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Formation process of ejecta morphology around the crater formed on glass beads in laboratory

Ayako Suzuki[1*], Toshihiko Kadono[2], Akiko Nakamura[3], Masahiko Arakawa[3], Koji Wada[4], Satoru Yamamoto[5]

[1]Center for Planetary Science, [2]Inst. of Laser Engineering, Osaka Univ., [3]Grad. School of Sci., Kobe Univ., [4]PERC, Chitech, [5]Center for Global Environ. Res., NIES

The ejecta morphologies around impact craters represent highly diverse appearance on the surface of solid bodies in our Solar System. It is considered that the ejecta morphologies depend on the emplacement processes and/or the environments when its formed, such as the atmospheric pressure, the volatile content in the subsurface, etc. Clarifying the relationships between the ejecta morphologies and formation processes/environments could constrain the ancient surface environment and the evolution of the planets.

We investigated the ejecta patterns around the impact crater which formed on a glass beads layer in laboratory, and found that the patterns depend on impact velocity, atmospheric pressure, and initial state of packing of the target [Suzuki et al., 2010, JpGU]. Now, we focus on one of the ejecta patterns which has the petal-like or concentric ridges. This ejecta pattern is very similar to so-called ”rampart” morphology observed around Martian impact craters.

This series of the experiments are performed by using the two-stage light gas gun placed in Kobe University. The projectile is an aluminum cylinder, having a diameter of 10 mm and a height of 10 mm. The target is a layer of glass beads (nearly uniform diameter) in a tub with 28 cm in diameter. The bulk density is 1.7 g/cm^3. The following three parameters are varied: 1) the diameter of the target glass beads (50, 100, 420 microns), 2) the ambient atmospheric pressure in the chamber (500 Pa - atmospheric pressure), 3) the impact velocity of the projectile (a few - 90 m/s).

In our experiments, the ridged patterns are observed with the condition of, 1) the diameter of the target glass beads is 50 and 100 microns, 2) the ambient pressure in the chamber is higher than 10^4 Pa, 3) the impact velocity is higher than 16 m/s. Eventually, we succeed to capture the formation of the ridges with high-speed video camera. The ridges are formed just outside of the base of the ejecta curtain. It is found that erodible surface around the crater is essential to produce the ridges.

Keywords: Impact Experiments, Cratering, Ejecta