RATIO OF ASTEROIDAL IMPACT RATES ON MARS AND EARTH; G. W. Wetherill, Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, D.C. 20015.

A consistent Monte-Carlo dynamical model for extraction of asteroidal collision debris from the asteroid belt into the terrestrial planet region has been presented (1,2). This predicts a total flux and orbital distribution of stony meteorites that agrees with observation. Direct application of this same model to calculating the steady-state number of Earth-approaching objects of asteroidal origin predicts about 1/2 the number estimated observationally. Neither the theory nor the observational evidence are sufficiently accurate to attach much significance to a factor of two discrepancy, however.

If it is assumed that impact of objects originating in the asteroid belt is primarily responsible for production of craters on the terrestrial planets at the present time, this model can be used to calculate the cratering rate on these planets. Whole-planet impact rates of asteroidal bodies with diameter >1.0 km of 0.60 $(m.y.)^{-1}$ and 0.52 $(m.y.)^{-1}$ are found for Mars and Earth respectively. The corresponding r.m.s. velocities at impact are 11.1 and 19.1 km/sec. The ratio of crater-formation rates is calculated by use of Schmidt-Holsapple scaling (3), in a form that has been used for gravity scaling of impacts into basalt (4). Per unit area, the present ratio of the cratering rate on Mars to that on Earth is found to be 3.8.

Evidence for a major extinct comet component in the Apollo population has not been sufficiently compelling to win general acceptance. Nevertheless, a significant body of circumstantial observational evidence supports this hypothesis. Monte-Carlo calculations have been carried out for the orbital evolution of an extinct comet Apollo source model with sufficient strength ($\sim$1/50000 yr) to supply 1/2 the observed Apollos. Inclusion of this component in the cratering calculations lowers the Mars/Earth cratering ratio to 2.2.

The only promising way to reduce this ratio to $\sim$1.0 appears to be the assumption that terrestrial planet cratering is dominated by active comets rather than Apollo-Amor objects, despite the conclusion of most workers (e.g. (5)) that cratering by active comets is of relatively minor importance. Recent observational evidence for very low cometary albedos (6,7) suggests this possibility deserves more consideration, however.

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