Flow directions and emplacement mode of a subaqueous ignimbrite based on twofold directional fabric analyses

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Directional fabric – in the sense of preferred grain alignment – of deposits from subaerial pyroclastic density currents (PDCs) are widely reported and are related to forces are acting just before the emplacement of the load from the mass flow. In this way, flow direction, source area and emplacement mode have successfully obtained by investigating the flow-related directional fabric (e.g. Giordano *et al.*, 2008) in such cases. On the contrary, the development of fabric in subaqueously deposited volcanogenic mass flows (i.e subaqueous pyroclastic flows) is not a well-known phenomenon. The implications on flow directions and emplacement mode of a subaqueously deposited ignimbrite are presented in this study, which are based on a twofold petrofabric analyses.

The directional fabrics of the Rám Hill Pumiceous Sandstone were revealed. The formation is known from four outcrops around a deeply eroded Middle Miocene lava dome group in North Hungary, the so-called Keserűs Hill volcano (Karátson *et al*., 2007). The Rám Hill Pumiceous Sandstone is interpreted as a flow unit of a small ignimbrite that were deposited around the central lava dome group on the proposed ring plain under submarine conditions.

The directional fabric of the present subaqueously emplaced deposit from a PDC-derived mass flow has investigated by a twofold approach: 2D photo-statistical analyses on rock surfaces and anisotropy of magnetic susceptibility (AMS) measurements have also performed. Investigations have made on four outcrops which are scattered on the proposed submarine ring plain.

Anisotropic grain alignment, thus directional fabric have revealed by both methods which indicate well-clustered clast a-axes azimuths and/or imbrication, in this way reliable flow directions. The obtained fabric properties are similar to ones from subaerial PDC deposits, which are reported by many studies (pl.: Capaccioni & Sarocchi, 1996, Giordano *et al*., 2008). The obtained flow directions along vertical profiles show smaller or greater scatter.

The well-clustered clast a-axes and the imbricated fabrics imply laminar flow motion and high particle concentration (e.g. Rees, 1968) at the stage of emplacement. In this way, in spite of mixing with ambient water and basement sediments, thus dilution during subaqueous movement similar conditions than in subaerial PDCs can be retained under submarine conditions.

The vertical variability of fabric directions (Fig. 1 B) indicates incrementally shifting flow directions during deposition. This observation is in accordance with emplacement by progressive aggradation rather than by freezing 'en masse'.

Considering the obtained flow paths (Fig. 1 A) the investigated flow unit can be originated from the central part of the eroded volcanic terrain, from the Keserűs Hill lava dome group.

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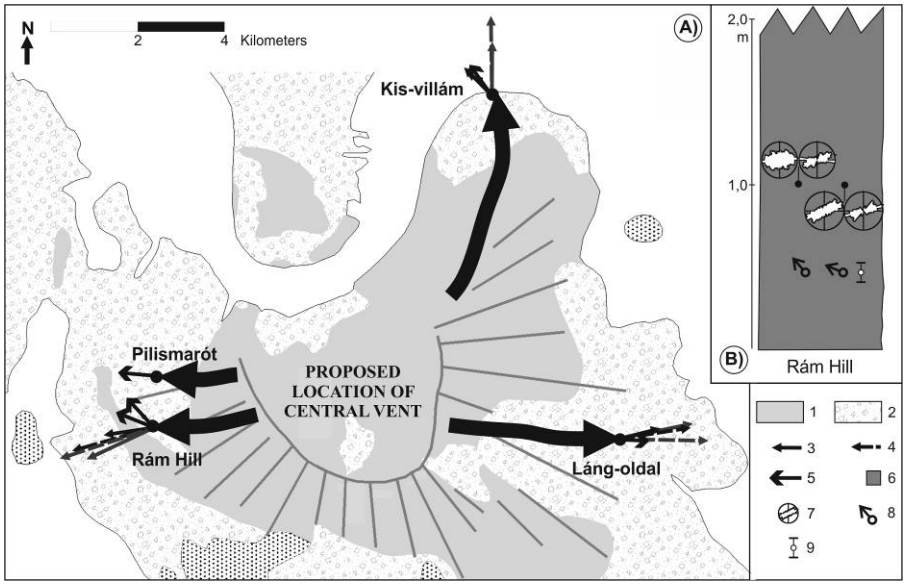

Fig. 1.: Subaqueous flow directions of the Rám Hill Pumiceous Sandstone. A) Inferred flow directions and large scale flow paths, which show a near radial pattern, B) Variation of obtained flow directions along vertical profile at Rám Hill locality; A: 1 - Formations related to core facies, 2 - Formations related to ring plain, 3 - Flow direction from photo-statistics, 4 - Flow direction from photo-statistics are indicated only by the most elongated clasts, 5 - Flow direction from AMS pattern, B: 6 - Investigated flow unit, 7 - Circular frequency of clast a-axes azimuths, 8 - Flow direction from AMS pattern, 9 - Vertical dispersion of AMS samples