ENERGY PARTITIONING IN IMPACTS INTO REGOLITH-LIKE POWDERS, William K. Hartmann, Planetary Science Institute, Tucson, Arizona 85719

Analysis of experimental impacts at the Ames Vertical Gun Facility, described earlier in LPSC abstracts (Hartmann, 1980, 1981, 1982), has continued. A paper has been prepared interpreting data from 14 impacts into fine regolith-simulating basalt and pumice powers *in vacuo* (Hartmann, to be submitted to Icarus). These impacts were made at a wider range of velocities (5 to 2321 m/s) than has been applied in many earlier studies of impact phenomena, in order to acquire results applicable to rings and early solar system environments, as well as to hypervelocity regimes common among contemporary meteorite and asteroid impacts.

Several results detailed in the new paper have been discussed briefly in the earlier abstracts. Primary results include measurement of velocity distributions in the ejecta by means of sample collection in annular rings around the impact point. Additional results include correlations of ejecta velocities with impact energy and impact velocity, considerations about scaling the results to much larger crater sizes, and thickness distributions in the ejecta blanket.

The present abstract reviews the paper's results about energy partitioning. This has been historically very difficult to measure in powders because of the difficulty of measuring ejecta velocities throughout the continuous spray of photographically unresolved fine ejecta. However, in the present experiments the total kinetic energy in the ejecta could be estimated because the ejecta mass was collected in annular bins corresponding to known ejecta energies. Ejecta energy in each bin was thus tabulated. The principal difficulties involved a small fraction of ejecta moving too fast to be collected in the bins and another fraction that landed too close to the crater rim to be collected without risking interference with crater formation. These difficulties were taken into account by a graphical analysis in which collected masses and corresponding kinetic energies from the sampled ejecta were plotted as a function of distance from the crater and extrapolated to include the fast-moving and slow-moving material, while conserving mass and energy.

This procedure gave at least rough estimates for the fraction of initial impact energy that went into the total kinetic energy of all ejecta. Results shown in Figure 1 suggest that a very low fraction of impact energy goes into ejecta from subsonic impacts, but that a higher fraction goes into ejecta from hypersonic impacts. Best estimates of the (ejecta energy)/(impact energy) fraction mostly ranged from 10^{-4} to 10^{-2} for impacts at $V_{imp} <$ 1500 m/s, and rose to about 0.01 to 0.3 for faster impacts. This is consistent with an estimate by Braslau (1970) of about 0.30 to 0.53 for impacts at 6370 m/s into fine sand, although my paper criticizes some of Braslau's assumptions in deriving his result. The problem deserves more refined experimental study to reduce limitations in techniques used to date.

ENERGY PARTITIIONING IN IMPACTS

Hartmann, W. K.

REFERENCES:

Braslau, David (1970), J.G.R., 75, 3987-3999.

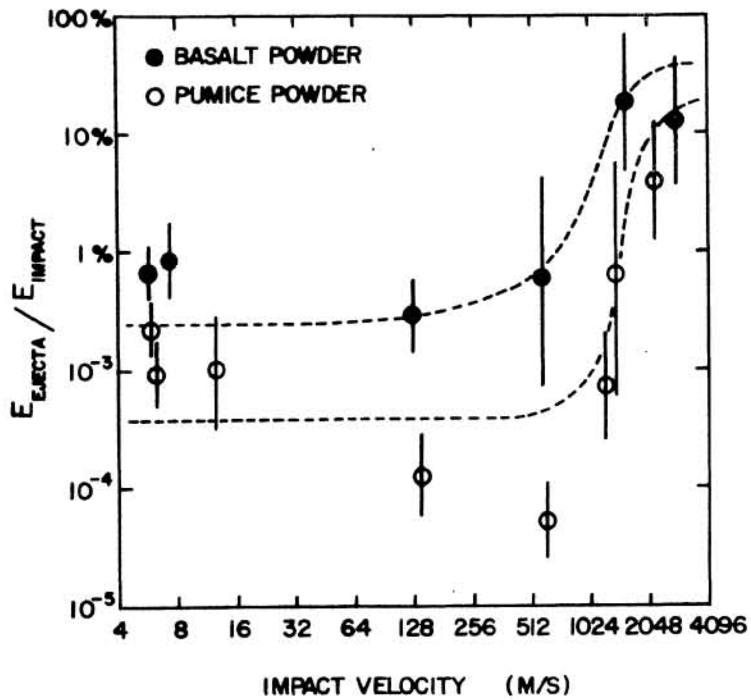

Figure 1: Fraction of initial impact energy partitioned into kinetic energy of ejecta among impacts into powders *in vacuo* as a function of impact velocity. Less than 1% of impact energy appears to go into ejecta among low speed impacts, rising to a higher fraction (~1 to 30%) among hypervelocity impacts. A systematically lower fraction of energy appears partitioned into the (finer) pumice powder than into the (coarser) basalt powder.