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The Morsárjökull rock avalanche in the southern part of the Vatnajökull glacier, south Iceland

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On the 20th of March 2007 a large rock avalanche fell on Morsárjökull, one of the outlet glaciers from the southern part of the Vatnajökull ice cap, in south Iceland. This is considered to be one of the largest rock avalanches which have occurred in Iceland during the last decades. It is believed that it fell in two separate stages, the main part fell on the 20th of March and the second and smaller one, on the 17th of April 2007. The Morsárjökull outlet glacier is about 4 km long and surrounded by up to 1000 m high valley slopes. The outlet glacier is fed by two ice falls which are partly disconnected to the main ice cap of Vatnajökull, which indicates that the glacier is mainly fed by ice avalanches.

The rock avalanche fell on the eastern side of the uppermost part of the Morsárjökull outlet glacier and covered about 1/5 of the glacier surface, an area of about 720,000 m2. The scar of the rock avalanche is located on the north face of the headwall above the uppermost part of the glacier. It is around 330 m high, reaching from about 620 m up to 950 m, showing that the main part of the slope collapsed. It is estimated that about 4 million m3 of rock debris fell on the glacier, or about 10 million tons. The accumulation lobe is up to 1.6 km long, reaching from 520 m a.s.l., to about 350 m a.s.l. Its width is from 125 m to 650 m, or on average 480 m. The total area which the lobe covers is around 720.000 m2 and its mean thickness 5.5 m. The surface of the lobe shows longitudinal ridges and grooves and narrow flow-like lobes, indicating that the debris mass evolved down glacier as a mixture of a slide and debris flow. The debris mass is coarse grained and boulder rich. Blocks over 5 to 8 m in diameter are common on the edges of the lobe up to 1.6 km from the source. No indication was observed of any deformation of the glacier surface under the debris mass.

The first glaciological measurements of Morsárjökull outlet glacier were carried out in the year 1896 and it is evident that since that time the glacier has retreated considerably and during the last decade the melting has been very rapid. It is thought that undercutting of the mountain slope by glacial erosion and the retreat of the glacier are the main contributing factors leading to the rock avalanche. The glacial erosion has destabilized the slope, which is mainly composed of palagonite and dolerite rocks, affected by geothermal alteration. Hence a subsequent fracture formation has weakened the strength of the bedrock. However the exact triggering factor is not known. No seismic activity or meteorological signal such as heavy rainfall or intensive snowmelt recorded prior to the rock avalanche which could be interpreted as triggering factors.

From 2007 considerable changes have been observed on the glacier. The ice-front has retreated considerably and the debris lobe of the rock avalanche has moved downward along with the glacier ice about 90-100 m per year. The rocky material, by insulating the ice, has reduced its melting, leading to a relative “thickening” of the ice beneath the rock avalanche debris up to 11-15 m per year. After three melting seasons the debris mass was about 29 m above the surrounding ice surface.