**METEOR CRATER**
The Most Fascinating and Significant Meteor Impact Site on Earth

- See and touch the largest meteorite fragment found at Meteor Crater.
- Experience artifacts from early exploration and scientific study of the crater, meteor collisions worldwide and on other planets, and guest-generated computer simulations of meteorite collisions.
- Shop for Meteor Crater souvenirs, authentic fossils, Southwest and Route 66 memorabilia, games, and postcards. Also available are space and geology related items.
- Experience the unique international tourism and scientific venue, that is still an active geological and meteorite impact research site.
- Stand on the site of one of the most dramatic natural events in Earth's history, only at Northern Arizona's Meteor Crater - Family owned and operated for more than 100 years.
  - Take a guided hike on the newly paved rim trail.

**EASY ACCESS FROM I-40**
Just minutes off Interstate 40, 35 miles east of Flagstaff and 20 miles west of Winslow.

**OPEN YEAR ROUND** (Admission charged)
The Visitors Center and RV Park are open throughout the year.

**SEASONAL HOURS**
Visit us on the web: meteorcrater.com
Email: info@meteorcrater.com

**RV PARK**
The Meteor Crater RV park offers 71 pull-through RV spaces, full hookups, tent sites, gated entry, private restrooms with showers, recreation room, laundry, free WIFI, camper convenience store with food, Mobil gas station, ADA accessible facilities, mild evening desert temperatures in summer, and breathtaking open-sky star gazing.

**Meteor Crater Enterprises**
P.O. Box 30940, Flagstaff, AZ 86003-0940
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Meteor Crater: (928) 289-2362 • RV Park: (928) 289-4002

The best preserved and first proven meteorite impact site on Planet Earth
50,000 years ago a meteor ended its 500 million year long race through space in a spectacular collision with Earth. The resulting violent explosion created Meteor Crater, the first proven, best preserved impact site on our planet.

The meteor’s impact left a crater nearly a mile across and more than 550 feet deep. Today, visitors from across the globe marvel at the huge site where a 60-story building on the floor would not reach the rim. It would accommodate two million fans on the crater walls watching 20 football games being played simultaneously on the crater floor.

Visitors can choose to view the crater via the air-conditioned indoor viewing area or venture out on the crater’s rim on one of several observation trails. Guided rim tours are also available (weather permitting).

Meteor Crater’s terrain so closely resembles that of the moon and other planets it was an official training site for NASA Apollo astronauts. Information learned here has provided scientists with the keys to unlock the secrets of how our solar system and universe were formed.

Located on the rim of the crater, the Meteor Crater Visitor Center is one of the most popular attractions in Northern Arizona, and one of the best facilities of its kind.

The fully air-conditioned modern Visitor Center features an 80-seat wide-screen theater, meteorite displays, site exploration artifacts, interactive exhibits, gift shop, rock shop, and Subway restaurant.

Visitors are encouraged to begin their Meteor Crater adventure by enjoying a 10-minute movie called “IMPACT! The mystery of Meteor Crater.” It focuses on Meteor Crater’s continuing value as a living geological and astrogeological laboratory.

“IMPACT! The mystery of Meteor Crater” allows visitors to experience the thunderous sound and explosive fury of the meteor’s burning trip through the Earth’s atmosphere and ground-shaking collision with Earth in Northern Arizona.

An actual Apollo NASA test capsule, American Astronaut Wall of Fame, and striking views of Northern Arizona’s high desert plateau and San Francisco Peaks are found in the Visitor Center courtyard.
In recent years, work has been completed at Meteor Crater in the fields of terrestrial impact craters, cratering mechanics, planetary studies, and astronaut training. From 1964 through 1972, the U.S. Geological Survey and NASA provided extensive science training at Meteor Crater for the Apollo astronauts, under the guidance of Dr. Eugene Shoemaker and David Raddy, both with the Branch of Astrogeology of the U.S. Geological Survey. This training was particularly significant because scientists were extremely interested in what materials lay on the lunar surface as well as what was beneath the surface. Astronauts still train here today.

At an impact site, the craterring process ejects material that actually originates below the surface of the crater, therefore, when our astronauts want to the moon, they knew they should be able to collect material on ejecta blankets that originated beneath the cratered region—a valuable sampling technique learned at Meteor Crater.

Photographs of our moon, the other planets, and their satellites clearly show that the millions of craters on their surfaces were caused by meteorite impacts. Three decades of research on the earth's surface show that not too has been the target of numerous collisions, both large and small.

Today, Mother Nature continues her process of slow but inevitable erosion by wind, water, and heat. Fortunately for science and all of us, Meteor Crater has sustained relatively little removal of material since it's formation 50,000 years ago. The crater walls have only been slightly modified by erosion and, in places, still exhibit some of the original fallback from the debris cloud. The rim crest is estimated to have been lowered by erosion less than a few tens of feet and still stands some 150 feet above the surrounding plain. The majority of the ejecta blanket is still present.

Most of the craters on Earth have been leveled by erosion. Although there are many larger terrestrial impact sites, Meteor Crater is the first known and best preserved impact site on Earth.

This feature, named Meteor Crater or Barringer Meteorite Crater, represents the most basic type of impact crater in the solar system. In 1968, Meteor Crater was designated a Natural Landmark by the Department of the Interior.

Here at Meteor Crater, we are attempting to illustrate collision and impact processes which played a dominant role in the development of our planets, satellites, asteroids and comets. The geologic and planetary records are clear: collisions, ranging in size from microscopic to gigantic events, have occurred since the beginning of the solar system, and will continue to occur.

Indeed, the very course of life on Earth has been affected by this endless bombardment. No less can be expected in the future!!
A dense hot cloud quickly rose high above the crater carrying with it droplets of molten iron-nickel, pieces of molten rock, and abundant shocked rock debris. This material rained down as fallout until the cloud drifted away and dissipated.

Meteorite fragments that separated early from the main mass during its passage through the atmosphere continued to fall at lower velocities on the crater and surrounding area during and immediately after the impact. Some of these fragments are on display in our museum.

Prior to impact, less than a percent or so of the meteorite was lost due to atmospheric heating and ablation as it plummeted to Earth. During impact, however, it is believed that a small percentage was vaporized, whereas the majority was melted. Any meteorite material that did not vaporize or melt was intensively fragmented and either thrown out during excavation or mixed with the fragmented rock that remained in the crater. About half is thought to have been ejected out of the crater, and about half is thought to be present in very small amounts on the ground. Occasionally, meteorite fragments have been found scattered throughout the region.

From where you now stand, the floor of the crater is 550 feet deep, equivalent to a 60-story building. If you walk to the edge of the crater, you will find that it is about 3,000 feet across and 2.4 miles in circumference. For a meteorite only 150 feet across to blast a hole three quarters of a mile wide and sixty stories deep, its high velocity is clearly one of the major factors required to create a crater this large.

To give you a better idea as to the crater’s size, imagine twenty football games being played simultaneously on its floor, while more than two million spectators would be able to see the entire scene.

There is evidence of the crater being eroded by Native Americans in the area, however, the first written report was not made until 1871 by a man named Franklin. Also, the crater is named after General Custer. For years the crater was referred to as Franklin’s Hole.

Later, local settlers named it Coon Butte and it was thought to be just another extinct volcano, possibly part of the Hopi Buttes volcanic field located northeast of here.

In 1866, iron-nickel meteorites were found by a shepherd, but believing them to be silver, he did not report his finds until 1891. Eventually, such discoveries led to the suggestion, by some, that the crater had been formed by a giant meteorite.

During that year, the chief geologist of the United States Geological Survey, G.K. Gilbert, briefly visited the crater. He had earlier correctly concluded that the bulk of the craters on the moon were formed by impacts. However, he interpreted the field evidence at Meteor Crater incorrectly and concluded it had a volcanic origin. Although this idea held fast for the next two decades, a major change in scientific thinking was about to occur.

In 1902, Daniel Marcus Barringer, a Philadelphia mining engineer, had become interested in the site as a potential source of mining iron. He later visited the crater and was convinced that it had been formed by the impact of a large iron meteorite. He further assumed that this body was buried beneath the crater floor.

Barringer formed the Standard Iron Syndicate and had four placer mining claims filed with the Federal Government, thus obtaining the patents and ownership of the two square miles containing the crater. This was ten years before Arizona became the 48th state.

Barringer was correct. The crater was formed by a meteorite impact. What he did not know was that the meteorite underwent total disintegration during the impact through vaporization, melting and fragmentation. There was never a single large mass buried beneath the crater.

In 1903, Barringer came to Meteor Crater and spent the next 26 years attempting to find what he believed would be the giant iron meteorite. For the next two and one-half decades, his work and scientific research were carried out with great perseverance and bitter disappointment.

Since the crater is roughly circular, it was natural at that time to assume that the body that formed it lay beneath its center. Consequently, the first shaft was started where the low, white mounds of pulverized Cenonino sandstone can still be seen on the crater floor. A few small meteoritic fragments were reported in the shaft, but unfortunately, the pulverized rock beneath the water table turned to quicksand and prevented mining to a depth where the main body was suspected to lie.

After the initial exploration, Barringer conducted some simple experiments and discovered that a rifle bullet fired into thick mud, even at a low angle, generally produces a round hole. This was an important clue...could the meteorite have penetrated at an angle and buried off center?

Looking at the south crater wall you will see, as did Barringer, that the rock is noticeably uplifted. Sandstone and limestone beds, which were once deeply buried are now more than 250 feet above their pre-impact levels. In fact, they are higher than anywhere else in the crater.

This observation, coupled with the fact that many meteorite fragments had been found on the northeast side of the crater, led Barringer to conclude that the mass had come in at an angle from that direction and buried itself beneath the south rim of the crater.

Looking again at the south crater wall, you will see a notch with a streak of red debris running down the slope. Drilling was started at that notch and at a depth of 1,250 feet Barringer reported increasing numbers of oxidized meteorite fragments. At times, hours passed with no progress in deepening the hole and the drill bit would gouge into something at least as hard as the drill bit itself. Then at 1,376 feet, the rotary drill bit jammed completely. Barringer interpreted this to be caused by meteorite debris. The bit was permanently stuck, the drill cable broke, funds were exhausted, and the exploration was abandoned in 1929.

Although Barringer died later that year, he lived to see his theory of the impact origin of the crater begin to be increasingly accepted by the scientific community.

In 1941, the Barringer family entered into a lease with Barr T Barr Ranch Company, a cattle operation which started in the 1880s and owns or leases the surrounding lands. In 1955, Barr T Barr Ranch Company formed a separate corporation, Meteor Crater Enterprises, Inc., and entered into a long-term lease with the Barringers.

All the facilities at Meteor Crater were built, maintained, and staffed by the employees. Today the Barringers still own the land and both the Barringer family and the owners of the Enterprises regard the property as a public trust. Each year both make substantial contributions to science and education through grants, scholarships, and special awards.

Today, modern geological and geophysical exploration techniques have largely replaced the earlier method of just digging shafts and simple rotary drilling. New approaches include the use of seismic, gravity, magnetic, and electrical field techniques. Recently, cosmic ray stimulation procedures were used to arrive at a more accurate age of Meteor Crater and C14 dating techniques have been used to address erosion and climatic issues. Advanced microscope, X-ray, and other laboratory procedures are in use to study the shocked rocks, meteoric material, and their histories.

Dr. Eugene Shoemaker, former Chief of the Branch of Astrogeology of the U.S. Geological Survey in Flagstaff, proved in 1960, beyond any doubt that Meteor Crater was indeed the product of a giant impact event. Shoemaker and his wife Carolyn have recently completed a number of studies that provide estimates of the rates and energies associated with comets and asteroids that might impact Earth. For example, a Meteor Crater size event should occur about once every 50,000 years.

Dr. Shoemaker, Ed Chau and Don Milton, all of the U.S. Geological Survey, discovered two important new minerals at Meteor Crater: coesite and stishovite. Both are high-pressure polymorphs of silica, or silicon dioxide (SiO2), altered to very dense crystalline states by extremely high pressures equivalent to more than 20,000 times atmospheric pressure, or 300,000 pounds per square inch. Although coesite and stishovite can be produced in the laboratory, they had not been recognized as natural occurrences until now. Since the Meteor Crater research, both minerals have been identified at a number of other geological features called impact craters. These two high-pressure minerals are now diagnostic criteria proving these sites are the scars of ancient impact craters.