

Complex correspondence between families and collisions

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Abstract

Asteroid families are identified as statistically significant concentrations of asteroids in the space of proper elements. The purpose of family classifications is meant to be the identification of the largest collisional events occurred during the history of the asteroid main belt. However, are the families as found in 1-1 correspondence with ancient collisional events?

A recent analysis of larger classifications, based on larger and more accurate datasets of proper elements, indicates that this is not the case. There are multiple cratering events on the same parent body. There are collisional families split into two by the YORP effect. There are subfamilies arising from secondary collisions after the one forming a larger family, and this is not limited to recent events. There are families overlapping in proper elements space but with composition incompatible with a common parent body. There are cases not yet understood, but pointing to a complex collisional history.

In total at least 10 cases of complex correspondence between families and collisional events have been identified, more are suspected but not yet supported by enough evidence. Finally, some information can be obtained even from the absence of a family, as in the case of Ceres. The disentangling of these complex collisional histories is an essential step towards the understanding of the asteroid collisional evolution.