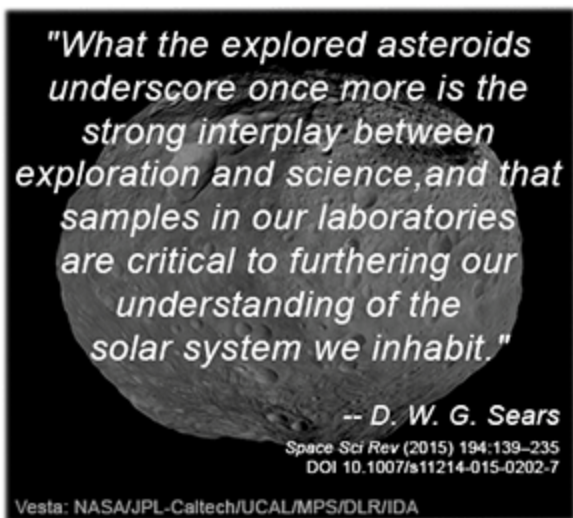


Comprehending Asteroids



Of the hundreds of thousands of asteroids in our Solar System, a dozen of them have been explored by spacecraft. These bodies: Gaspra, Ida and its moon Dactyl, Annefrank, Braille, Mathilde, Eros, Itokawa, Lutetia, Steins, Toutatis, and dwarf planets Vesta and Ceres are the subject of a recent review by Derek Sears (Space Science and Astrobiology Division, Bay Area Environmental Institute/NASA Ames Research Center).

Sears covers the first discovery of these dozen asteroids and reviews the eight robotic spacecraft missions that encountered them, giving us information about the physical and compositional properties of the bodies from flybys and orbit, plus the landing and return of small grains from asteroid Itokawa.

In his summary of how space missions have contributed to our knowledge of asteroids, Sears includes:

- Confirmation that **space weathering** occurs on these bodies as expected from previous modeling and meteorite studies.
- All these bodies have **regolith**; an important fact for understanding the thermal/cooling histories of these bodies, as well as impact mechanics.
- Some of the asteroids have grooves and ridges, a plus for arguments for the solid nature of the bodies but not consistent with the reassembled rubble pile model.
- Confirmation of a continuum between asteroids and comets in colors, **albedos**, densities, and some surface features.
- Some asteroids eject dust, which may be consistent with the idea of **volatile** release from water-bearing bodies.
- Conclusive links between asteroids and meteorites: **HED** meteorites with Vesta, and LL **chondrites** with Itokawa.

We have much more to learn about asteroids, their interiors, and their water and mineral resources. Happily, our exploration of the Solar System and the field of comparative planetology is benefiting from the effective blend of laboratory analyses of meteorites and samples and data obtained with asteroid missions. Two new asteroid missions will return samples for study by cosmochemists in their laboratories: JAXA's Hayabusa2 (launched in 2014 for asteroid encounter in mid-2018 followed by return to Earth in 2020) and NASA's OSIRIS-REx mission scheduled for launch in 2016 with asteroid encounter in 2018 and return to Earth in 2023.

See Reference:

- Sears, D. W. G. (2015) The Explored Asteroids: Science and Exploration in the Space Age, *Space Science Review*, v. 194, p. 139-235, doi: 10.1007/s11214-015-0202-7. [[abstract](#)]

Also:

- [PSRD](#) article [Samples from Asteroid Itokawa](#).
- [PSRD](#) [archive of asteroid articles](#).

Written by Linda M. V. Martel, Hawai'i Institute of Geophysics and Planetology, for [PSRD](#).



[[About PSRD](#) | [Archive](#) | [CosmoSparks](#) | [Search](#) | [Subscribe](#)]

[[Glossary](#) | [General Resources](#) | [Comments](#) | [Top of page](#)]

 [Share](#)

January 2016

<http://www.psrд.hawaii.edu>

psrd@higp.hawaii.edu