



May 19th rain triggered lahar originating in the Eyjafjallajökull 2010 volcanic ash. Observation, mapping and granulometric study.

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Syn-eruptive or post-eruptive concentrated debris flows of remobilized airfall tephra are rare in Iceland. A lahar cascading down the south slopes of the Eyjafjöll volcano on May 19th, is the first such event observed by scientists in Iceland.

The lahar was first noticed at a nearby farm around 9 AM, as heavy noise sourced from the slopes of the volcano. A few minutes later the lahar reached a man-constructed protection dyke at the bank of river Svadbælisá, close to the farm. The lahar was described to have the consistency of wet concrete. The peak discharge was reached by 10 AM. It had overflowed the banks of the river and left about 30-cm-thick deposit along the first 4 km of the channel and river fan. Conditions did not allow thickness measurements elsewhere along the route of the flow. The lahar reached the valley floor of Svadbælisá through a narrow and steep gully on the slopes of the volcano beneath the glacier. At that time it probably had a sediment load about 50-60 % by volume, suggesting transitional character between a debris flow and a hyperconcentrated flow. The lahar was soon diluted by the river. At the time of first sampling, 5 hours after the outburst, it contained 17 % sediment load by wt (<10 % by vol), corresponding to a muddy streamflow. Pulses or waves passing through the flow were detected every 1-2 minutes. The deposit consists mostly of juvenile volcanic material, indicating minor sediment uptake during advance.

The flow originated in the south slopes of the glacier as verified by radar image taken from the Icelandic coast guard aircraft TF-Sif. It shows a main sliding area of a few square km, and two smaller areas. The area was inspected on May 25. Where the sliding had cut the tephra deposit, a 50 cm thick profile was revealed. It contained three layers, the middle layer was very fine grained and water saturated. Seemingly, this layer had failed and slid on the coarser bottom layer which was characterized by aggregates. The top layer was dry, well sorted ash. Thus, this lahar appears to have been initiated by similar mechanism as an avalanche, which then passed along the jökulhlaup channel formed earlier in the eruption leading to the Svadbælisá river gully and then spread over the wide river fan. The night before the May 19th rainfall in the farming district was moderate, but heavier rain is likely at higher elevations under such conditions.

This lahar was expected. The tephra fall on the hill slopes south of the glacier contains very fine grained, water retaining ash bed. This layer was strongly water-saturated and by stepping on it liquefaction occurred. Water content of the layer was measured to be up to 29 % by wt. Several mini-lahars had occurred on the steepest slopes. These observations suggest that it was heavy rain that triggered the lahar. The tendency of the fine-grained ash layer to retain water implies that debris flows can be expected in the area for months or even years to come.