# Depositional features and emplacement mechanism of the 1991-96 pyroclastic flows and surges at Unzen Volcano, western Japan

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More than 9400 dacitic pyroclastic flows were produced at Unzen Volcano from 1991 to 1996. The thickness of a flow unit ranges from 20 cm - 5 m. Some flow units show reverse grading of larger clasts. The clasts are angular to subrounded. Around big boulders and carbonized wood fragments, a fines-depleted part, segregation pipes and pods were seen. Layer 2a, and surge beds occur at the bottom of the deposit. Lobes and levees were observed at the surface of the deposit. The emplacement mechanism of the Unzen pyroclastic flows can be explained by the high-density turbidity current model and the higher density, density-modified basal grain flows.

More than 9400 Merapi-type dacitic pyroclastic flows (totaling 0.2 km3) were produced from lava dome collapse at Unzen Volcano, western Japan from May 24, 1991 to May 1, 1996. The number of flow units at each locality was less than 30, even though thousands of pyroclastic flows occurred. The thickness of a flow unit ranges from 20 cm - 5 m. Some flow units show reverse grading of larger clasts. The clasts are angular to subrounded. Big boulders (<13 m) with cooling joints were observed in the deposits. Steam was sometimes observed from cracks in the big boulders. Grain size analysis show the matrix of the deposit to be coarse grained (Md=-1.8 - 0.4) and poorly sorted (Sigma=2.6 - 3.3). Around big boulders and carbonized wood fragments, a fines-depleted part (Md=-3.2 - -0.1, Sigma =2.0 - 3.5), segregation pipes and pods were seen, indicating they formed after deposition of the flow. Layer 2a (Md=-0.8 - 1.8, Sigma =1.7 - 2.9, <18 cm thick), and surge beds (Md=-0.7 - 3.7, Sigma=0.6 - 2.5, <20 cm) occur at the bottom of the deposit. Lobes (<10 m wide, <2 m high) and levees (<3.5 m high) were observed at the surface of the deposit. Estimated yield strengths of the flow based on lobes and levees were 10^3-10^4 Pa.

The reverse grading, layer 2a at the bottom, containing angular to subrounded clasts, and fine materials in the matrix suggest that larger clasts in the Unzen pyroclastic flows were transported by saltation, traction, and collisional dispersive force. Therefore, the transportation mechanism of the Unzen pyroclastic flows can be explained by the high-density turbidity current model (Lowe, 1982). However, well-defined lobes and levees on the surface indicate that the matrix of the Unzen pyroclastic flows had a yield strength at least at the time of deposition. Therefore, the higher density, density-modified basal grain flows are considered to have formed due to accumulation of clasts on a gentle slope.