

Definition: **meteorite** from *The Penguin Dictionary of Science*

A rocky meteoroid that is sufficiently large not to burn up completely in the Earth's atmosphere and so reaches the Earth's surface.

Summary Article: **meteorite**

From *The Columbia Encyclopedia*

meteor that survives the intense heat of atmospheric friction and reaches the earth's surface. Because of the destructive effects of this friction, only the very largest meteors become meteorites.

Classification of Meteorites

Not until the early 19th cent. did scientists fully accept the fact that meteorites came to the earth from outer space. Since then many studies have been made of their composition and crystalline structure; the use of microchemical analysis, X rays, and the mass spectrograph has facilitated such work. The age of meteorites can be determined by measuring their radium and helium contents. Some meteorites might be fragments of comets; others, small asteroids whose orbital paths crossed that of the earth. Geochemical analysis has shown that more than 170 known meteorites are of lunar origin and more than 100 are of Martian origin. One of the Martian meteorites—known as ALH84001—is believed by some scientists to show evidence of there once having been primitive bacterial life on Mars, but most experts disagree with this conclusion. The lunar and Martian meteorites are thought to have been broken away from the moon and Mars by the impact of large asteroids.

Three general categories are used to classify meteorites. The siderites, or irons, are composed entirely of metal (chiefly nickel and iron). The aerolites, or stony meteorites, show a diversity of mineral elements including large percentages of silicon and magnesium oxides; the most abundant type of aerolite is the chondrite, so called because the metal embedded in it is in the form of grainlike lumps, or chondrules. The siderolites, which are rarer than the other types, are of both metal and stone in varying proportions.

As a meteor speeds through the atmosphere, its outer surface becomes liquefied; the friction of the atmosphere finally reduces its velocity (if the meteor is not large), and the surface cools and solidifies into a dark, smooth crust. Lines of flow in the hardened surface can indicate its motions in flight. Cone-shaped meteorites show that one end was directed forward. Others, which are unevenly shaped, probably spun while falling. The smallest meteorites, dust-sized particles known as micrometeorities, may pass through the atmosphere without heating up due to friction because of their very small mass.

Formation of Craters

Friction with the atmosphere has little effect in slowing down a very large, fast-moving meteorite. When it reaches the earth, it strikes with tremendous force and becomes buried beneath the surface. This sudden impact causes great compression, heating, and partial vaporization of the outer part of the meteorite and of the materials in the ground; expansion of the gases thus formed and of steam produced from groundwater causes an explosion that shatters the meteorite and carves out a crater in the ground. Such a crater is the huge Meteor (or Barringer) Crater near Winslow, Ariz. Some 190 impact locations have been identified on earth. The largest known impact craters, each estimated at 80 mi

(130 km) or greater in diameter, are located at Vredefort, South Africa, Chicxulub (off the coast of the Yucatán peninsula), Mexico, and Sudbury, Ontario. The concentration of craters is much greater on the moon and Mars because they lack an atmosphere capable of burning up—or reducing to small meteorites—all but the largest meteors before they reach the surface. The fractured rock of buried impact craters may act as a trap for oil and natural gas rising from deep underground, as is the case with Chicxulub.

Notable Meteorites

Mexico's Chicxulub crater is believed to be the site of a meteorite impact so immense that the resulting environmental changes caused or greatly contributed to the mass extinction 65 million years ago which the dinosaurs did not survive; other meteorite impacts also may have contributed to the mass extinction. In 1908 in the Tunguska Basin in Siberia a meteor that was probably a stony asteroid about 100 ft (30 m) in diameter completely disintegrated before hitting the ground, so no crater was formed; however, all the trees were flattened and wildlife killed in an area 30 mi (50 km) in diameter, more than half the size of Rhode Island. The Hoba meteorite, the largest known at an estimated 60 tons, rests where it was discovered, near Grootfontein, Namibia, in 1920. Among the exhibits at the American Museum of Natural History in New York City are three large meteorites brought from Greenland by R. E. Peary (one, called Ahnighito, weighing 36 1/2 tons) and the conical Willamette meteorite, weighing about 14 tons, found (1902) near Portland, Oreg. In N Mexico a number of meteorites have been found weighing a ton or more each. Siderites weighing more than a ton have been discovered in Brazil, Argentina, and Australia.

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