Transportation and deposition processes in pyroclastic flow and co-ignimbrite ash deposits from Mashu caldera volcano, eastern Hokkaido, Japan, inferred from grain size distribution

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Mashu volcano is a Holocene active volcano, East Hokkaido, Japan. The largest caldela-forming eruption Ma-f (20km3)occurred 7.5 ka. Ma-f can be divided into three layers, which correspond to the typical section to explain different regions within a pyroclastic density current: Layer 1-3, bottom to top. The Layer 1 is coarse-grained, lithic rich, dark gray layer. The Layer 2 is matrix-supported, pumice rich, light gray layer. The Layer 3 is well-sorted, tan ash layer. To investigate the transportation and deposition processes of Ma-f, we performed field surveys and grain size analysis. The survey region consists of three areas: East of Mashu (along Shibetsu River: E1-6, near to far from the source), Southeast of Mashu (along Nishibetsu River: SE1-4) and West of Mashu (W1-4).

Boundaries between the Layer 2 and 3 are gradual, and lahar deposits are found between them at SE1-3. Layer 2 shows larger thickness change (9-800cm) than Layer 3. In the West area, Ma-f can be recognized within Akan caldera (W4), relative elevation of whose topographic barrier (caldera rim) is 580m.

Based on field occurrences and grain size data, we firstly discuss whether the Layer 3 is co-ignimbrite ash or pyroclastic fall from a eruption column. Comparing the data of windward side (W4) and the leeward side (E5), both of which are on the same distance (38km) from the source, the thickness and grain-size of the Layer 3 is larger in W4. However, Ma-j to -g (preceding plinian falls of the same eruption) are distributed only in the east side of the source by westerlies. These suggest that the Layer 3 can be concluded as co-ignimbrite ash.

Secondly, we discuss the transportation and deposition processes of Ma-f in the West area. The thickness of Layer 2 at W2 is 30cm, whereas that of W3 (on the starting point for climbing of the Akan caldera wall) is 600cm. The Layer 2 at W4 (in the Akan caldera) is 20cm thick, and finer-grained and better-sorted than those of W2 and 3. These suggest that when the Ma-f run up the Akan caldera wall, coarser particles were left at W3. Compared with the Layer 2, lateral facies change is very small in Layer 3 . However, Layer 3 at W4 is finer and better sorted than those of W2 and W3. This infer that the transportation process of Layer 3 is also influenced by significant land forms. This is consistent with the previous conclusion that the Layer 3 is co-ignimbrite ash.

Finally, we discuss the relationship between the Layer 3 and lahar. Lahar had occurred during the Ma-f eruption in Southeast area. Layer 3 of SE1-3 are thinner, finer and more sorted than that of E3-5 at a given distance (20-30km) from the source. The grain size distributions of the upper, middle and lower parts of Layer 3 at East area show that it becomes finer and more sorted toward the top. It seems that coarser particles of Layer 3, which could be deposited in the earlier, were swept away by accompanying lahar at SE1-3.