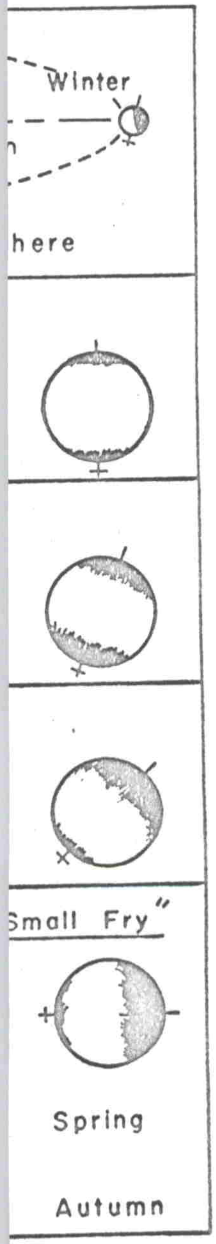

"It Cannot Happen Here" or Has It?

A certain amount of comfort can be derived from the knowledge that the solar system is believed free of spheroids 200-600 km in diameter cruising about in random orbits, although the asteroid belt certainly could supply them if disturbed. An extrapolation of H. Brown's data (see later) from 10^4-10^7 gm meteorites to those of 10^{20} gm reduces the frequency of large ones to only a few in the age of the earth. Besides, experiments and observations of crater forming processes have provided convenient factors for estimating dimensions. One is that crater diameter is proportional to the ⅓ exponent of energy and another is that the diameter of the colliding body (for moderate meteor velocities) will be about 1/20 (or 1/30) that of the crater formed. The latter brushes away the annoying Hudson Bay Crater as insignificant because the meteor would have had to be in the order of 20 km, too small for changing things. It also kills suggestions that 600 km spheroids have scarred the earth—simple 12,000-18,000 km craters are hard to accept, and harder to recognize.

The comfort, however, should not be bone deep. The ballistics experiments were of low total energy and at speeds considerably lower than those of *slow* meteorites. The explosion experiments have been in the 10^{13-16} erg range until the recently reported[15] cratering experiments with 1.2 kiloton nuclear explosions. Even so, these involved but 10^{20} ergs and were by no means the equivalent of impacts. Pertinent findings were that maximum craters were formed by explosions at a critical depth but they *decreased sharply* for shallow and surface explosions (see also Ref. 16). The ⅓ exponent was found to hold for charges up to about 10^{16} ergs (1,000 pounds of TNT), but in the larger explosions 1/3.4-1/3.6 gave better fit to predictions. In fact, exponents down to 1/4.1 were found to fit in certain studies.[17] Smaller exponents might be expected in higher energy explosions.

What this leads to is quite interesting. The simple "dig-out" energy for the Hudson Bay Crater would be 10^{30}-10^{31} ergs—just to dig and cart away. The rule of thumb estimate of projectile size would be 1/20-1/30 of 440 km, say 18 km, which from the data of Table II would correspond to 2.5×10^{32} ergs. This does not appear sufficient to balance the mechanical energy of the recoil jet and the motions of the earth one might expect of such high order collisions. Scaling with $(\text{Energy})^{1/4.1}$, using the Arizona Crater as a reference model, it is found that the energy required to form a Hudson Bay Crater is about 2.7×10^{34} ergs, corresponding to a meteorite 87 km in diameter. The diameter of the crater is only 5 times this value. The potential for axis change is about 6′ of arc at least in the simple model set up. In the formation of this size of crater the earth starts to move.