Measurements of the amount of ejected material in impact cratering

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Impact craters have been considered to be formed by two processes: excavation of target material and displacement of target material downward. The amount of excavated material is an important parameter for studies of internal structure and surface evolution of bodies in the solar system. However, there are few experimental data concerning the amount of excavated material.

Therefore we conducted impact cratering experiments to measure the mass of excavated material. Polycarbonate and aluminum projectiles were accelerated by a single-stage light-gas gun. Impact velocities ranged from 46 to 328m/s. The impact angle to target surface was vertical. We used soda-lime glass spheres with mean grain diameters of 220 and 40um as the targets. In order to measure the mass of ejected material, we used a board with a circular hole to cover the target surface. When a projectile impacts at the center of the hole, ejecta are thrown out through the hole. After experiment, we collected the ejecta outside the hole and measured its mass. Based on these measurements, we derived the mass of excavated material. The mass Mex of excavated material is shown to be nearly proprotional to v (v is projectile's impact velocity) and m0.7 (m is projectile's mass). The present results also show that Mex depends on target grain sizes. Next we estimated the volume ratio of excavated material to a transient crater. The volume ratios were shown to be independent of transient crater radius and grain sizes, and the average value of volume ratio was about 0.31+/-0.11.