Volcanic Input From the Short-lived Plinian 871AD Settlement Event, Southern Iceland

A K Mortensen (The Nordic Volcanological Institute, Grensásvegur 50, 108 Reykjavik, Iceland; ph. +354 525 4489; fax +354 562 9767; e-mail: anette@norvol.hi.is); N. Óskarsson (The Nordic Volcanological Institute, Grensásvegur 50, 108 Reykjavik, Iceland; ph. +354 525 4480; fax +354 562 9767; e-mail: niels@norvol.hi.is); G Sverrisdóttir (The Nordic Volcanological Institute, Grensásvegur 50, 108 Reykjavik, Iceland; ph. +354 525 4486; fax +354 562 9767; e-mail: gsv@norvol.hi.is)

The atmospheric input of tephra and gas from the silicic part of the 871AD Settlement Layer, Southern Iceland is estimated to evaluate its regional environmental impact and for modelling the hazards associated with eruptions of this type. Special attention is focused upon volcanic hazards for the air traffic over the North Atlantic.

The 871AD Settlement Layer is deposited in volcanic soils of the south-western part of Iceland. The tephra layer is characterized by a lower, light silicic part and an upper dark, basaltic part. The silicic part of the 871AD Settlement Layer was formed in the early phase of the Vatnaöldur eruption, triggered by the lateral injection of basaltic magma from the 42km long, discontinuous Vatnaöldur fissure into the magma chamber of the Torfajökull central volcano. The Vatnaöldur fissure is part of the Veidivötn fissure swarm, which has produced a sequence of mixed eruptive events with a 500-800 year interval; the last three eruptions dated 150AD, 871AD and 1477AD. A crosswind influenced the tephra dispersal from the plume, distributing the tephra to the west forming isopach contours with two distinct lobes (Larsen, 1984). Correlation with the present day wind directions over Iceland seems to indicate that this eruption took place during the spring-summer season, which is in good agreement with interpretations from the stratigraphic position of the Settlement Layer in the Greenland GRIP ice core (Grönvold et al., 1995).

Granulometric analyses of samples collected along and perpendicular to the dispersal axis up to 120 km from the source were obtained by combining hand sieving of the coarse particle population and laser diffraction analysis of the fine particle population. The samples within 60 km of the vent express a bimodal size distribution, which beyond 60 km of the vent shifts to a unimodal size distribution. The median diameter of the fine population of the proximal bimodal samples and the median diameter of the distal unimodal samples coincides at ~ 63 mm. The coarse (> 250 mm) and the fine suspended (< 250 mm) grain

size populations represent fallout from the wind-blown plume and fallout by rain flushing or particle aggregation, respectively. The volcanic input of tephra is constrained for the two grain size populations. Combining the estimated volume of erupted tephra with both the surface areas of the two particle populations and the volatile composition (S, Cl and F) of the degassed glass and of the silicate inclusions in the phenocrysts gives an estimate of the climatic chemical impact of this event. The relative high abundance of the fine-grained particles indicates long residence time of the atmospheric particle load. This is also suggested by the occurrence of the tephra in the Greenland GRIP ice core.

Larsen, G., 1984. Recent volcanic history of the Veidivötn fissure swarm, Southern Iceland. JVGR 22, 33-58 Grönvold, K et al., 1995. Ash from Iceland in the Greenland GRIP ice core correlated with oceanic and land sediments. EPSL 135, 149-155.