The Moon Implies Planetary Migration

Analyses of samples from the Moon imply the ancient cratered highlands were sculpted mostly by impacting asteroids. The size distribution of those impact craters also imply the asteroid belt between the orbits of Mars and Jupiter was the principal source of the impactors (see first illustration).

To generate the size distribution of craters observed on the Moon, gravitational resonances probably swept through the asteroid belt during the latter period of heavy bombardment that characterizes the lunar cataclysm. If gravitational resonances swept through the asteroid belt, then that implies the orbits of Jupiter and Saturn shifted (see second illustration). The sweeping resonances flung asteroids into Earth-crossing orbits and caused collisions with the Earth, Moon, and Mars. Where the resonances stopped and asteroids were depleted, gaps were produced in the asteroid belt. These are the Kirkwood Gaps seen today.

If we return to the Moon to collect more samples, we will obviously learn more about it. Those studies will also reveal, however, a surprising number of details about the entire solar system, including the origin and orbital migration of the giant planets in the outer solar system.

Illustration credit: LPI/SwRI/CNRS (Marchi, Bottke, Kring, & Morbidelli)

The Moon is only three days from Earth and provides a surprising number of clues about the origin and evolution of planets throughout the solar system.

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