsvötn-Laki and Bárdarbunga-Veidivötn produce mainly basalts. Eruptions on their ice-covered parts are hydromagmatic, producing tephra. Tephra layers deposited on the accumulation areas of Vatnajökull are preserved in the ice, forming distinct horizons in the ice that crop out in ablation areas as bands of tephra. They provide the most detailed eruption record of these volcanic systems. Detailed measurements and sampling of tephra horizons on ablation areas of four outlet glaciers of Vatnajökull have provided new insight into the eruption history of Grímsvötn-Laki and Bárdarbunga-Veidivötn.

The ice record brings the number of Grímvötn eruptions during the last millennium to roughly 70 and those of Bárdarbunga-Veidivötn to about 20. The eruption time series also shows that the volcanic activity has a 130-140 year period, split into two intervals of about equal length; an interval of low activity and an interval of high activity. During high-activity intervals, 6-11 eruption occur per 40 years. This is most pronounced for the Grímvötn system but the other two systems join in when activity is high at Grímsvötn. An interval of low activity beginning in the 1930s lasted into

the 1990s. Extrapolation of the tephrochronological record predicts that the next 60-80 years are likely to be an interval of high activity. This is supported by the recent volcanic activity since three eruptions have occurred in the last eight years, compared to one in the 58 years prior to 1996.