

## METEORITES

### What Is A Shooting Star?

A shooting star is not a star, but rather a small piece of rock that falls through the earth's atmosphere. More precisely, these rocks are called meteors. Meteors travel very fast, some up to 100,000 miles (161,030 km) per hour. When they enter the earth's atmosphere at these tremendous speeds, the air around the meteor and the surface of the meteor burn and vaporize. This burning is the light we see shooting across the sky. Meteors can be seen in the daytime, but are most frequently observed at night.

### What Is The Difference Between A Meteor And A Meteorite?

A meteor is a burning rock from outer space that we see streaking across the sky. Many meteors burn up before hitting the earth, while others deflect (skip) off our atmosphere back into space.

As the earth revolves around the sun, its path crosses through areas of space containing comet debris. Meteors can be observed at any time of the year, but, during certain times of the year, the earth encounters more debris. These times, when there are many meteors in the sky, are called meteor showers. Table 1 lists some of the annual meteor showers.

A meteorite is a rock from outer space that was once a meteor and has fallen to the earth. Some meteorites are made of broken up pieces of planets. Other meteorites may be parts of comets. Some are believed to be pieces of our moon or even Mars that broke off when other meteorites collided with them. A meteorite is a rock we can hold in our hands, while a meteor is something we can only see with our eyes.

**Table 1: Meteor Showers**

DATE	SHOWER NAME	LOCATION IN THE SKY
January 2-3	Quadrantids	east
April 20-22	Lyrids	northeast
May 4-6	Aquarids	east
August 10-13	Perseids	northeast
October 8-10	Draconids	east
October 18-23	Orionids	east
November 8-10	Taurids	northeast
December 10-12	Geminids	east

**Table 2: Meteorites Found In South Dakota**

<b>LOCATION</b>	<b>TYPE OF METEORITE</b>	<b>YEAR(S) FOUND</b>	<b>WEIGHT (Kg)</b>
Bath	stony	1892	21.26
Bennett Co.	iron	1934	88.87
Cavour (7)	stony	1938-1944	0.45-5.44
Centerville	stony	1956	0.046
Emery	iron-stony	--	--
Faith	stony	--	--
Flandreau	stony	1981	21.363
Fort Pierre	iron	1856	16
Harding Co.	stony	1941	3.075
Mission	stony	--	--
Wolsey	stony	1990	72.5

## Have Meteorites Been Found In South Dakota?

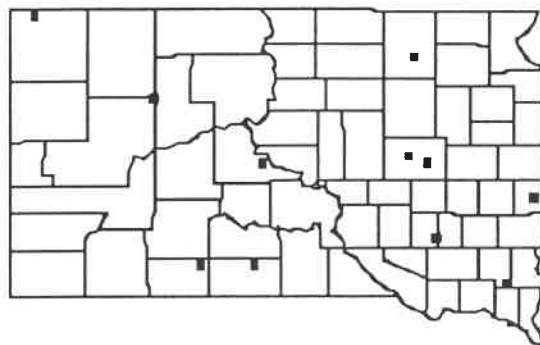
It is estimated that nearly 3000 meteors hit the earth each year and become meteorites. Each year, several hundred meteorites are found all over the earth.

There are 11 sites in South Dakota where meteorites have been found. Many more meteorites probably have fallen in the state, but have not been located. Table 2 lists the meteorites known from South Dakota.

Many meteorites are found by farmers, ranchers, and other people who work with the land. They often notice that some rocks appear different from others. Their curiosity frequently leads to the discovery of new meteorites. Bruce Eichstadt uncovered a meteorite in Wolsey, South Dakota while using a disc harrow. The Harding County meteorite was discovered by a person herding sheep. Some meteorites are discovered as they hit the earth. The Bath meteorite was witnessed falling at approximately 4:00 pm, August 29, 1892. One of the state's most fascinating meteorites is the Centerville meteorite. It wasn't directly witnessed as it fell, but was found the morning after it fell through the roof of a machine shed. The Centerville and several other South Dakota meteorites may

be seen at the Museum of Geology at the School of Mines and Technology in Rapid City.

Sometimes a meteorite breaks up into several pieces before hitting the ground. When several pieces of meteorite fall in a general area, the location is called a strew field. Near Cavour, 7 meteorites have been found having similar characteristics. There are probably more pieces of the Cavour meteorite in the fields around Cavour.



**Locations of Known Meteorites**

## What's In A Meteorite?

There are several characteristics that all meteorites share:

- All contain some metal;
- All are magnetic or partially magnetic;

- All have fallen to earth as meteors;
- All contain the element nickel.

There are three basic kinds of meteorites. The most common type is the *aerolite*, or stony meteorite. *Aerolites* often look like ordinary stones and contain minerals found in many of the rocks on earth, such as *plagioclase*, *olivine*, and *pyroxenes*. However, upon close inspection, meteorites differ from earthly rocks in that meteorites contain small specks of metal (primarily iron). In Antarctica, where meteorites are easier to find in the icy, white glaciers, nearly 90% of the meteorites are *aerolites* or stony meteorites.

Meteorites can also be made of metal. Such meteorites are called *siderites* or iron meteorites. These meteorites are very dense (heavy for their size). The Bennett County iron meteorite is about as big as a medium-sized dog, yet weighs 88.87 kilograms (or about 196 pounds). When it was first found, it was used as a counter weight on a tractor.

The third type of meteorite is the rarest. They are called *siderolites* or iron-stony meteorites. As the name implies, they contain a nearly half and half mixture of iron and stony characteristics. Scientists finding a rock that may be a meteorite, immediately look for metal. If they suspect it is a stony meteorite, the metal may be present as small specks. The metal is then usually tested with a magnet, or tested for nickel.

The surface of a meteorite is generally darker and softer than its interior. Meteorites commonly have dimpled surfaces referred to as thumbprints, because they look like pitted shapes one can make in clay using one's thumbs. Meteorite surfaces can also be rusty if they have been exposed to water, rain, and snow.

Meteorites are frequently cut open with diamond saws. Stony meteorites are lighter colored in the interior. Most, but not all, stony meteorites contain small, rounded grains of silicate minerals called chondrules. Stony meteorites containing

chondrules are called *chondrites*, whereas stony meteorites that lack chondrules are called *achondrites*.

Freshly sawed iron meteorite sections are sometimes etched with weak nitric acid to expose the metallic crystal grains called Widmanstätten patterns. Iron meteorites sometimes have irregular *sulfide nodules* included in the metal grains.

## Why Does The Moon Have So Many Craters While The Earth Does Not?

The earth does have meteorite craters such as Meteorite Crater near Winslow, Arizona, Campo del Cielo, Argentina, and the Manicouagan Reservoir, Quebec, Canada. However, the moon appears to have many more. One of the main differences between the earth and the moon is that the earth's surface is constantly changing. Rivers, floods, glaciers, wind and other natural forces change what the earth looks like. Large craters, called *astroblemes*, are frequently hidden by the earth's own natural processes. Nearly 65 million years ago, a meteorite left behind a crater 25 miles wide near the town of Manson, Iowa. During the last Ice Age, glaciers covered the crater with rock and dirt. Another large *astrobleme* was discovered 2 miles underneath Williston, North Dakota. Unlike the earth, the moon has no atmosphere, oceans, rain, glaciers, or other forces to constantly change its surface.

## Are Meteorites Important?

Certainly yes! Meteorites tell us about what space is like. Meteorites can tell us about other planets and even about our own earth. Some meteorites have been found to contain amino acids, a chemical that makes up all life on earth. Some people speculate that life didn't begin on this planet, but was brought here by meteorites. Others believe that meteorite collisions with earth were responsible for catastrophic events in the earth's history, such as the demise of dinosaurs.

## Glossary

- Achondrites** - stony meteorites that do not contain grains of silicate material.  
**Aerolites** - stony meteorites that contain only small amounts of metal, usually iron.  
**Astroblemes** - large craters caused by the impact of meteorites.  
**Chondrites** - stony meteorites that contain grains of silicate material.  
**Olivine** - a mineral composed of silica, magnesium and iron that is often found in rocks in the form of green crystals.  
**Plagioclase** - a group of silicate minerals containing calcium and sodium.  
**Pyroxene** - complex silicate minerals containing iron, magnesium, and calcium.  
**Siderite** - a meteorite composed primarily of iron.  
**Siderolite** - a meteorite having nearly equal amounts of metal and stony minerals.  
**Sulfide nodule** - a small lump containing sulfur.

## Selected Resources for Teachers

- Comets, Meteors and Asteroids* by Berger, Melvin, 1981. G. P. Putnam and Sons, 75 p.  
*Comets, Meteoroids, and Asteroids: Mavericks of the Solar System* by Franklyn M Bradley, 1974, Thomas Y. Crowell Co., 106 p.  
*Comets and Meteors* by George S. Fichter, 1982. Franklin Watts Publishing.  
*Our Stone-Pelted Planet* by H.H. Nininger, 1933. Houghton Mifflin Company, 237 p.

### Written by:

Eric Fritsch, Museum of Geology, South Dakota School of Mines & Technology, Rapid City, South Dakota 57701-3995. © 1994.

### Reviewed by:

Dr. Paul Gries, Geology Department, S.D. School of Mines and Technology, Rapid City, SD 57701.

Publication of the *Meteorites* Fact Sheet was funded through a Natural Resource Conservation Education Grant from the USDA, Forest Service.