Pyroclastic density current from the caldera-forming S2 eruption of Izu-Oshima volcano, Japan

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The Sashikiji 2 (S2) member in the products of Izu-Oshima volcano was formed by an explosive eruption accompanied with caldera depression. This member is characterized by breccia called low-temperature pyroclastic flow deposit. In this paper, the S2 breccia is re-examined based on stratigraphy, grain fabrics, grain-size distributions and modal compositions. The S2 member is divided into six units from S2-a to S2-f in ascending order. The S2-a unit consists of scoria, bomb and aa lava flows from flank fissures. The S2-b unit is made up of well-bedded ash and fine-lapilli from the summit. The S2-c unit is composed of matrix-supported breccia, locally filling the valley bottom and containing abundant deformed soil fragments and woods. The S2-d unit consists of reverse to normal grading, clast-supported breccia with ash matrix, covering the topographic relief of the whole island. The S2-e unit is composed of dune- to parallel-bedded lapilli and ash in the proximal facies. The S2-f unit is clast-supported breccia with and without ash matrix. New 14C ages of wood fragments in the S2 member have been determined as about cal AD 340. Although the S2-c and -d units are previously interpreted to the low-temperature pyroclastic flow deposit, they are quite different in sedimentological features as follows. The grain fabric measurements have revealed that the S2-d unit has a-type imbrication showing the longest axis of grains parallel to the flow direction. On the other hand, the S2-c has random grain fabrics. The grain size distribution of the S2-d unit shows a bimodal nature having subpopulations at phi -1.0 to 1.0 and coarser than phi -2.5. The bimodal nature and a-type imbrication suggest that the two transport processes overlap; the load of a turbulent suspension is not all in true suspension as the coarser population may travel in intermittent suspension (saltation). The S2-c unit shows a polymodal grain size distribution with multi subpopulations from coarse to fine. The poor sorting, massive appearance, valley-confined distribution, and random grain fabric of the S2-c unit are characteristic of deposition from a cohesive flow without formation of traction-related bedforms or sorting of different grain sizes by turbulence. The modal composition measurements have indicated that the S2-c and -d units lack essential scoriaceous or glassy fragments. This evidence indicates that both units are derived from steam explosions due to outburst of highly-pressurized aquifer within the edifice. The S2-c unit was plausibly generated by remobilization of phreatic debris around the summit caused by ejection of condensed water from a plume or heavy rainfall. The S2-d unit was a pyroclastic density current deposit resulting from collapse of a highly-discharged phreatic plume. Estimated velocities of the current are 150 to 30 m/s based on suspended grain sizes.