

FIREBALLS

in the sky

WHAT IS AN ASTEROID?

Asteroids are large rocks that have accreted together over millennia but never became large enough to form into a planet.

Asteroids can come in a variety of shapes and sizes from as small as ten metres to hundreds of kilometres across. It is estimated that nearly two million asteroids exist in the main asteroid belt between Mars and Jupiter, but there are other asteroid groups such as the Jupiter Trojans that orbit next to Jupiter and near Earth asteroids which orbit closer to the Earth.

TYPES OF ASTEROIDS

There are many different types of asteroid, but there are three main categories which scientists use to distinguish them.

CARBONACEOUS ASTEROIDS

C-Type or carbonaceous asteroids are the most common type of asteroid. The materials inside C-type asteroids are very similar to the kinds of materials found in chondritic meteorites, which suggests that chondritic meteorites may have originally come from the C-type asteroids.

Chondritic materials are incredibly old and represent the primitive materials which may have been around since the formation of the Sun.

STONY ASTEROIDS

S-Type or stony asteroids are made of stony minerals such as silicates but can have a variety of compositions, including iron and magnesium bearing minerals. It is likely that most stony achondrite meteorites would have originally come from stony asteroids. In 2010 the Hayabusa space

probe returned samples from the stony asteroid 25143-Itokawa, making this the first asteroid to be directly sampled by a spacecraft. Pictures of the asteroid revealed that it was less of an asteroid and more of a rubble pile loosely held together by gravity.

METALLIC ASTEROIDS

M-type or metallic asteroids are incredibly dense asteroids with high concentrations of nickel and iron. They are thought to be the broken iron cores of larger asteroids which have been torn apart by ancient collisions. It is believed that nickel-iron meteorites probably come from M-Type asteroids or from the interior of much larger stony meteorites.

VESTA

4 Vesta is the second largest asteroid in the asteroid belt and is the source of HED meteorites which are a very rare type of achondritic meteorite. In 2011 NASA's Dawn spacecraft visited Vesta and discovered two enormous craters over the north and south poles which were probably formed in a massive collision billions of years ago. This collision generated a large number of secondary asteroids called V-Type asteroids as well as a large number of the HED meteorites which we can find on Earth.

CERES

The Dawn spacecraft is also scheduled to visit the asteroid Ceres in 2015. Ceres is the largest asteroid ever discovered and has a total surface area of 2.8 billion square kilometres which means that if it was laid flat it would be even larger than Western Australia. The asteroid is so large it has been called a dwarf planet and may contain water ice or other hydrated minerals on its surface.

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GLOSSARY

1-Ceres: The largest asteroid ever discovered. Its status has recently been upgraded to dwarf planet, putting it in the same category as Pluto. As Ceres is too far away to be directly observed by space telescopes, we still don't know much about it.

Achondritic meteorite: Stony meteorite that doesn't contain any chondrules. These meteorites have been melted or recrystallised while they were part of a planet, moon or large asteroid, much like igneous rocks on Earth.

Chondritic meteorite: Stony meteorites that contain chondrules, circular grain structures that formed during the early solar system. These are the most common meteorites that fall to Earth.

Chondrules: Round grains in rocks from space. Chondrules were formed when molten droplets of minerals at very high temperatures hardened quickly as the solar system was being formed.

Dawn spacecraft: The Dawn spacecraft is a space probe on a mission to explore the two largest objects in the asteroid belt; the protoplanet Vesta and the dwarf planet Ceres. The Dawn spacecraft uses ion-propulsion engines to move between the asteroids making it the first spacecraft to orbit two different astronomical bodies.

Hayabusa space probe: Hayabusa was a Japanese space probe designed to rendezvous with an asteroid and collect sample to return to Earth. Hayabusa also had a mini lander named MINERVA which was supposed to land on Itokawa, but the lander detached too early and was thrown into deep space.

HED meteorite: HED meteorites are a rare subgroup of meteorites. The HED stands for Howardites, Eucrites and Diogenites. All HED meteorites are believed to have originally come from the asteroid Vesta or from the V-type asteroids.

Hydrated mineral: A mineral which has been altered by the presence of water to create a hydrated form of the original mineral. It is rare to find hydrated minerals outside of water bearing planets such as Earth and Mars because of the lack of liquid water in space.

25143-Itokawa: Itokawa is a near Earth asteroid and is also the first asteroid to be successfully sampled by a spacecraft.

Silicates: Silicates are rocks that are formed of minerals that contain an oxygen and silicon structure. Silicates are very light rocks and so they mostly occur on bodies with enough gravity to separate heavy and light minerals.

4-Vesta: the second largest asteroid in the asteroid belt. Vesta has two large craters named Rheasilvia and Veneneia on its south pole and a variety of other interesting surface features including several strange troughs that may have formed from large collisions.

V-type Asteroid: V-Type asteroids are large fragments of Vesta that may have been knocked off in the collision which created the Rheasilvia crater. These asteroids share the same composition as Vesta and are also a source of HED meteorites.