Meteorites: rocks from space

Every year the Earth is showered by extraterrestrial material falling from space. The Museum's mineralogy and petrology collections include a small holding of meteorites, and a display of some of this material is on show in the rocks and minerals aisle of the main court, along with a large touchable specimen that fell in Nantan in China.

The Nantan meteorite

This meteorite comes from either Lihu or Yaozhai town in Nantan County, Guangxi, China, where it fell in 1516. It is an iron meteorite weighing over 155 pounds (71kg), and is composed of the minerals kamacite and taenite (each alloys of the metals iron and nickel). The surface of the meteorite is rusty, and covered in thumb-like depressions called regmaglypts, which have been produced by melting of the meteorite during entry into the Earth's atmosphere. It is currently on display in the rocks and minerals aisle of the main court as one of a series of touchable specimens.

What is 'Learning more'?

'Learning more' presents a series of articles about the Museum and its collections. It is designed for older students, teachers, researchers, and anyone who wants to find out more about particular aspects of the Museum's work and its history.

This article introduces the meteorites in the Museum currently on display in the mineralogy and petrology aisle of the court.

Rocks from space

It has been estimated that 100,000 tonnes of extraterrestrial material reach the Earth's surface every year. It can be anything from fine dust to metallic masses weighing many tonnes.

Extraterrestrial material that falls towards the Earth is classified by size. The majority of this material is in the form of tiny particles called micrometeorites. They fall continuously, and arrive unnoticed.

Meteors or 'shooting stars' are often seen in a clear night sky. They are larger dust particles and small rocky fragments, many no more than a gram in weight, which are burnt up by friction as they fall through the Earth's atmosphere.

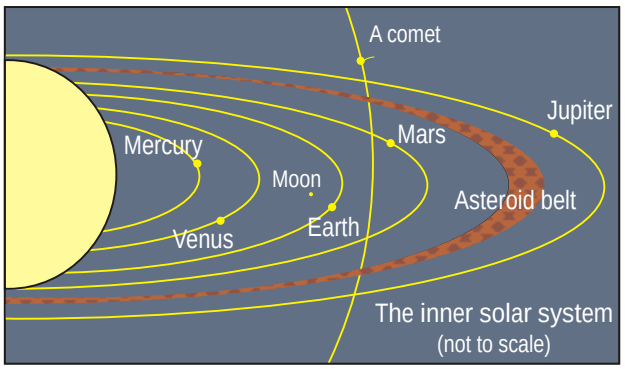
Meteorites are larger pieces of rock that reach the Earth's surface without getting burnt up in the atmosphere. A meteorite whose arrival has been witnessed is called a fall. Meteorites discovered without a known time of fall are called finds. All meteorites, falls and finds, are named after the place where they were picked up. They are broadly classified according to their composition into stones, stony-irons and irons.

Campo del Cielo meteorite

This large meteorite comes from Campo del Cielo in northern Argentina where it fell three or four thousand years ago, along with many other similar pieces of up to 37 tonnes in weight. This particular specimen weighs 120 pounds (55 kg).

Where do meteorites come from?

Most meteorites are thought to come from asteroids, small rocky bodies orbiting the Sun. The largest known asteroid is 930km across, just over one quarter the diameter of the Moon. Most asteroids are to be found in the 'asteroid belt' between Mars and Jupiter. A small number of meteorites are thought to come from the Moon or Mars, and others originate from the tails of comets.



A diagram showing the inner solar system and the position of the asteroid belt between Mars and Jupiter.

What happens when meteorites fall?

As a meteorite reaches the Earth's atmosphere it slows down from supersonic speeds. Reports of falls describe meteorites as 'glowing fireballs' in the sky, and are often accompanied by a sonic boom. Both these effects are caused by the friction an object experiences travelling through the Earth's atmosphere. Often, a single rock will break up as it falls, forming a meteorite shower.

On impact, a meteorite will usually form a crater as the surrounding rock and soil is thrown out of the way by the impact. Small glassy objects called tektites form when molten and vapourised rock is blasted into the atmosphere during the formation of an explosion crater.

Shatter cones

When a meteorite hits the Earth a shock-wave travels through the underlying rock causing it to crack. The fractures gradually spread out, creating a cone structure that points towards the impact site.

Why are meteorites important?

Despite their rarity, meteorites are more than exotic curiosities. They can provide important clues about the origin, age and evolution of the solar system and the structure of the Earth. Meteorites may also hold clues to the origins of life on Earth, and they may have contributed to 'mass extinctions' (for example the extinction of the dinosaurs) identified in the fossil record.

Tektites and moldavites

Tektites are fragments of natural green glass formed by the solidification of blobs of molten rock that are ejected into the atmosphere when a meteorite falls to Earth. Moldavites are a specific type of tektite, found across Europe from an impact in southern Germany 14 million years ago.

Moldavite, Czech Republic

Is it a meteorite?

People often come into the Museum claiming they have found a meteorite; to date, there have been just 23 meteorite falls recorded with certainty in Great Britain and Ireland, and so they are an extremely rare find.

Meteorites are usually quite distinctive rocks. Because they can contain high levels of iron, they are often more dense than terrestrial rocks and tend to feel heavier. Their characteristic black fusion crust is caused by surface melting during their fall through the atmosphere, but by the time they reach the ground, they are warm or even cool to touch - not hot.

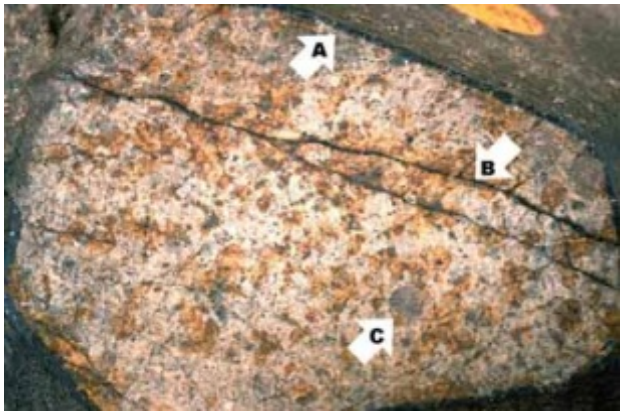
Extra-terrestrials in the Museum

Samples of meteorites from the Museum's collection are on display in the rocks and minerals aisle of the main court. They include examples of stones, stony-irons and irons, and show the fusion crusts of the meteorites. Some of the iron meteorites have been etched and polished to reveal the pattern where crystals of two minerals (kamacite and taenite) composed of iron and nickel have intergrown.

The Launton meteorite

The Launton meteorite fell on 15 February 1830 at 7.30pm and an account of 1831 describes how a bright fireball was seen and loud bangs were heard, typical phenomena accompanying the arrival of a meteorite. The Launton is a stony meteorite of the most common type, known as an 'ordinary chondrite'.

On 15th February 1830 a meteorite landed at Launton, ten miles from Oxford. It belongs to the chondrite group of stony meteorites and has a thin black fusion crust which was produced as the surface melted on entering the Earth's atmosphere. The one and only specimen is now in the Natural History Museum in London, but a nineteenth century replica is kept by the Museum in Oxford.



Features of the meteorite

Photograph of the central part of the only specimen of the Launton meteorite (held at the Natural History Museum in London), showing: (a) fusion crust, (b) iron-nickel vein, and (c) chondrule; (width approximately 4 cm).

Structure and composition

The meteorite was lost after its original owner's death, and subsequently traced and bought by the Natural History Museum in London. There it was analysed by G T Prior in 1916. The mineral composition corresponds to an olivine-bronzite rock with additional iron-nickel, iron sulphide and feldspar.

Description of the Launton Fall

An account of the landing of the meteorite is reproduced below, from the *Magazine of Natural History*, 1831. This account is by a Mr Stowe, a medical doctor from Buckingham who had obtained a fragment of the meteorite for analysis. At the time, Dr John Lee of Hartwell House near Aylesbury, who made the Museum's model, owned the specimen. His handwritten notes on the fall differ in one respect from Mr Stowe's description in that the sound was compared to 'the rapid discharge of a triple-barrelled gun'. In other words there

'An event occurred in this neighbourhood a short time ago which excited a good deal of curiosity and enquiry, and which, as far as I can learn, is unprecedented in the history of the county in which it happened, and, on that account, worthy of being put on record in a more permanent publication than the ephemeral columns of a newspaper. The circumstance to which I allude is the fall of a meteoric fall on Monday, the 15th day of February, 1830, at half-past seven in the evening, in the garden of John Bucknell, a labourer in the employment of Mr. Cross, farmer, at Launton, near Bicester, Oxon. Its descent was accompanied with a most brilliant light, which was visible for many miles around, and attended with a triple explosion, which was described to me, by a person who heard it at the distance of four miles, as resembling the rapid discharge of three ordinary guns. It penetrated some newly dug mould nearly a foot deep; and, though seen to strike the earth, was not sought for till the following morning, when, of course, it had become cool.
A man named Thomas Marriot was passing near the garden at the moment, and states that it came rapidly towards him from the north-east, not perpendicularly but obliquely, appearing about the size of a cricket-ball; and that expecting it would strike him, he instinctively lowered his head to avoid it.'

This page was originally written by a student from Oxford Community School during a week's placement at the Museum funded by the British Gas Lattice Foundation.