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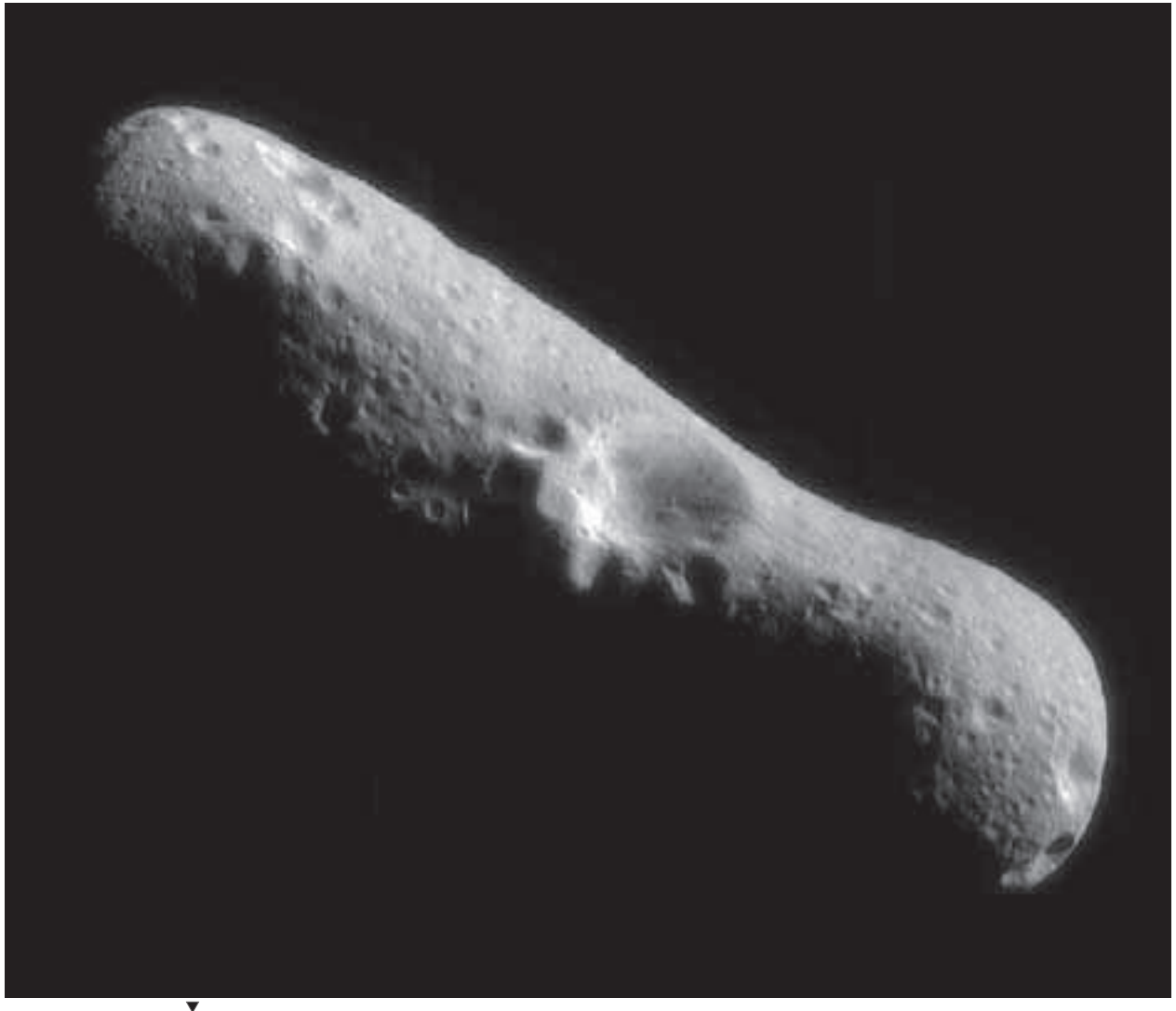
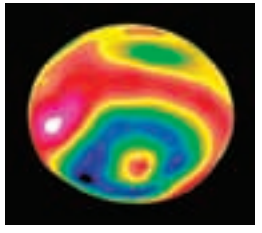
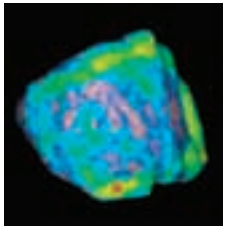
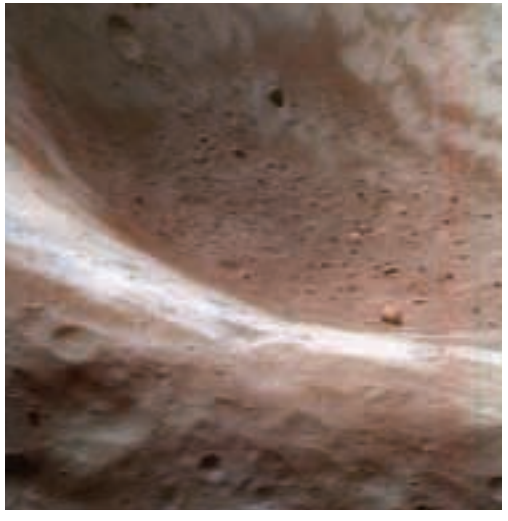
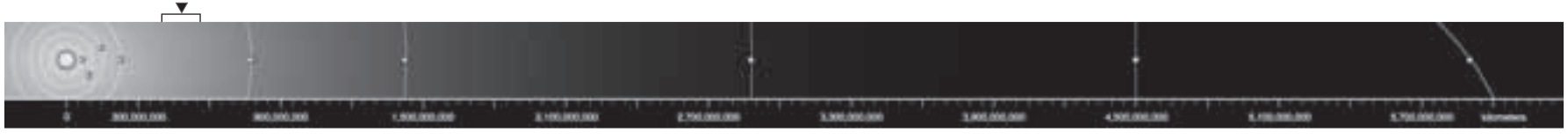
Asteroids











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Asteroids

Asteroids, sometimes called minor planets, are small, rocky fragments left over from the formation of the solar system about 4.6 billion years ago. Most of this ancient space rubble can be found orbiting the Sun between Mars and Jupiter. Asteroids range in size from Ceres, about one-quarter the diameter of Earth's Moon, to bodies that are less than 1 kilometer (0.6 mile) across. The total mass of all the asteroids is less than that of the Moon.

Early in the history of the solar system, the formation of Jupiter brought an end to the formation of planetary bodies in the gap between Mars and Jupiter and caused the small bodies that occupied this region to collide with one another, fragmenting them into the asteroids we observe today. This region, called the asteroid belt or simply the main belt, may contain millions of asteroids. Because asteroids have remained mostly unchanged for billions of years, studies of them could tell us a great deal about the early solar system.

Most asteroids are irregularly shaped, though a few are nearly spherical, and are often pitted or cratered. As they revolve around the Sun in elliptical orbits, the asteroids also rotate, sometimes quite erratically, tumbling as they go. A few asteroids are known to have a small companion moon, and there are even some binary asteroids, in which two rocky bodies of roughly equal size orbit each other.

There are three broad composition classes of asteroids: C-, S-, and M-types. The C-type asteroids are most common, probably consist of clay and silicate rocks, and are dark in appearance. They are among the most ancient objects in the solar system. The S-types ("stony") are made up of silicate materials and nickel-iron. The M-types are metallic (nickel–iron). Their compositional differences are related to how far from the Sun asteroids of different types formed. Some of the asteroids experienced high temperatures after they formed and partly melted, with iron sinking to the center and forcing basaltic (volcanic) lava to the surface. One such asteroid, Vesta, survives to this day.

Jupiter's gravity and occasional close encounters with Mars or with another asteroid change the asteroids' orbits, knocking them out of the main belt and hurling them into space in both directions across the orbits of the planets. Stray asteroids or asteroid fragments slammed into Earth and the other planets in the past, playing a major role in altering the geological history of the planets and in the evolution of life on Earth. Scientists monitor asteroids whose paths intersect Earth's orbit, called Earth-crossing asteroids. Some of these come so close to Earth that they are further classified as near-Earth asteroids.

Radar observations that bounce signals off asteroids can tell scientists a great deal about an asteroid's size, shape, spin, and metal concentration. Radar is used to track asteroids that pass close to Earth; sometimes it detects small companion asteroids.

A few space missions have flown by and observed asteroids close up. The Galileo spacecraft flew by asteroids Gaspra in 1991 and Ida in 1993; the Near-Earth Asteroid Rendezvous (NEAR) mission studied asteroids Mathilde and Eros; and Deep Space 1 and Stardust have both had close encounters with asteroids. NASA's Dawn mission is planned to orbit asteroids Vesta and Ceres. Vesta and Ceres are considered "baby planets" — their growth was interrupted by the formation of Jupiter, and they followed different evolutionary paths. Scientists hope to characterize the conditions and processes of the solar system's earliest epoch by studying these two very different large asteroids.

SIGNIFICANT DATES

1801 — Giuseppe Piazzi discovers the first asteroid, Ceres.
1898 — Gustav Witt discovers Eros, one of the largest near-Earth asteroids.
1991–1994 — On its way to Jupiter, the Galileo spacecraft takes the first close-up images of an asteroid (Gaspra) and discovers the first moon (later named Dactyl) orbiting an asteroid (Ida).
1997–2000 — NEAR Shoemaker spacecraft flies by Mathilde and orbits and lands on Eros.

ABOUT THE IMAGES

1 A four-image mosaic of asteroid Eros taken by the NEAR spacecraft.

2 A Galileo image of asteroid Ida and its moon Dactyl.

3 Elevation mapping using imagery from the Hubble Space Telescope reveals a giant crater (the blue ring) on asteroid Vesta.

4 This computer-generated model of asteroid Golevka was created from radar data. Tiny Golevka is just 0.5 kilometer (0.33 mile) across.

5 A false-color view of a large crater on Eros. Redder hues indicate rock and soil altered by exposure to the solar wind.

FOR MORE INFORMATION

solarsystem.nasa.gov/planets/profile.cfm?Object=Asteroids

FAST FACTS

	433 Eros	951 Gaspra	4 Vesta	1 Ceres	243 Ida
Mean Distance from the Sun (AU*)	1.46	2.21	2.36	2.77	2.86
Orbit Period (years)	1.76	3.29	3.63	4.60	4.84
Orbit Eccentricity (Circular = 0)	0.22	0.17	0.09	0.08	0.05
Orbit Inclination to Ecliptic (deg)	10.83	4.10	7.13	10.58	1.14
Rotation Period	5 hr, 16 min	7 hr, 2 min	5 hr, 20 min	9 hr, 4 min	4 hr, 38 min
Dimensions (km)	34 × 11 × 11	20 × 12 × 11	578 × 560 × 458	960 × 932	60 × 25 × 19
Dimensions (mi)	21 × 7 × 7	12 × 7 × 7	359 × 348 × 285	597 × 579	37 × 15 × 12

*AU = astronomical unit, the mean distance from Earth to the Sun: 149.60 million km or 92.96 million mi.

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