

Size distribution of asteroids and terrestrial old craters: Implication to the asteroidal dynamics during LHB

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Recent progress of detailed asteroid surveys has revealed the fine structure of the size-frequency distribution (SFD) of main-belt and near-Earth asteroids down to sub-km in diameter. These SFDs of asteroids can be compared with the projectile SFD of lunar and planetary craters, supposing they came from ancient asteroid region.

The oldest crater SFDs on the lunar, martian, and mercurian highlands, which are considered a fossil of the Late Heavy Bombardment impactors, show very good agreement with that of the current main belt asteroids. We think the period of Late Heavy Bombardment was the result of asteroids ejected from the main belt by the inward movement of secular resonances due to the migration of Jupiter and other jovian planets. This event occurred about 3.9 billion years ago and resulted in a catastrophic bombardment of the Moon and inner planets that lasted about the order of 100 million years.

The crater size frequency distribution on the Moon as well as on terrestrial planets of post heavy bombardment surfaces is very different from those resulting from Late Heavy Bombardment. The derived projectile size frequency distribution is quite similar to the size distribution of near-Earth asteroids. The different size distribution from main belt asteroids might be the result of the Yarkovsky effect that preferentially pushes smaller objects into resonances where they are delivered to the inner solar system. Thus, the impact history of the inner planets after the period of late heavy bombardment could be dominated by near-Earth asteroids.

Keywords: crater; asteroid; late heavy bombardment; resonance migration