

# Meteorites

TEA Workshop

April 17, 2004

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The solar system consists of an enormous number of objects in orbit around the sun. Like any other kind of science, to learn about the solar system we need to make observations. The problem is that almost all of the things we want to study in the solar system are too far away to bring back to the laboratory. So, we must rely on messengers from space to tell us something about planets, stars, and other objects in space. Light is the messenger that telescopes collect to learn about the motion, temperature, and gases of the solar system. Meteorites are rocky messengers that can give us direct evidence about how planets formed, what they are made of, and what goes on inside stars.

Besides helping us learn about the solar system, meteorites also play an important role here on Earth. Meteorites carry chemicals from outer space, including complex organic compounds that may be the origins of life. The impacts from large meteorites reshape the surface of the moon and Earth and other objects they strike. It appears likely that very large meteorite strikes on Earth are associated with abrupt mass extinctions that appear in the fossil record.

Meteorites have the potential to tell us about some central questions in science:

- How did the planets form?
- How did life begin on Earth?
- Can meteorites cause extinctions?

We study meteorites directly by collecting them and measuring their chemical composition and structure. The simplest classification scheme separates meteorites into three groups---stony, iron, and stony-iron---based on the relative amounts of iron and silicates. About 90% of meteorites are stony, but these can be broken down into smaller categories as described later. If there was a witness to the meteorite, it is called a fall. If there are no witnesses, so that the time of impact is unknown or must be inferred by other methods, it is known as a find. Large meteorites are studied indirectly by examining the impact craters they produce.

The purpose of this workshop is to introduce some methods for locating meteorites, both finds and falls, and to learn more about and participate in the ongoing science involving meteorites. There have been approximately 20,000 meteorite fragments collected as of 2004. Of these, a very small fraction are falls.

## **Background**

The solar system consists of the sun and the objects in orbit around it. There are many more objects revolving around the sun than the planets and their moons. Comets move in highly elliptical paths and make periodic visits near the sun. Comets occasionally produce dramatic viewing with their long tails visible with the naked eye. However, since they are composed primarily of ice and rock, fragments of comets do not reach the Earth's surface intact. Asteroids are rocky or metallic bodies of sub-planetary size whose orbits are scattered throughout the solar system but more concentrated in the asteroid belt between Mars and Jupiter. Meteoroids are fragments of asteroids produced in collisions and orbit the Sun near the Earth's orbit. These collisions can be with other asteroids or with a planet or Moon. Meteor is the name given to the visible light produced when a meteoroid enters the Earth's atmosphere and burns due to friction.

If the meteoroid is very large, it produces a much bigger fireball. A meteorite is a meteoroid that arrives safely on the Earth.

### Producing a meteorite

- Asteroid collisions produce fragments called meteoroids.
- A meteor is the visible light produced when the meteoroid burns in Earth's atmosphere.
- A bright meteor is known as a fireball.
- A meteoroid that makes it to Earth's surface it is a meteorite.

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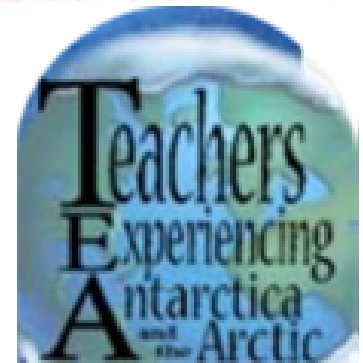
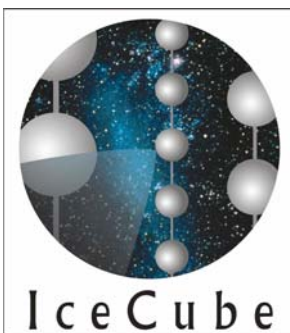
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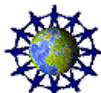
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