Distribution, volume and emplacement mechanism of Aso-4 large-scale pyroclastic flow

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Distribution, volume and emplacement mechanism of the 90 ka large-scale Aso-4 pyroclastic flow are surveyed and discussed. The large-scale pyroclastic flow (ignimbrite) usually cause catastrophic disasters around the caldera as shown at 1883 Krakatau pyroclastic flow, which caused 36,400 fatalities. The 90 ka large-scale Aso-4 pyroclastic flow reached as far as more than 160 km from the source. The precise distribution, volume and emplacement mechanism studies of large-scale pyroclastic flows are necessarily to mitigate the volcanic disasters.
The estimated current total distribution area is about 2,500 km^2. The estimated total volume of Aso-4 pyroclastic flow in DRE are about 20-60 km^3 (current), and 50-140 km^3 (just after the event). The maximum size of pumices and lithics of 8 samples in each outcrop in the main pyroclastic flow deposits (except the lag breccia facies) were measured in E and NNE directions from the source. The size of maximum pumices at up to 16 km outcrops show 3-9 cm, 17-20 km show 28 cm, 26 km near the break-in-slope point shows 47 cm. Then the maximum sizes gradually decrease up to 3 cm at 72 km. The maximum sizes of pumices at outcrops in Yamaguchi prefecture (132-162 km from the source) show 0.4-0.9 cm. The maximum sizes of lithics at 6.5 km from the source show 1-2.5 cm, 16 km show 11.2 cm and gradually decreases up to 0.3 cm at 117 km in Kita-Kyushu. No measurable lithics are contained in outcrops in Yamaguchi prefecture. Further investigations are planning including unit correations and grain-size variations in other directions.
The relatively small maximum size of pumices and lithics near the source suggest that the quite high turbulence of pyroclastic flow was enough to transport large pumices and lithics due to turbulence within or near the volcanic plume. The maximum size of pumices reached 47 cm at the break-in-slope region on the original slope (26 km from the source) suggests sudden drop of large pumices at this point due to hydraulic jump. The gradual decrease of maximum size of pumices and lithics up to 72 km suggests deposition from the bottom of turbulent pyroclastic flows. Subtle revere grading of pumices about 20-70 cm in thickness are sometimes observed within the deposit. This feature indicates that interaction of pumices at the final stage of deposition, suggesting relatively high-density density currents were formed at the bottom of pyroclastic flow and successively settled forming depositional subunits. The thickness of pyroclastic flow deposits in Yamaguchi prefecture are about 10 cm –6 m in thickness and sometimes show surge features at relatively high area. The sizes of maximum pumices are less than 1 cm and no measurable lithics are contained. These features suggest that the pyroclastic flow reached to Yamaguchi prefecture was relatively low-density current with only small-size materials.

Keywords: Aso, pyroclastic flow, large-scale, emplacement mechanism, distribution, volume