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Reproduction of the Kenmarubi Lava Flow by a Numerical Simulation

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It is important to recognize the properties of lava flows to establish the disaster prevention programs of Fuji Volcano. The authors carried out the two-dimensional numerical simulations reproducing the Ken-marubi Lava Flow, ca.1,200 yBP, to find an appropriate method for Fuji Volcano hazard zoning.

Lava flows can be treated as the Bingham Fluid. Yield shear stress and viscosity characterize the fluid. Because they have tendency to increase by cooling, it is necessary to calculate temperature of lava by the conservation equation of heat. The rate of radiation was obtained by the Stefan-Boltzmann equation. Additionally, the cooling efficiency e (Miyamoto and Sasaki, 1990) were introduced to take account of a difference between surface and inner temperature of lava flow caused by developing of a thermal boundary layer.

The reconstruction of digitalized topography before the eruption was used for the calculations. The rate of outflow and initial temperature of lava were referred as 100m3/s and as 1,200 degree centigrade from actual eruptions of similar volcanoes, respectively. The temperature function of lava related between yield shear stress and viscosity by Ishihara et al.(1988) were used. The value of the cooling efficiency e was 0.0045 from some trial calculations and comparison between the calculations and actual longitudinal coverage of Ken-marubi Lava Flow.

The calculated result corresponded with the actual range of reach and the thickness in stopping range of Ken-marubi Lava Flow. And the temperature of lava when the flow stopped was about 950-1,000 degree centigrade and the Yield stress was about 60,000–160,000 dyn/cm2. This value of Yield share stress agreed with the range of Yield share stress (=rghi) 50,000-150,000 dyn/cm2 which calculated from the thickness (h=10-15m), the gradient of slope (i=0.02-0.04) in stopping range of Ken-marubi Lava Flow, density of lava(r=2,500m3/s) and gravity acceleration (g=9.8m/s2).