

METEORITE SPOTLIGHT

FIREBALLS

in the sky

Every now and then an interesting meteorite falls to Earth which catches the attention of scientists and the public.

These famous meteorites stand out because of their interesting stories and the lessons we learn from studying them.

MUNDRABILLA

In 1966 two geologists, Wilson and Cooney, discovered a number of large pieces of iron around 200 metres apart from each other in the middle of the Nullarbor Plain. These iron pieces were fragments of a large meteorite that had fragmented on re-entry. The largest of these pieces weighed 12.4 tonnes and is one of the largest iron meteorites ever discovered.

These meteorites were carried to Perth, Western Australia and now reside in the West Australia Museum on permanent display.

MURCHISON

In 1969, residents of town of Murchison, Victoria were shocked to see a super bright fireball passing over their town and lighting up the night. The meteor exploded in the air causing a tremor and scattered into hundreds of smaller pieces.

The Murchison meteorite has been extensively studied because it contains evidence of fluid alteration and organic molecules which formed before landing on Earth. Some of the molecules found in the Murchison meteorite include amino acids which are necessary for the creation of

proteins and even nucleobases which are vital components of DNA.

PEEKSKILL

The Peekskill meteorite fell in 1992 over the East Coast of the US at 7.50 pm. The fireball was seen by thousands of people and filmed by 16 different cameras. A fragment of the meteorite collided into a red Chevy Malibu in Peekskill, New York. The owner of the car, 18 year old Michelle Knapp, had only just purchased the Chevy for \$300 and was able to sell the crushed car to a meteorite collector for \$10,000.

The meteorite was well documented on amateur film because many people were recording high school football games when the fireball appeared. Using multiple recordings it was possible for scientists to triangulate the orbit of the fireball, and find out that the Peekskill meteorite had originally come from the inner asteroid belt.

The Peekskill meteorite itself is a common type of meteorite – an ordinary chondrite. What made this event very special is the fact that so many people recorded it, meaning scientists could use the footage to calculate its origin. This is the idea behind the Desert Fireball Network.

BUNBURRA ROCKHOLE

The Bunburra Rockhole meteorite is the first meteorite to be recovered in Australia based off of remote camera data and the first meteorite to be recovered using the Desert Fireball Network (DFN). The DFN was able to photograph the meteor as it burned through the atmosphere which made it possible to calculate its original orbit and recover the fragments that survived re-entry.

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Bunburra Rockhole is a unique meteorite because it has a eucrite composition which indicates that it is from the asteroid 4-Vesta. However the oxygen isotope composition does not match other eucrite rocks making the Bunburra Rockhole truly one of a kind.



Bunburra Rockhole - the first meteorite discovered using the Australian Desert Fireball Network just 100m from the predicted fall location.

CHELYABINSK

On the 15th of February 2013 a 17 metre wide rock entered the Earth's atmosphere over the Chelyabinsk Oblast region of Russia. The meteor was travelling at nearly 60 times the speed of sound when it entered the atmosphere causing a super bright fireball that exploded over the city of Chelyabinsk with 20 times the energy of the Hiroshima bomb.

The shockwave from the blast was powerful enough to shatter glass windows all over the city causing injury to over 1,500 people. The event damaged windows in over 7,000 buildings and destroyed the roof of a local factory.

The entry of the meteor itself was recorded on multiple cameras and news of the event rapidly spread worldwide. Shortly after the blast a number of small meteorites were recovered by locals throughout the region.

A large hole was also discovered in the frozen surface of nearby Lake Cherbakul which was the result of an impact with a fragment weighing over half a tonne, but it wasn't until October 2013 that the larger pieces were recovered from the lake.

The meteorite fragments show that Chelyabinsk is an ordinary chondrite but also contains 10% iron. Analysis of the fireball footage revealed that the meteor originally had an orbit that crossed between Earth and Mars, making it an Apollo asteroid.

Using the orbital data it was possible to find the parent asteroid, known as 2011EO40. It may be possible to estimate what the parent asteroid is made of by studying the composition of the surviving Chelyabinsk fragments.

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GLOSSARY

Amino acids: Molecules made of an amine and carboxylic acid. They can be combined into long branching chains to form proteins which are necessary for life. There are 20 different amino acids which are used to build all life as we know it.

Apollo asteroid: A near earth object that spends part of its orbit between the Earth and the Sun, and the rest of its trajectory beyond Earth. Apollo asteroids do cross the Earth's orbit and are a potential hazard to our planet.

DNA: Deoxyribonucleic acid. These molecules contain the genetic code necessary for the construction and function of all known forms of life.

Eucrite: Meteorites which are believed to come from the surface of the large asteroid Vesta. There are some examples of eucrites that may come from other asteroids or even V-type asteroids which were once part of Vesta itself.

Fluid alteration: Changes in a rocks chemical composition through exposure to water. Fluid alteration is common on Earth but much rarer in outer space, and can give us an insight into the presence of water in the early solar system.

Nucleobases: Nitrogen bearing molecules that are found in DNA. Nucleobases are able to link together in pairs which is why DNA forms a double helix structure. There are four bases that link DNA together but there also exist other nucleobases which have special uses within the body.

Organic molecules: Molecules made of carbon chains and other organic elements such as oxygen or nitrogen. Organic molecules are not necessarily biological in

nature and can be from

Proteins: Long chains of molecules that serve a number of different functions within life forms from cell walls to respiration. They are made of amino acid chains and can form incredibly complex structures.