A SATELLITE/ASTEROID MYSTERY AND THE PRIMORDIAL SCATTERING OF C ASTEROIDS THROUGH THE SOLAR SYSTEM; William K. Hartmann, Planetary Science Institute, Tucson, Arizona 85719

Two sets of emerging observations combine to make a mystery, vis-a-vis current solar system knowledge. The observations are: (1) Of 11 outer satellites of Jupiter, Saturn, and Mars that are believed to have been captured, all that have been adequately studied spectrophotometrically (8 or 9) have been identified as belonging to the C spectral class; (2) The C-class asteroids appear to be native only to the outer half of the asteroid belt, from about 2.7 to 3.5 AU. The "C-class" asteroids are very low albedo objects, one of the three classes (C, P, D) that constitute the asteroids of the solar system, from 2.7 AU outward. The mystery is: how could planets have captured asteroids that are native to the outer half of the belt, instead of capturing more local classes of asteroids?

I have investigated a possible solution. The capture mechanisms proposed by Pollack, Burns, and Tauper (1979, Icarus **37**, 587) and by Hunten (1979, Icarus **37**, 113) require extended atmospheres accumulated from the solar nebula late in the process of planet formation. Jupiter's core apparently accreted gravitationally to a critical mass of some 10-30 earth-masses, whereupon it gravitationally attracted its massive atmosphere. During the collisional accretion phase, the core swept up and scattered its local planetsimals, which were the redder classes of low-albedo asteroids known as P and D classes. At a later stage of planetary formation, ONLY DURING THE FINAL STAGES AS JUPITER APPROACHED ITS MAXIMUM MASS, were two conditions simultaneously satisfied: (1) Jupiter reached maximum efficiency in resonantly scattering asteroids out of the Kirkwood gaps in the asteroid belt; and (2) Jupiter and other planets were capturing extended atmospheres from the solar nebula gas, facilitating capture of approaching objects into satellite orbits.

The outer C-region of the belt is the most heavily populated part of the belt, and has two deep Kirkwood gaps corresponding to strong resonances at 7:3 and 5:2 commensurabilities. Thus, during a brief period at the close of planet formation, Jupiter was capable of scattering belt C's that could be captured by extended atmospheres and turned into satellites. Shortly before this C-capture era, Jupiter had too low a mass to scatter C's efficiently from the belt. During that earlier period, any planetesimals that were captured from local zones near the planet, such as D- or S-class objects near Jupiter or Mars, respectively, would have had time for their oribts to decay into the planet. Shortly after the C-capture era, extended atmospheres dissipated, preventing capture events.

This scenario explains why C-class objects may have been uniquely favored as captured satellites, and explains the deficiency of other classes of captured satellites. Attempts to examine the numbers of objects scattered from the Kirkwood gaps have been made, and areas of fruitful further research are suggested.

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