Comparing block and ash pyroclastic flow deposits and debris flow deposits from the 1990-1995 Mount Unzen Eruption (Heisei-Shinzan), Kyushu, Japan: implications for hazard assessment

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Mount Unzen is a polygenetic dacitic composite stratovolcano located on the Shimabara Peninsula, Nagasaki Prefecture, Kyushu, south western Japan. The most recent eruption from 1990 and 1995 produced 13 lava domes and approximately 9800 block and ash pyroclastic flows resulting from lava dome collapse events. 44 people were killed during the eruption. Five major deposit types were produced during and after the eruption: block and ash flow, debris flow, pyroclastic surge, hyperconcentrated flood flow and fallout deposits.

Distinguishing block and ash and debris flow deposits at Mount Unzen is very difficult in the field especially when close to the volcano (less than 2 km from summit). Currently the main criteria used to distinguish block and ash and debris flow deposits include: clast shape and angularity, carbonised versus non-carbonised vegetation material and ash matrix proportions. Grain size analysis revealed no differences between block and ash flow and debris flow deposits. The block and ash flow (BAF) deposits consist of block, lapilli and ash sized lava dome fragments of the same composition (monomictic). The deposits are very poorly sorted, massive, reverse and/or normal graded, and contain angular to subrounded clasts. Organic material is overwhelmingly carbonised. Ash particles are typically angular in form using photomicrographs and SEM imagery.

Debris flow deposits consist of remobilised block and ash flow deposit material and minor country rock material. The deposits are very poorly sorted, massive, normal and/or reverse graded, ash poor and contain angular to rounded clasts. Organic material varies from non-carbonised to variably carbonised. Photomicrographs and SEM images show ash sized clasts from debris flow and hyperconcentrated flood flow deposits are more rounded than block and ash flow and ash cloud surge deposit clasts.

Using the stratigraphic record of a volcano's style of behaviour as a tool to anticipate future hazards will not be easy given the difficulty in distinguishing primary eruption from secondary deposits. Detailed work is required in distinguishing block and ash flow from debris flow deposits. Similarly, there may be some difficulties in distinguishing some surge and hyperconcentrated flood flow deposits.