The strength of solid asteroids constrained by craters on boulders and NEO population estimates

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E-Lightning Talk: NEO Characterization

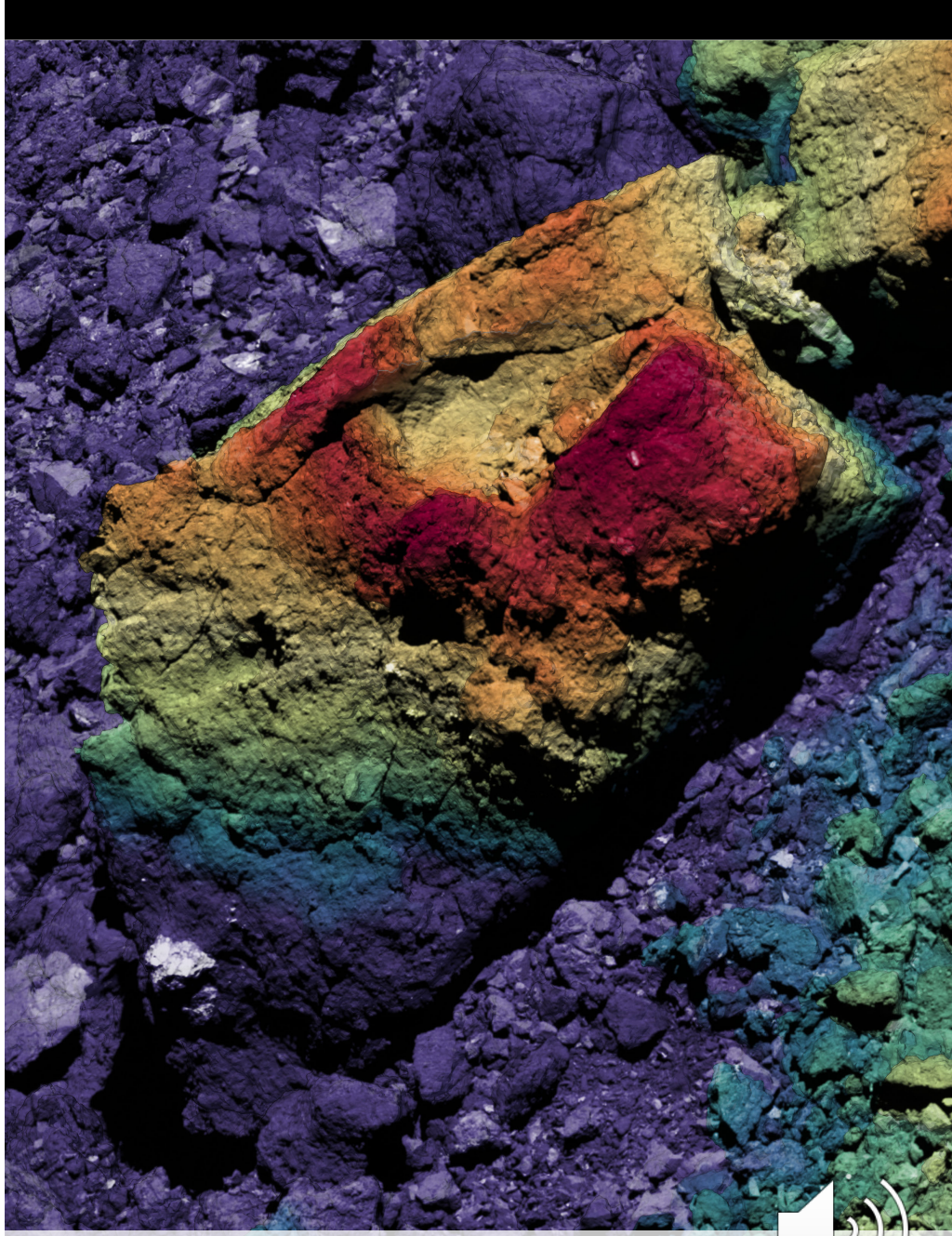


Image & LIDAR data of crater on 10 m boulder
OSIRIS-REx/OCAMS/OLA/UA/NASA

Strength-Dominated Objects on the Surface of Bennu

Measured the diameters of > 600 craters (D = 0.03 – 5 m) on Bennu's boulders (D = 0.5-50 m)

Y = 0.44 to 1.70 MPa for 1-m boulder (Ballouz et al. 2020)

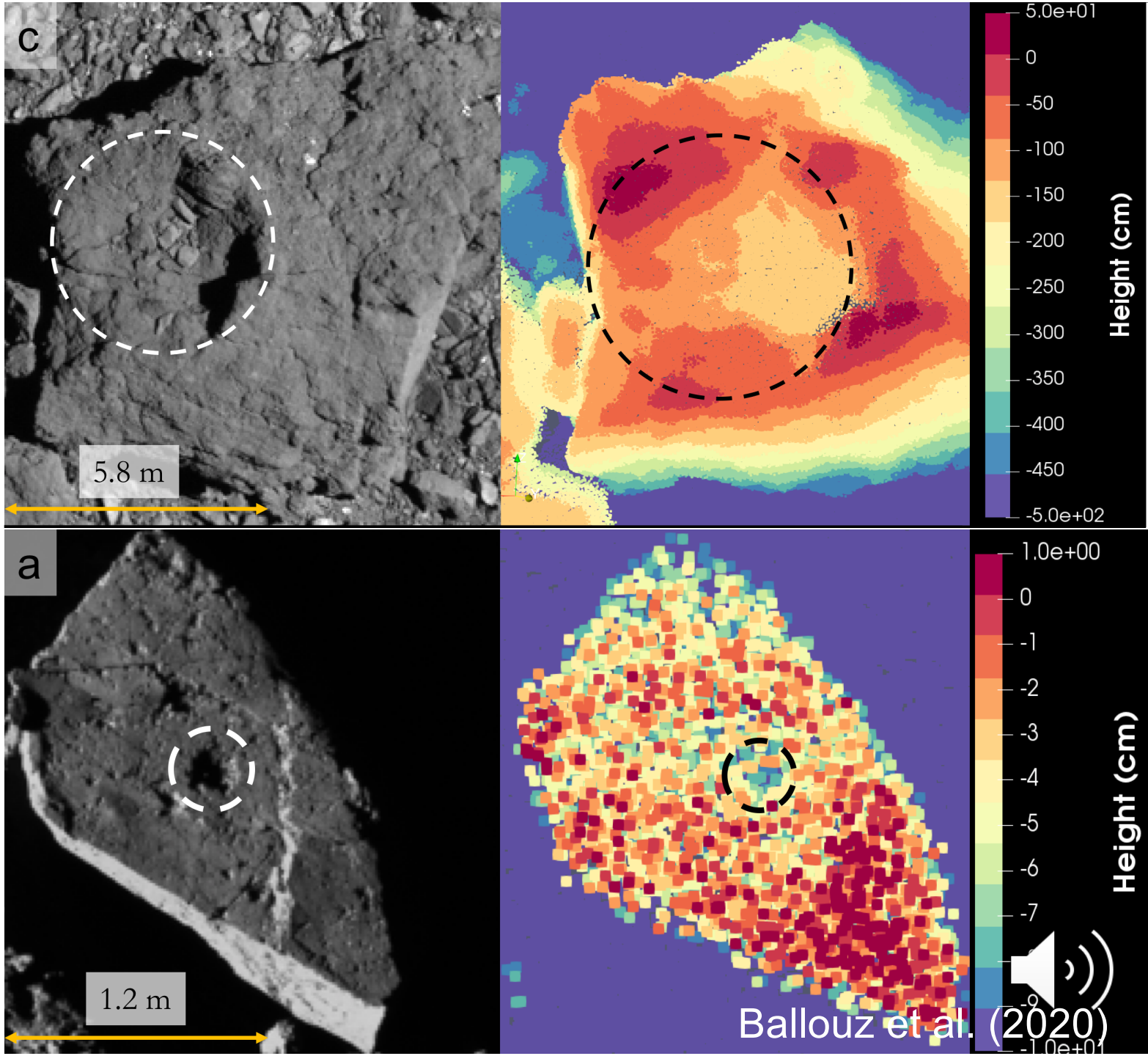
Thermal Inertia Measurement:
$Y \sim$ 0.2 MPa for boulder on Ryugu (MASCOT, Grott et al. 2019)

Meteoritic Analogs, CI/CM have tensile strength 0.2-85 MPa.

for 100-m C-type asteroid:

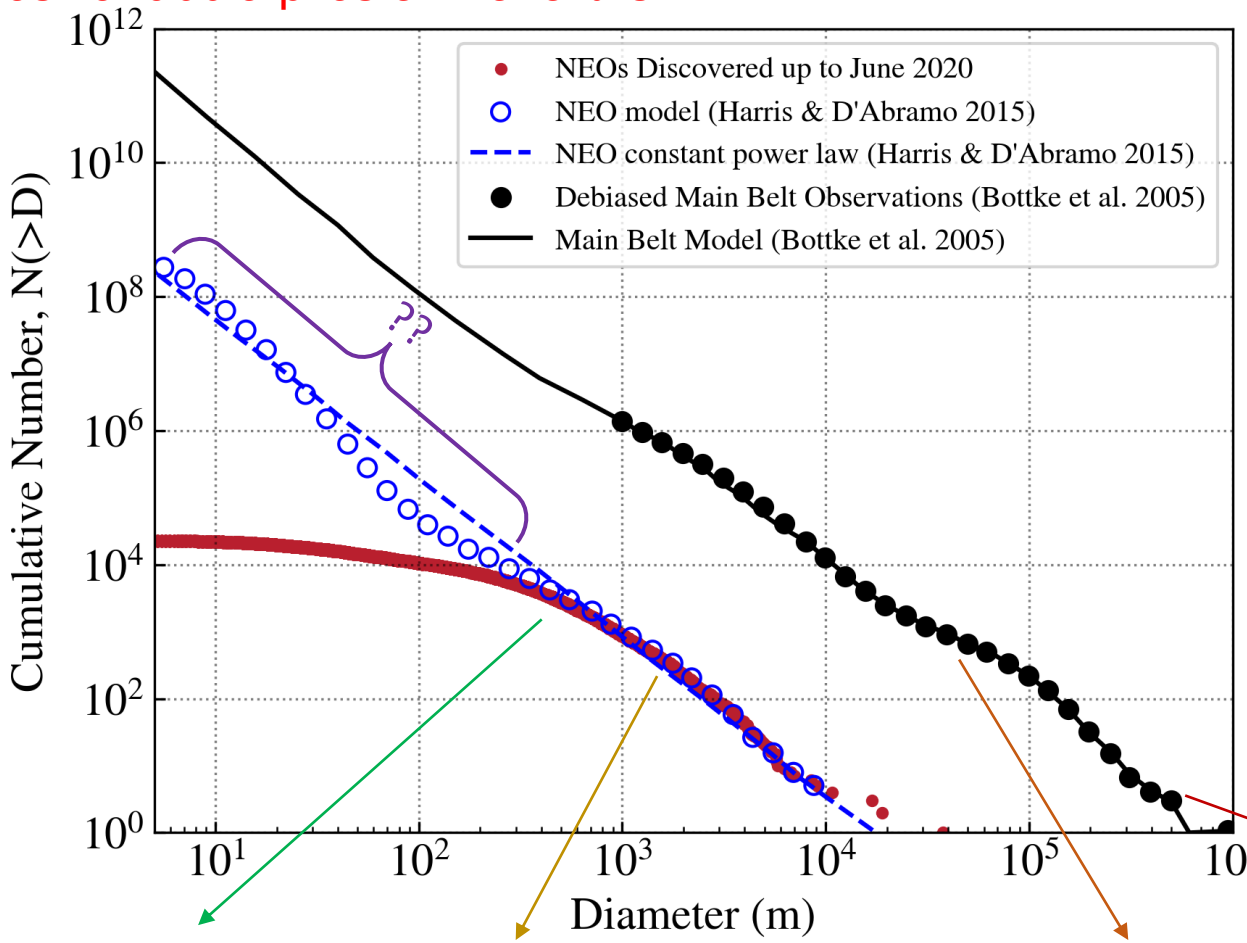
$\boldsymbol{Y \sim 0.13}$ **MPa**
$\boldsymbol{Q_D^* \sim 30\ \mathrm{J/kg}}$ (5 km/s impact)

See:
Ballouz et al. *Nature* **587,** 205–209 (2020).



The NEO Population at 140 m

Are NEAs ≲ 200 m cohesive rubble-piles or monoliths?



D < 0.2 km

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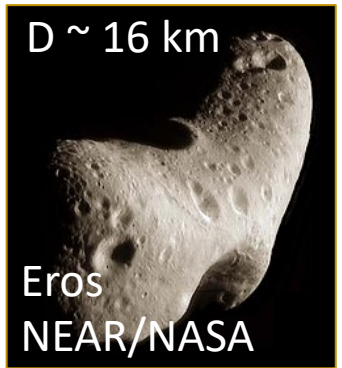
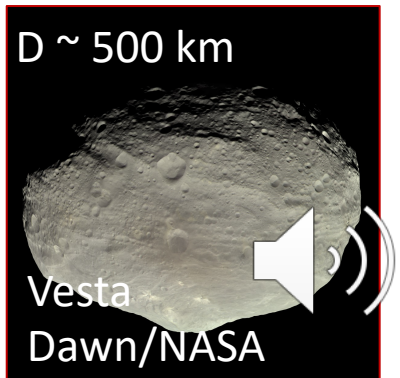
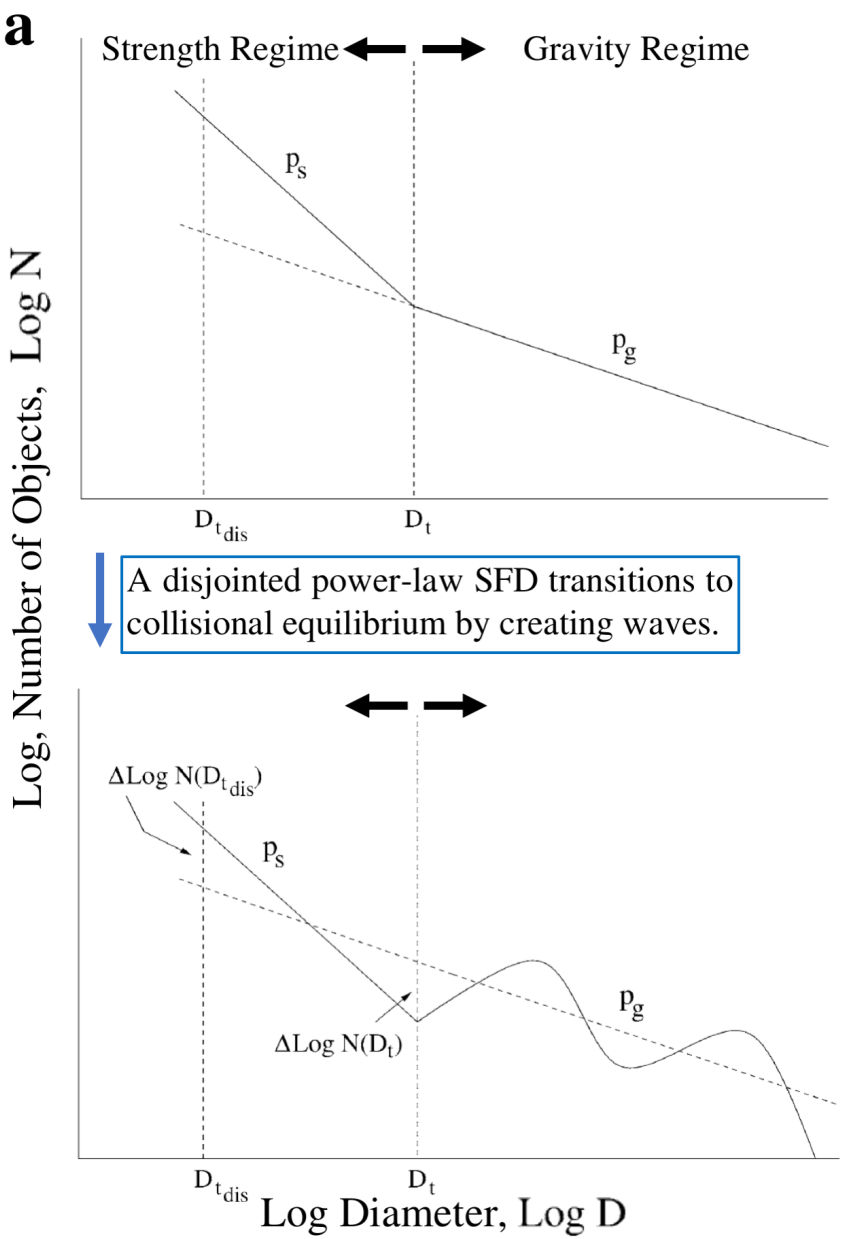
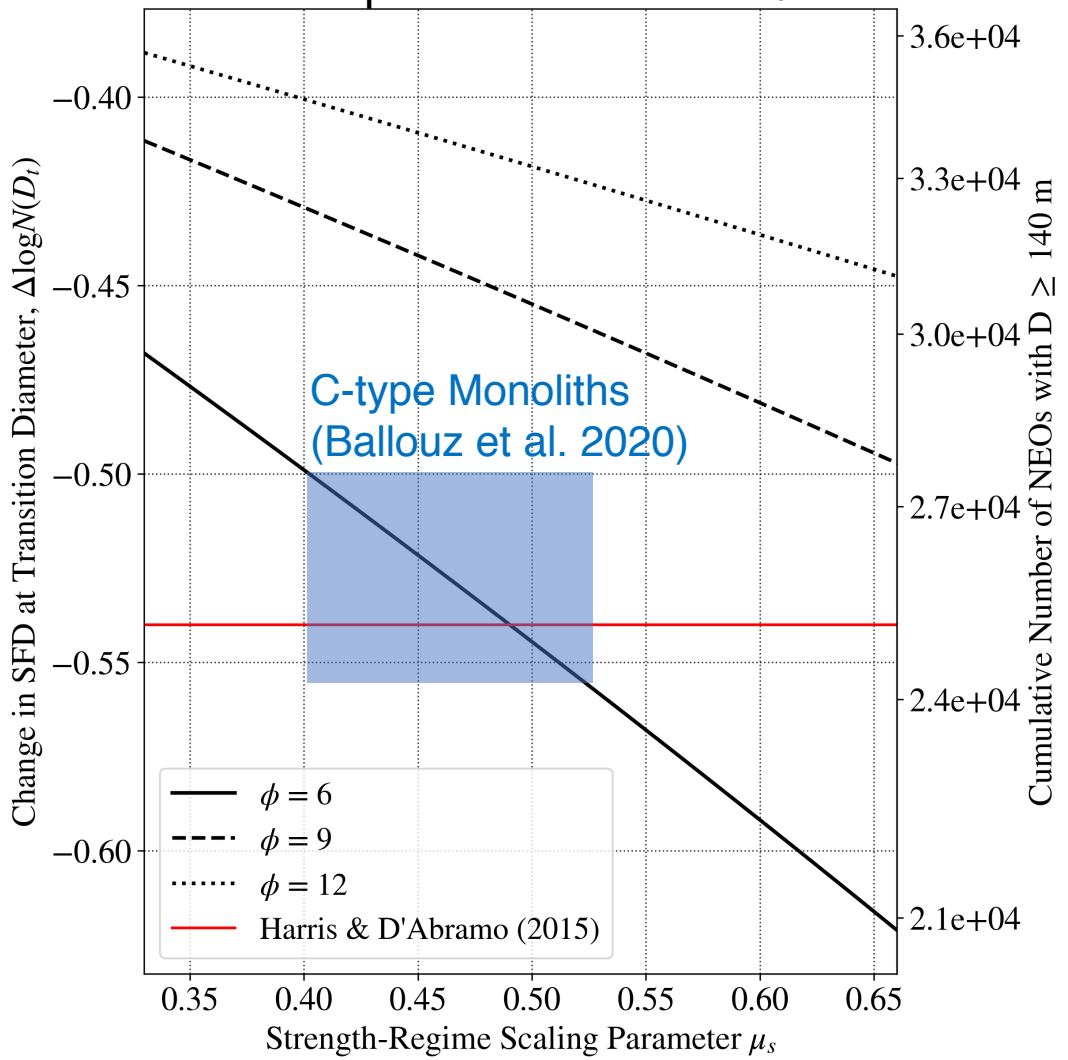




Constraints from NEOs population Estimates

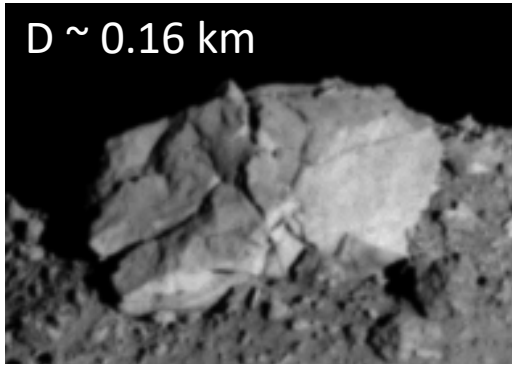


$\Delta\ log\ N\ (D_t)$:
Vertical Axes:
Amplitude of the inflection point = # of NEOs ≳140 m NEOs

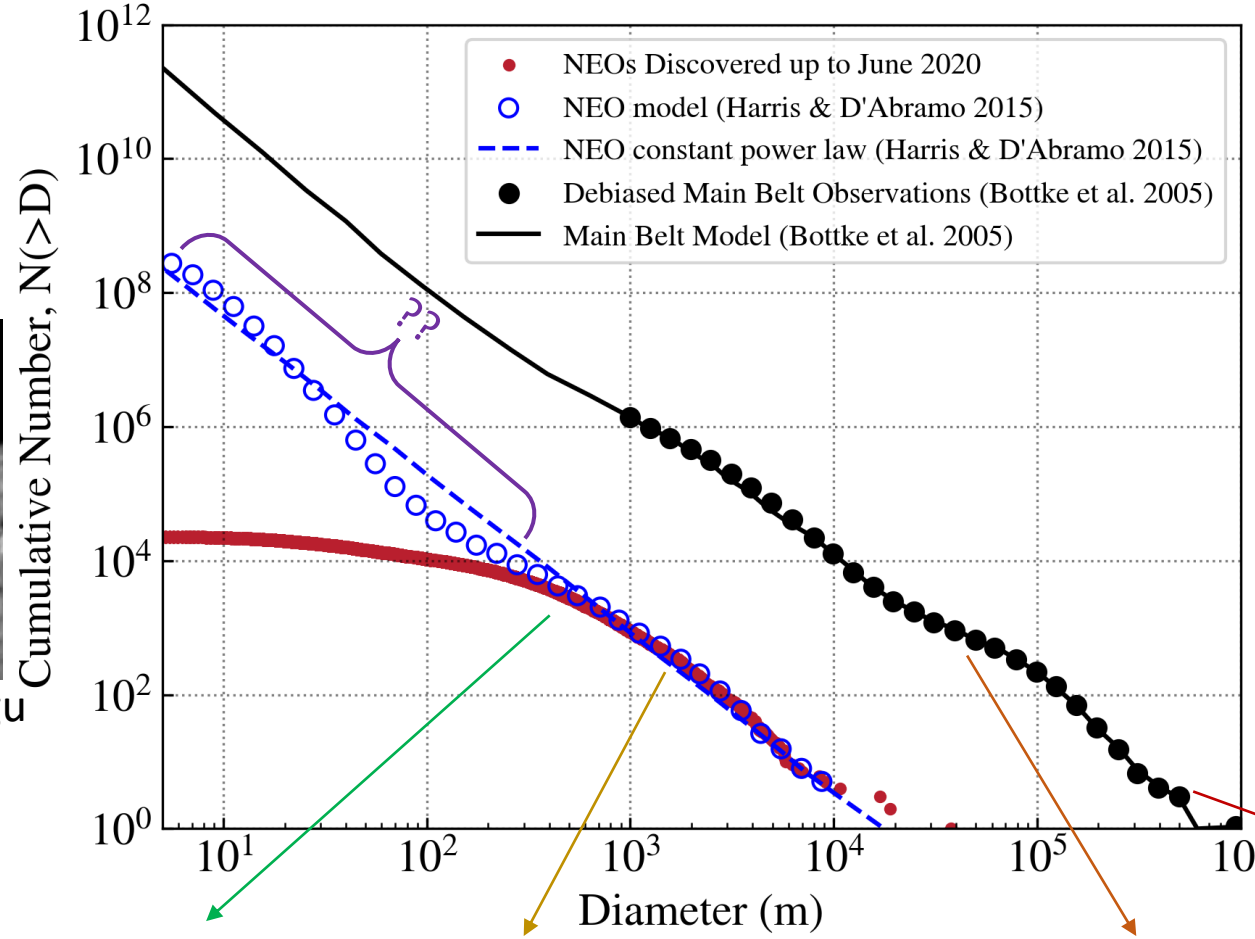


Adapted from: O'Brien & Greenberg (2005)

The strength of 100-m scale asteroids



Otohime Boulder on Ryugu
Hayabusa2/JAXA



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