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Morphology of proximal and distal ash grains from the 2010 Eyjafjallajökull summit eruption.

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Although most of the volcanic ash produced during the 2010 summit eruption of Eyjafjallajökull was deposited in southern Iceland, a significant proportion was transported across the Atlantic Ocean to Europe, causing major disruption to air travel. The eruption had three phases; an initial explosive phase (14 - 19 April) was followed by a lava producing phase (19 April - 5 May) before a return to more explosive eruptions that continued for a further two weeks. Here we present results from scanning electron microscope (SEM) studies of ash grains from both proximal and distal locations and from different phases of the eruption. Differences in the morphology of the grains can be interpreted in terms of fragmentation and transport processes.

Grains produced during in the opening explosive phase of the eruption were sampled at proximal locations in south Iceland. Dense, blocky, grains predominate. These typically range in size between 20 and 60 microns but much larger grains, from 100 to 500 microns also occur. Vesicles, where present, are isolated and sub-spherical, and some grains are bubble-wall fragments. Generally, smaller particles, from 1 - 10 microns adhere to the surfaces of larger particles, fill their vesicles, or form fragile, low-density aggregates with irregular shapes. 'Dendritic' chains of platy grains (0.1 - 1 micron diameter) are found, but are less common. Distal grains collected in the UK contain aggregates with a mean size of 85 microns (range 20 - 200 microns). These are well cemented with consequent low porosity, and have irregular shapes. Individual crystals and glassy particles with etched surfaces are also found.

Grains with less blocky forms are more prevalent in material formed during the end of the initial phase and dominate samples from the lava-producing phase. A well-sorted sample collected on the 22 April contains poorly-vesicular grains approximately 50 - 100 microns in diameter that are have either cuspate surfaces defined by vesicle walls or fluidal shapes such as Pele's hairs. Aggregates are absent from this phase and small adhering grains form only a minor component. This contrasts with ash produced during the final explosive stage of the eruption, grains from which are once more characterised by small, platy, particles (1 - 10 microns diameter) that adhere to grain surfaces and fill the vesicles. A spherical accretionary lapillus 100 microns in diameter (component grains < 10 microns) was observed in one sample. The grains themselves range in diameter from 50 - 1000 microns. They are poorly- to incipiently- vesicular, with irregular forms reflecting breakage across composite vesicles.

These observations will be combined with results from further analysis of samples from distal locations and used to relate ash morphology to the behaviour of the volcano and processes taking place during transport.