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# Total and single phase grain-size distributions for the 2011 sub-Plinian basaltic eruption of Grímsvötn, Iceland

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The subglacial Grímsvötn volcano is the most active volcanic centre in Iceland with >60 eruptions the last 800 years, where typical events (e.g. the 1998 and 2004 eruptions) produce steam-laden 6-12 km-high plumes and tephra falls with volumes on the order of 0.01-0.1 km3. On May 21, 2011 the second Grímsvötn eruption of the 21st Century began, featuring a spectacular 15–20 km-high eruption column, which at its peak was crowned by a 100 km-wide umbrella cloud. The main explosive phase lasted until 23 May, and after that the intensity of activity began to dwindle steadily until the eruption came to halt on May 28. About 0.6-0.8 km3 of tephra was produced (0.2-0.3 km3 DRE) during this event, which makes it the biggest Grímsvötn eruption since 1873, an order of magnitude larger than the 1998 and 2004 events. Bulk of the tephra was deposited along a wide sector to the south of the volcano. However, some tephra was deposited in most parts of Iceland. A concerted field sampling effort was carried out in the summer of 2011, with several field trips that covered large parts of Iceland, but notably the glacier and the south-trending main tephra sector. Sampling localities are densest on the glacier where stratigraphy of the tephra sector is also best preserved. On the basis of this, seven phases were identified. Two principal sections were logged and sampled: (1) a 4.8 m thick proximal section 1 km S of the went and (2) a 1.6 m thick section 6 km south of the went on the southwest slopes of the Háabunga ice dome. Grain-size analyses of samples from the glacier and the lowlands have been made. Based on grain-size distribution two types are identified. At Háabunga two dominant layers accounting for 60% of the total thickness show narrow, slightly bimodal log-normal grain-size distribution with maximum clasts being $\sim$20mm (-4.5 phi) in diameter and modal size at 5-8 mm (-2.4 and -3 phi). The other recognized type produced broader bimodal grain-size distributions with maximum clasts being $\sim$10mm (-3.5 phi), two modes at 0.5 and 0.09 mm (1 and 3.5 phi) and in a few instances hail/ash accretion indicating a wetter plume. The individual phases cannot be defined from grain-size or stratigraphy in the 1-10 cm thick sections found on the lowlands. However, the grain-size distributions and other morphological analysis of the tephra for individual phases provide an important opportunity to increase our understanding of magma-water interaction and the transitions from wet to dry conditions. Importantly, these deposit studies can be connected with visual observations and other such data obtained for this eruption.