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地面傾斜の時間進化を考慮した溶岩流の熱浸食モデルについて
Numerical thermal erosion model of lava flow coupling with evolution of ground slope

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Schroter's Valley is one of the largest sinuous rilles on the Moon, a meandering negative-relief feature. The Schroter's Valley is located on the Aristarchus Plateau (305 ~ 313^{o}E, 22 ~ 30^{o}N), which is supposed to be an uplifted mare terrain. The rille appears as a singular sinuous rille as meandering primary rille including a more meandering inner rille. Typical sinuous rilles are 20 to 40 km in length and less than 1 km in width (Schubert et al., 1970), however, the primary rille of Schroter's Valley has been reported to be 125 km in length, up to 4.5 km in width, and 400 m in depth (Gornitz, 1973), and inner rille which is originated from the cobra-head of primary rille is reported to be ~170 km in length, 640 m of average width, and 95 m in depth (Garry et al., 2008).

The origin of sinuous rille is poorly understood. Previous researches have supposed that sinuous rilles are related to the basaltic lava flow. In past research, Honda and Fujimura (2005) developed numerical model of the sinuous rille formation of lunar lava flow. In this model, cooling rate of lava temperature as a function of distance from the lava source was calculated for estimation of thermal erosion velocity. The variation of chemistry of lava, physical properties such as density and viscosity during solidification of lava flow are incorporated in this model. They considered the effect of shifting from turbulent flow in initial phase to laminar flow in the last stage in their model. This model assumes that the ground slope maintain constant with time. However, the slope of floor of lava flow is changing with time, an erosion velocity of lava flow decreases along the downstream of lava flow following the lava temperature decreasing along the downstream.

In this study, we constructed the numerical thermal erosion model of lava flow coupling with evolution of ground slope. By using this numerical model, more large volume of lava flow is needed to originate the Schroter's Valley, because the slope of ground becomes shallower than initial one with time. If the maximum volume of eruptive volume on the Moon (Head et al., 2000) constrains the formation of Schroter's Valley, the eruptive temperature and thickness of lava flow which originate the rille are more than 1600 ^{o}C and 30 ~ 40 m, respectively.

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