FUNDAMENTALLY DISTINCT OUTCOMES OF ASTEROID COLLISIONAL EVOLUTION: ITOKAWA AND EROS

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The outcomes of asteroid collisional evolution are presently unclear: are most asteroids larger than 1 km size gravitational aggregates reaccreted from fragments of a 1parent body that was collisionally disrupted, while much smaller asteroids are collisional shards that were never completely disrupted? The 16 km mean diameter S-type asteroid 433 Eros, visited by the NEAR mission, has surface geology consistent with being a fractured shard. The Hayabusa spacecraft visited an S-asteroid smaller than $1km$, namely 25143 Itokawa. Here we report the first comparative analyses of Itokawa and Eros geology. Itokawa lacks a global lineament fabric, and its blocks, craters, and regolith are inconsistent with formation and evolution as a fractured shard, unlike Eros. Itokawa is not a scaled-down Eros, but formed by a distinct process of catastrophic disruption and reaccumulation.