

Thermodynamic consideration of sliding surface and slope form of volcano

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On the slope of mountain, mass transfer such as landslides and lava flow in volcanoes is occasionally caused. In the field of soil mechanics, mechanical analysis of slope stability is carried out and dilatancy of porous-granular materials such as soil and rock can be expressed by the relationship between internal friction angle and energy ratio. On the other hand, non-observational and theoretical parameter such as the energy ratio is not noticed so much in the field of earth science, therefore there is few non-equilibrium thermodynamic approaches, e.g. geomorphology. Moreover, in order to explain the mechanism of mountain disasters, theoretical application of porous-granular materials as well as analytical research is also important. In this study, we described the theoretically thermodynamics and carried out Digital Elevation Model (DEM) analysis on the highly dangerous volcanoes and others among the constantly observed 50 volcanoes that will cause disasters in the future. Furthermore, based on previous studies, not only did we reveal some random conical-volcanos but also we derived the ridgeline (slope of the volcano) which is considered as the golden ratio theoretically from non-equilibrium thermodynamics in this study. Specifically, we derive the plastic potential from the first law of thermodynamics, and use the Clausius-Duhem variational inequality to make the model equation of volcanic landform shape in the previous study based on the earth pressure model representing the shear slip plane as a logarithmic spiral.

Keywords: Volcanic landform, Non-equilibrium thermodynamic, Digital Elevation Model (DEM), Plastic potential, Granular material