



**4 VESTA – its structure, composition,
and relation to the HED meteorites**

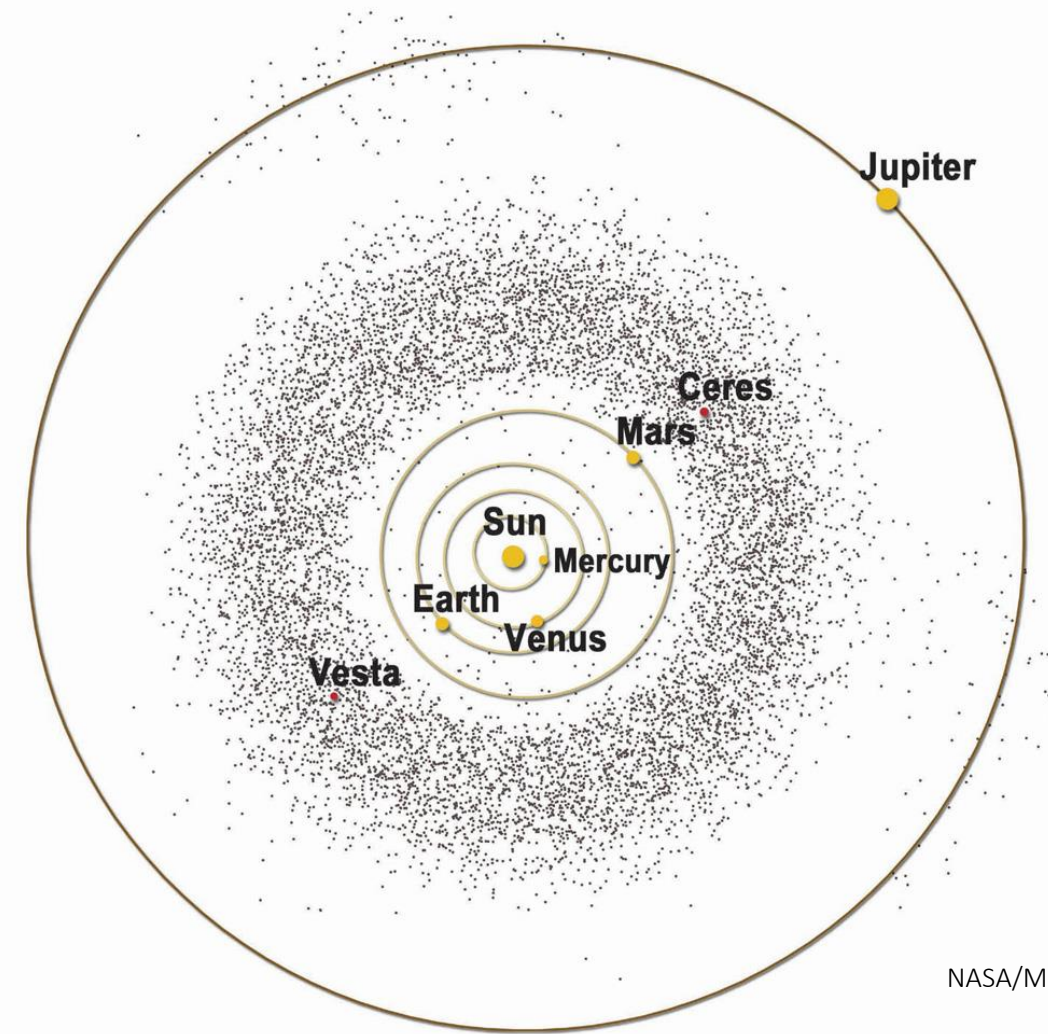
NASA / JPL / MPS /
DLR / IDA / Björn Jonsson

Maciej Fitt

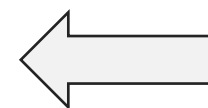
Asteroid belt of the inner Solar System



mythopedia.com

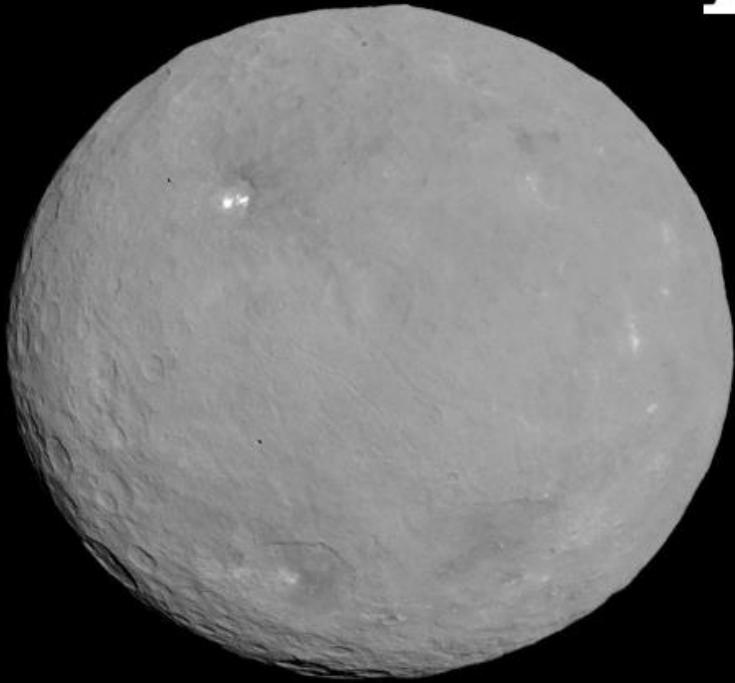


NASA/McREL



Vesta – roman goddess of the hearth, home, family, bakers and bread, donkeys

The four largest asteroids



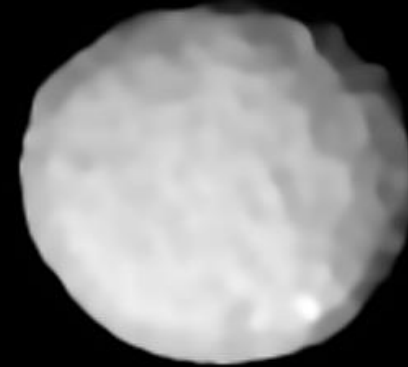
Ceres

939 km



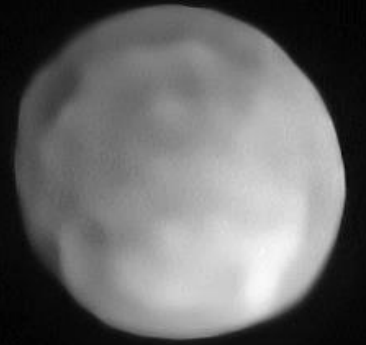
Vesta

525 km



Pallas

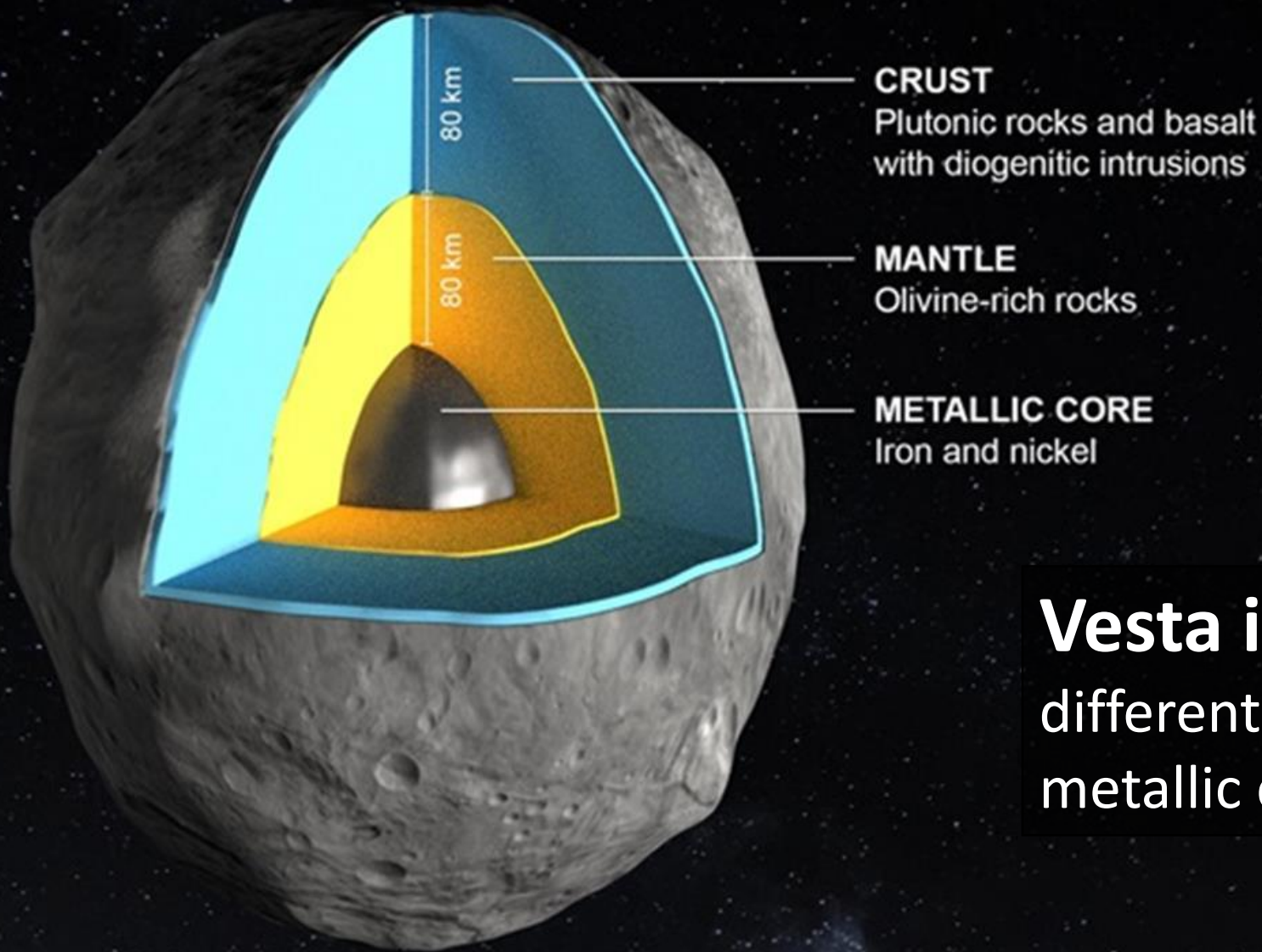
512 km



Hygiea

434 km

Small planet VESTA



CRUST

Plutonic rocks and basalt
with diogenitic intrusions

MANTLE

Olivine-rich rocks

METALLIC CORE

Iron and nickel

PROTOPLANET

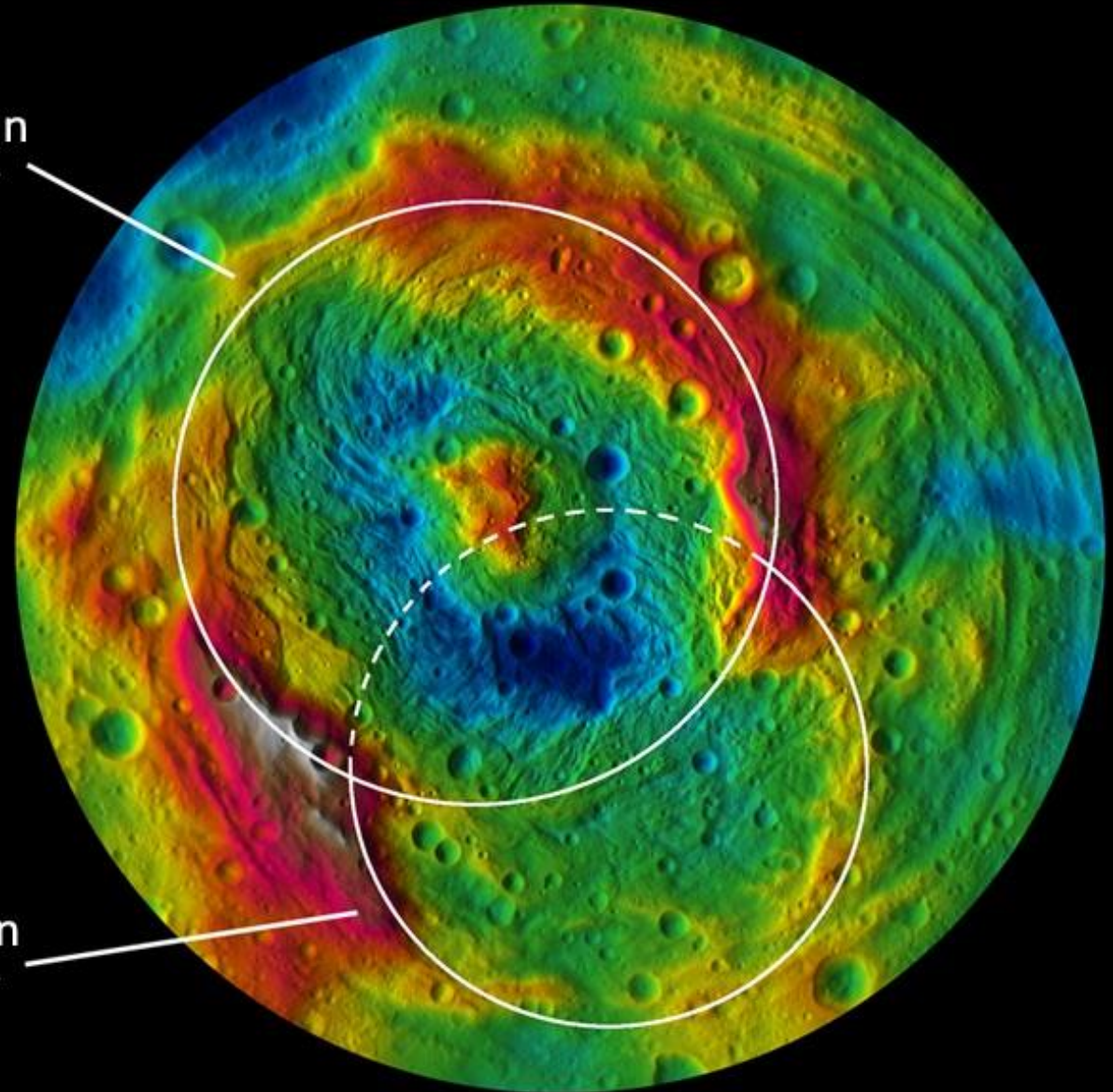
Vesta internal structure
differentiated three-section interior:
metallic core, mantle, and crust

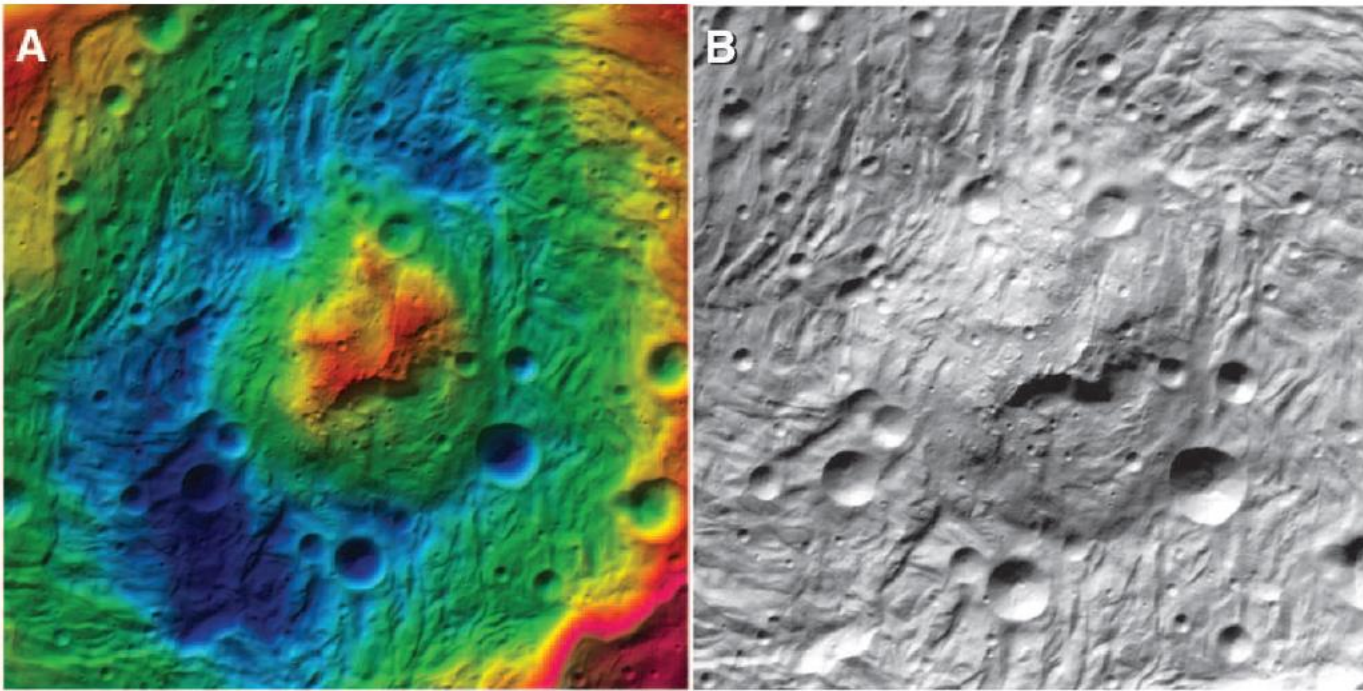
Giant craters:

- Southern Hemisphere
- 95% of the mean diameter of Vesta
- ~1.0 Ga old
- Exposition of the Vesta's mantle
- The highest peak of the Solar System?

Rheasilvia Basin
500 km diameter

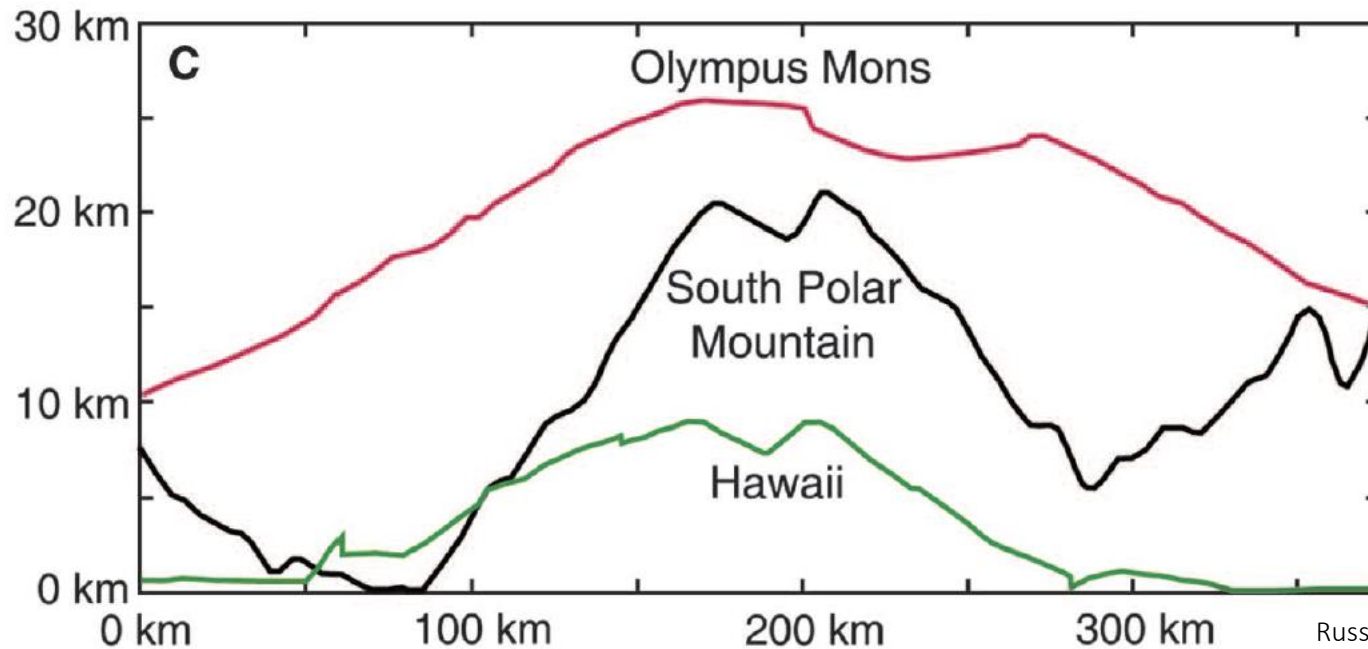
Venenia Basin
400 km diameter





Giant craters:

- Southern Hemisphere
- 95% of the mean diameter of Vesta
- ~1.0 Ga old
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- The highest peak of the Solar System?



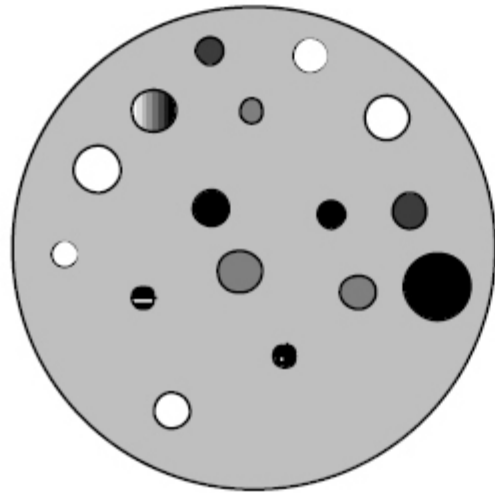


Series of parallel troughs on Vesta

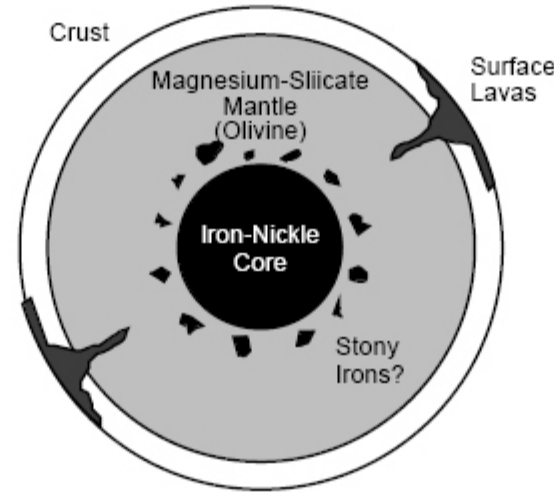
Evidence of global tectonics or the effect of a large cosmic collision?

VESTA asteroid evolution

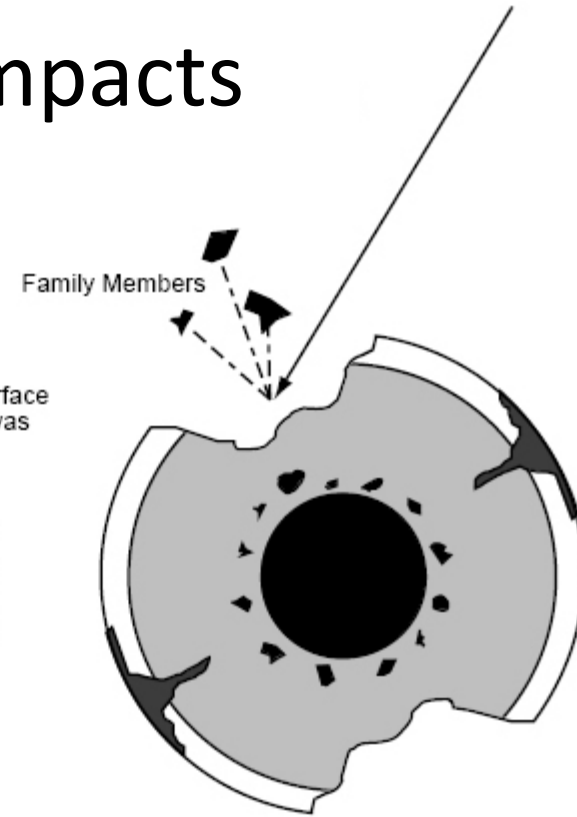
from differentiation to giant impacts



As smaller bodies in the early Solar System fall together, the asteroid agglomerates.



Heavier elements sink to the center as the asteroid heats. This forms a separate core, mantle, and outer crust. Lava from the interior flows to the surface.



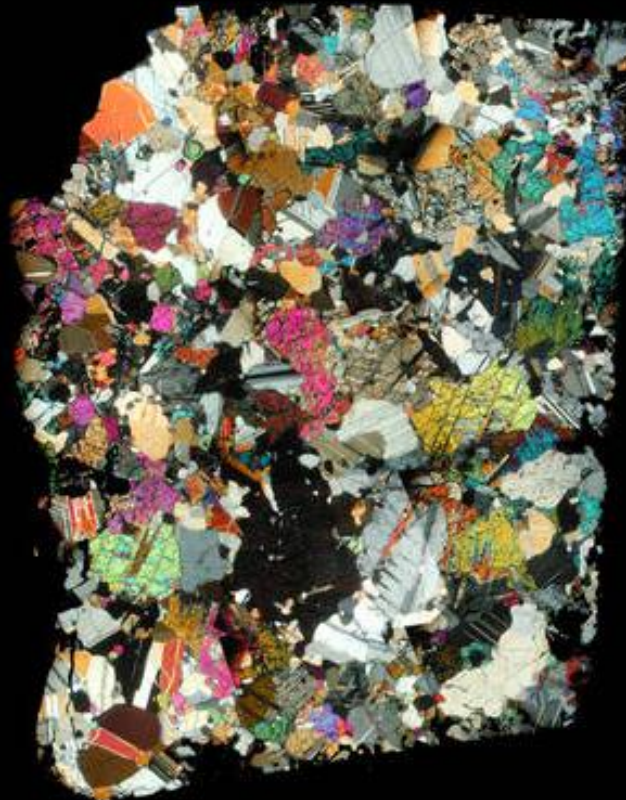
Occasional impacts with other bodies break off pieces of the crust, exposing the mantle.

HED meteorites

Impact responsible for Rheasilvia crater excavated about 1% of the volume of Vesta



Basaltic eucrite

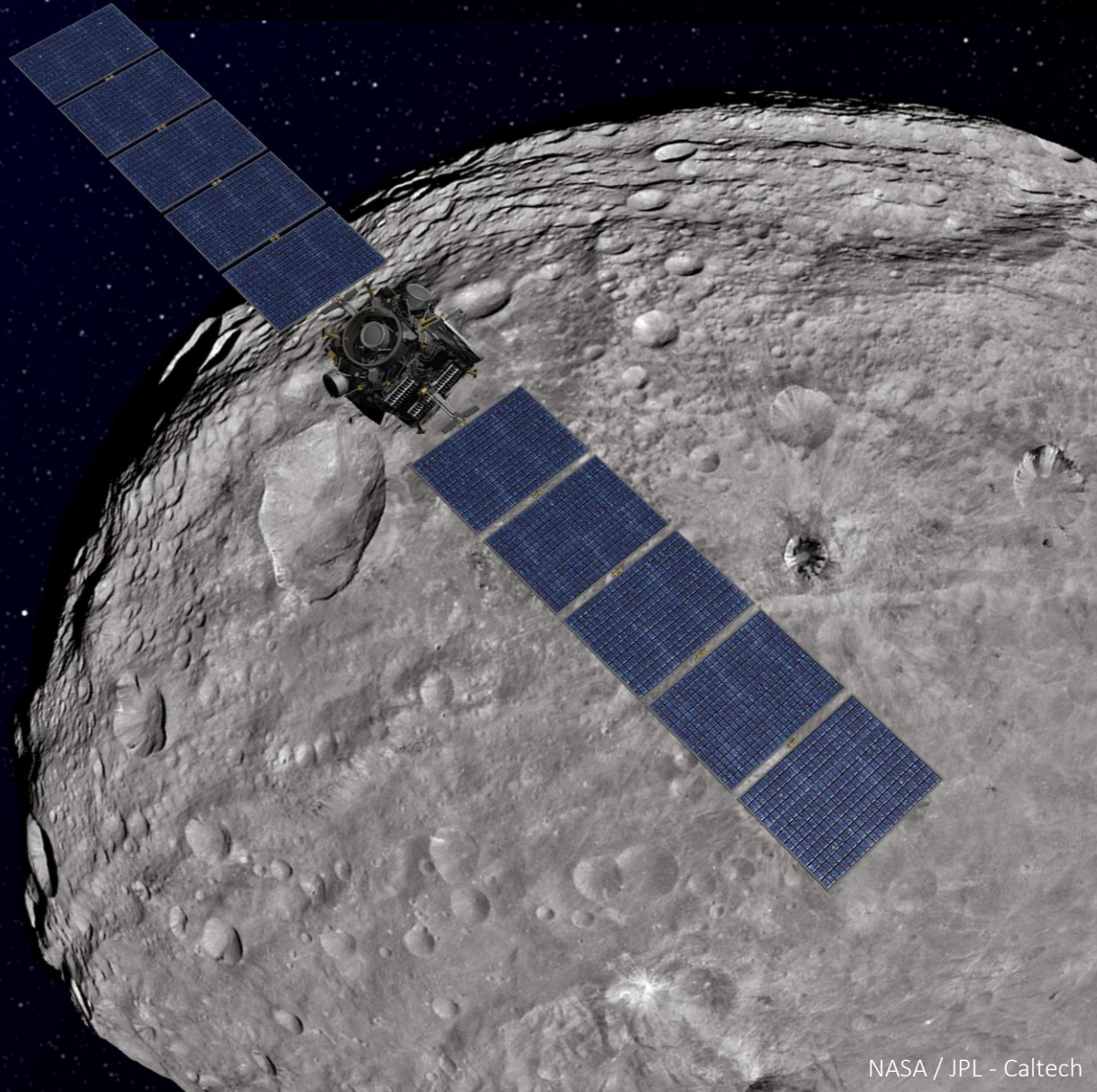


Cumulate eucrite



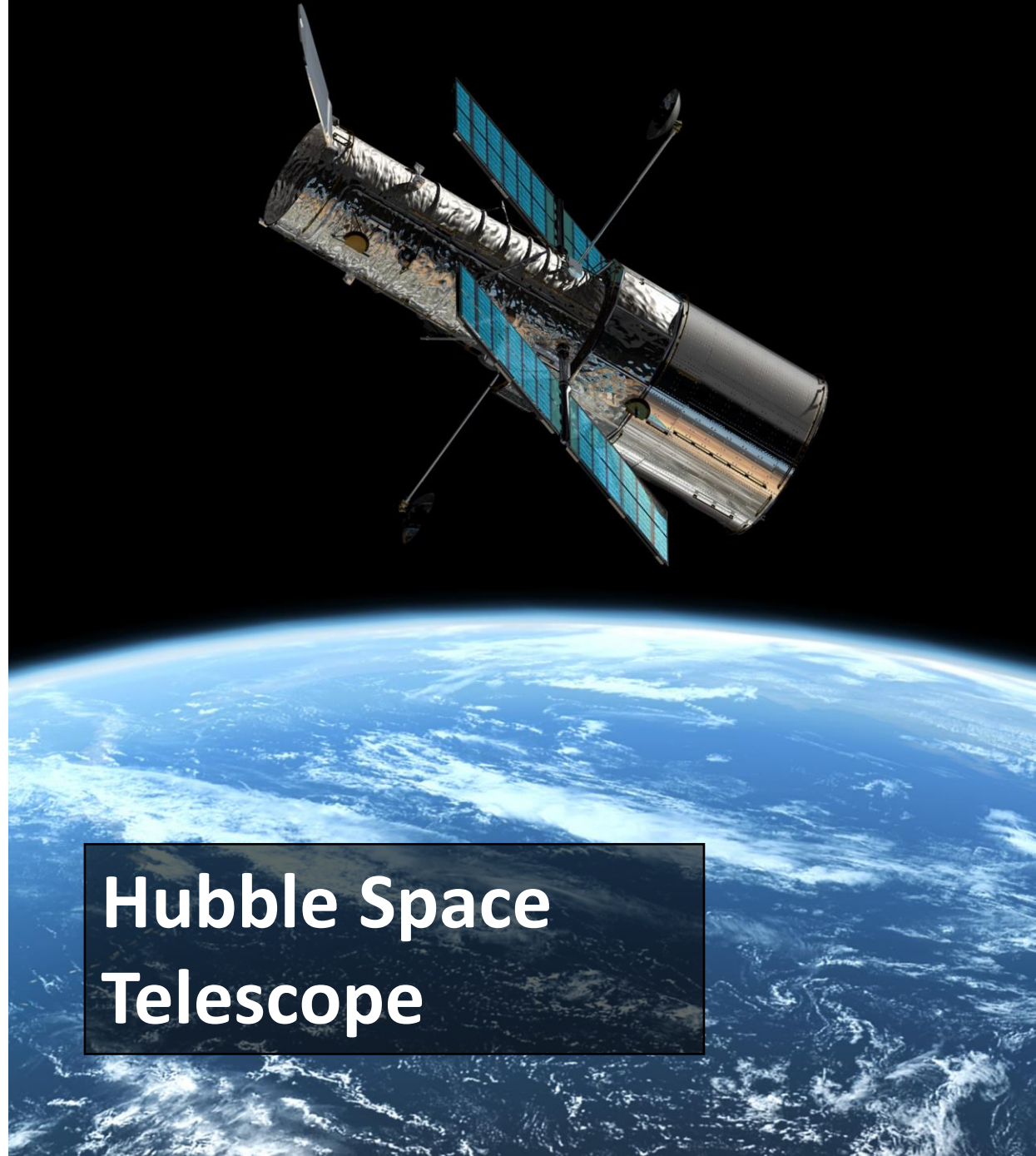
Diogenite

DAWN – NASA's mission to Ceres and Vesta



NASA / JPL - Caltech

European Space Agency



Hubble Space Telescope

SUMMARY

- Vesta is considered the second largest asteroid - both in terms of volume and mass. It is believed to be a protoplanet, with differentiated interior divided into core, mantle and crust.
- Planetoid experienced two major impact events, resulting in the formation of enormous impact craters in the southern hemisphere: Rheasilvia and Veneneia, constituting almost 95% of the Vesta's mean diameter.
- A series of parallel troughs are prominent in Vesta's topography. Could they be result of impact related deformation?
- Impact which created Rheasilvia basin, excavated about 1% of the volume of Vesta. V-type asteroids and HED meteorites are considered to be the products of this collision.
- HED meteorites are howardites, eucrites and diogenites. Eucrites represent crustal material, while diogenites originate from Vesta's mantle. Howardites are impact breccias composed of two before-mentioned lithologies.

LITERATURE

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