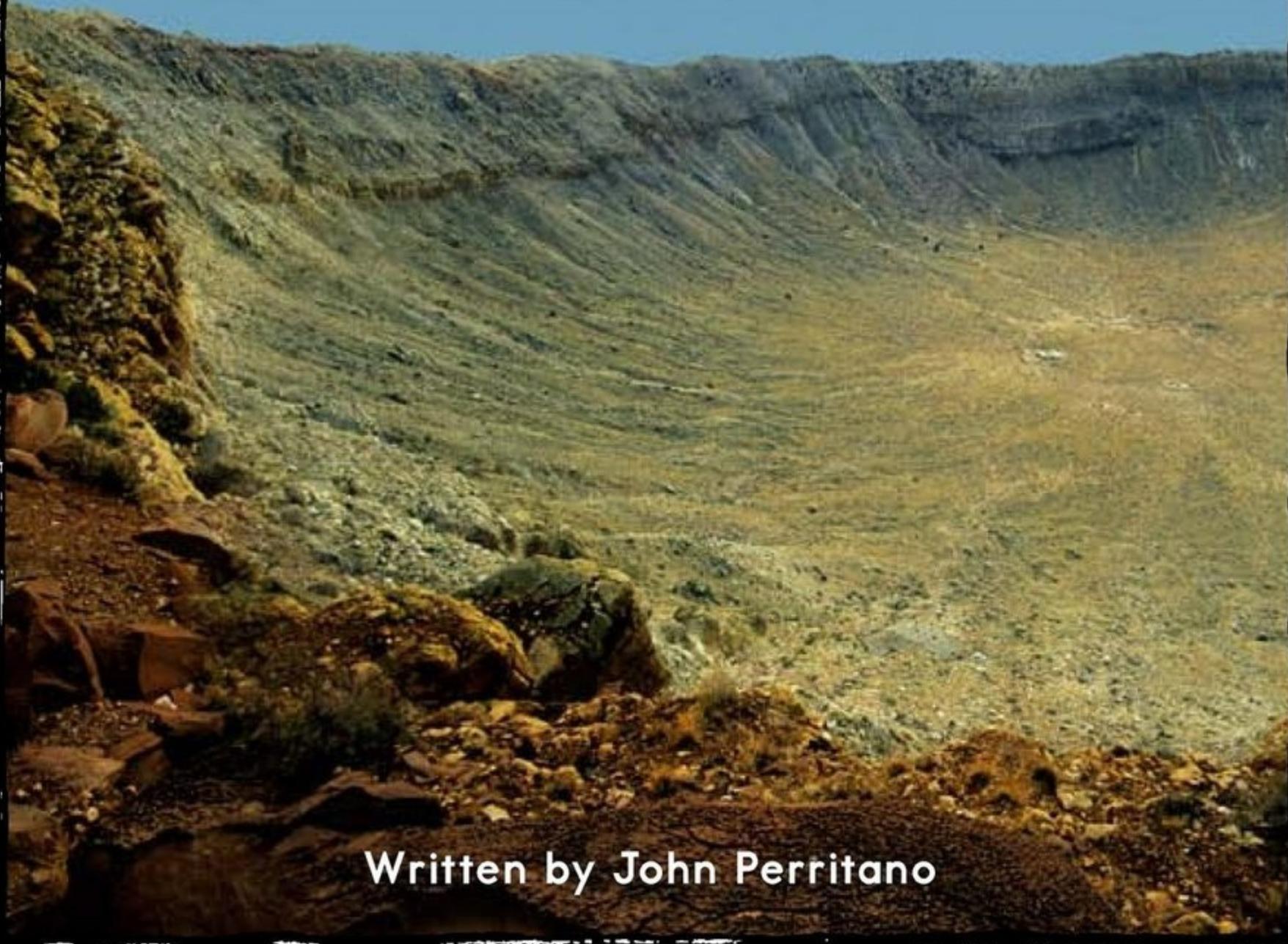


LEVELED BOOK • U

# Meteors and Meteorites



Written by John Perritano

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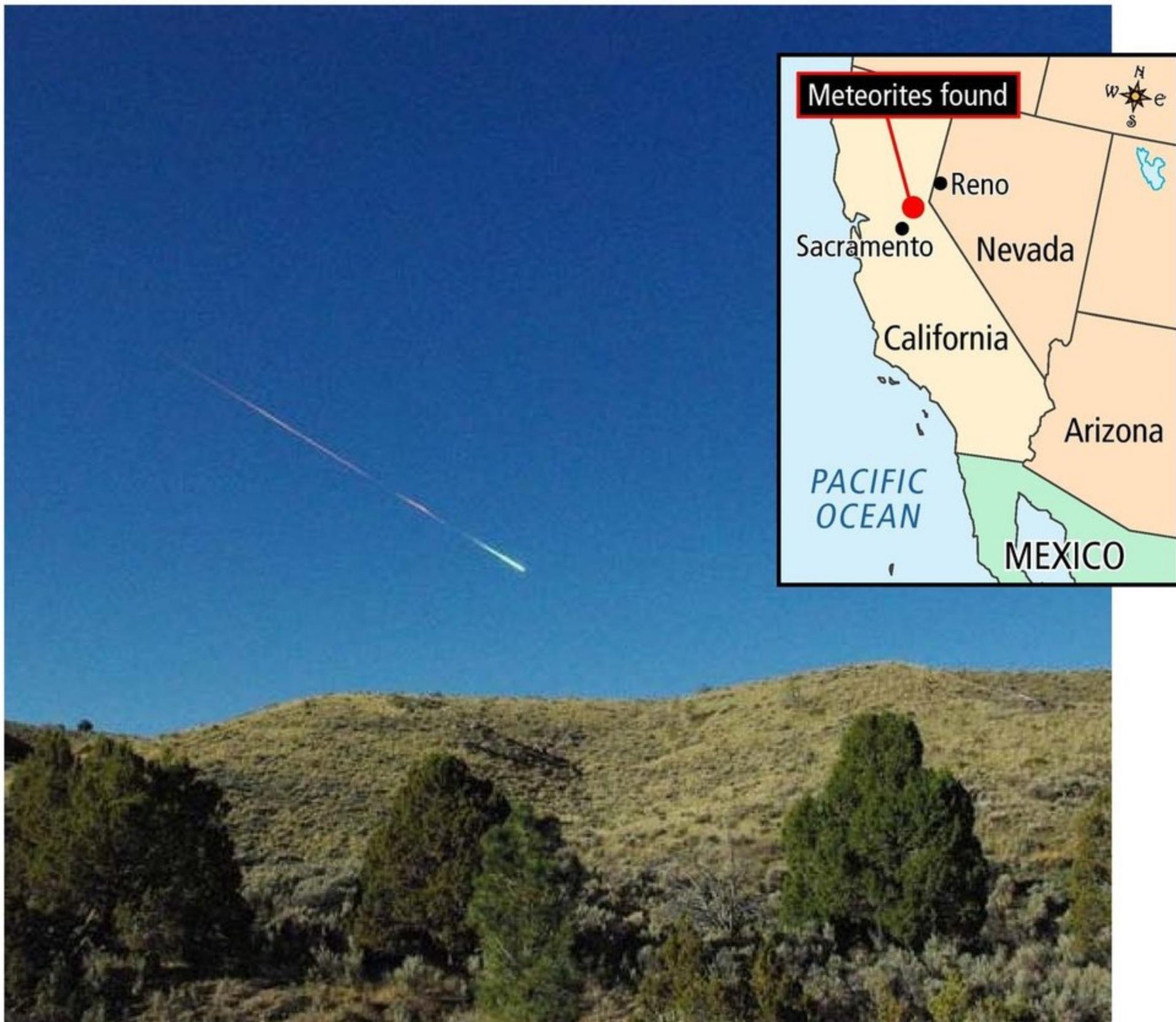
Written by John Perritano



The Hoba Meteorite in Namibia (Africa) is the largest known meteorite that is still in one piece.

## Table of Contents

The Sky Is Falling .....	4
Comets, Asteroids, and Meteoroids .....	6
A Martian Has Landed .....	8
Mighty Meteors .....	9
Fireballs and Micrometeorites.....	11
Meteor Showers.....	13
Space Gold .....	15
Types of Meteorites.....	17
Dying Dinos .....	19
Target Earth? .....	21
Glossary .....	23
Index .....	24



A meteor passes over Reno, Nevada, on the morning of April 22, 2012.

## The Sky Is Falling

The morning of April 22, 2012, began quietly. Suddenly, a ball of fire streaked through the sky over Nevada and California. Hundreds of people on the ground reported seeing the object passing high overhead. Many also heard a loud boom and said that their windows shook. The fast-moving ball of fire shone brightly as it raced through the sunny morning sky. Moments later, the object exploded in the air northeast of Sacramento, California, scattering pieces of itself over a wide area.

The flying object that lit up the sky that morning was a hunk of rock from space—a **meteor**. The meteor broke into pieces over an area of California where the famous gold rush of 1849 began. The minivan-sized meteor’s explosion set off a second gold rush of sorts as thousands of treasure seekers flocked to the area to look for **meteorites**, or pieces of the meteor, worth more than their weight in gold. Many scientists also rushed to the scene, hoping to recover meteorites that might help them learn more about the origins of our **solar system**.

Their efforts soon paid off as scientists and amateurs alike quickly found pieces of the meteor. Tests revealed that the rocks came from a rare kind of meteor that might be 4.5 billion years old—as old as our solar system.



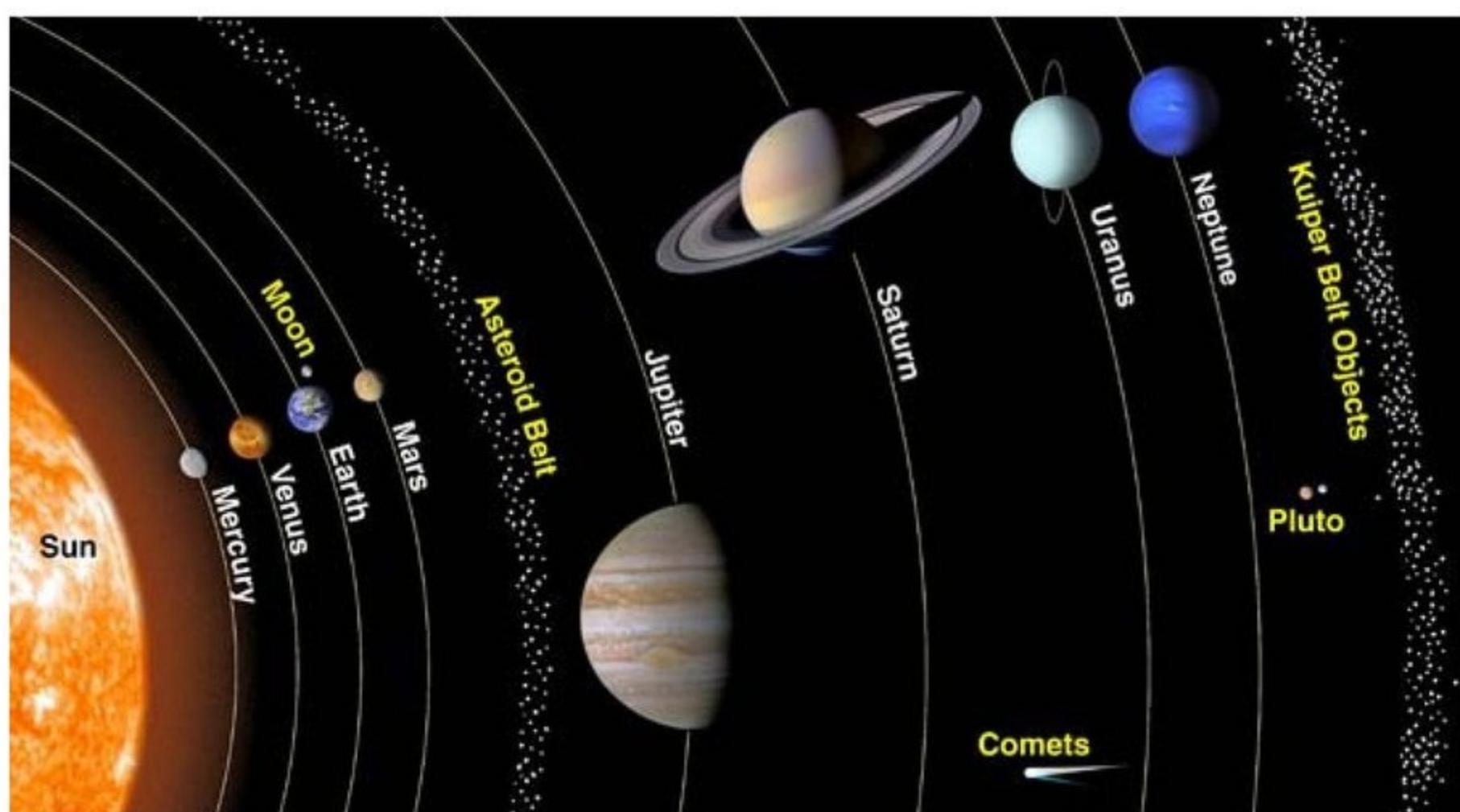
Robert Ward shows two pieces of the California meteor that he found.

## Comets, Asteroids, and Meteoroids

Where did the California meteor come from? Outer space is full of objects left over from the time when the planets in our solar system formed. **Comets**, asteroids, and **meteoroids** are three different kinds of these “leftovers.”

Comets are dirty snowballs. They are huge lumps of dirt and rock mixed in with frozen water and gases. Most comets travel through the Kuiper (KY-per) Belt, an area of our solar system located beyond the planets.

Asteroids are rocks that range from about the size of a school bus to as large as a small moon. Asteroids mainly **orbit** the Sun in the asteroid belt, which is between Mars and Jupiter.



Most of the space rocks that make their way to Earth come from the Asteroid Belt or the Kuiper Belt. Many comets have large orbits that carry them far beyond the planets. (Drawing not to scale.)



An artist's drawing shows an asteroid being broken apart by the gravity of a nearby star.

Meteoroids are rocks much smaller than comets and asteroids. Some are no bigger than a speck of sand. Others are as large as boulders. A meteoroid becomes a meteor when it hits Earth's **atmosphere**. We see meteors as streaks of light racing through the sky—"shooting stars." When a meteor hits Earth's surface, scientists call it a meteorite.

Meteorites are unlike any rocks on Earth. As our solar system originally took shape, bits of asteroids and planets broke apart. The rocks flew through outer space as meteoroids. Some are still crashing into Earth as meteorites. By studying these space rocks, scientists can figure out how our solar system formed. They can also learn how meteorites have changed our planet.

## A Martian Has Landed

In 1984, meteorite hunters found a greenish rock in Antarctica. Scientists were shocked when they studied the stone. This was no ordinary meteorite. Tests showed that the rock, about the size of a potato, came from Mars.

How did a Martian rock land on Earth some 140 million miles (225 million km) away? Scientists believe an asteroid or comet slammed into Mars 15 million years ago. The crash tossed the rock toward Earth, where it arrived only 13 thousand years ago.



Scientists collect a meteorite from the ice in Antarctica.



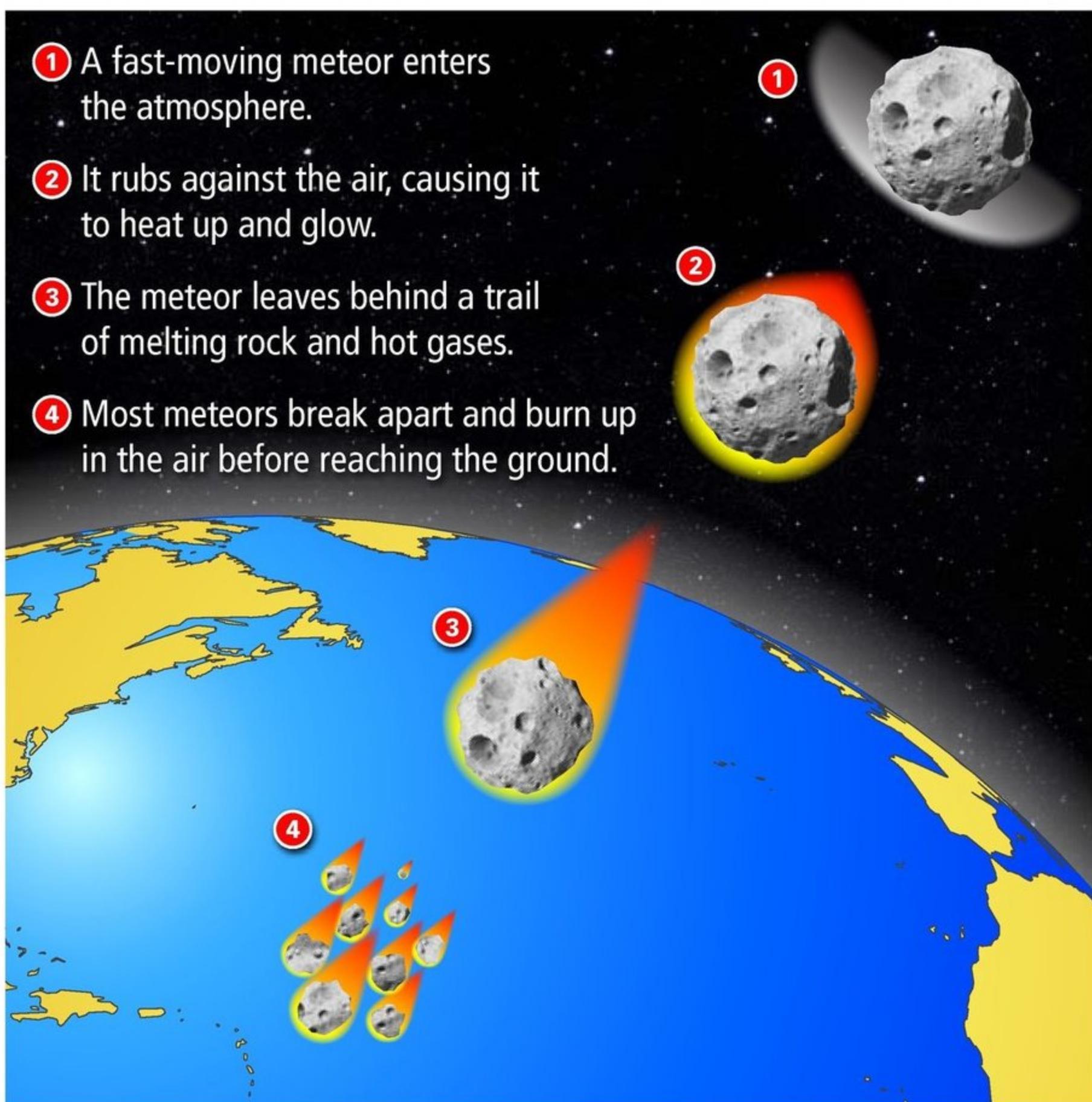
Scientists estimate that there are 300,000 large impact craters on the side of the Moon that faces Earth. Many more are on the Moon's far side.

## Mighty Meteors

When people say they've seen a shooting star, what they really saw was a blazing meteor streaking through Earth's atmosphere. The ancient Greeks believed the flashes of light were weapons of the gods. What they didn't know is that most meteoroids are pieces that have broken away from asteroids. Meteors are chunks of comets and planets.

Meteorites can do a lot of damage. Just gaze up at the Moon to see the evidence. The many circular **craters** on the Moon's surface are the result of millions of strikes by meteors and comets.

Since there is no atmosphere on the Moon, there's nothing to protect its surface from these flying space rocks. Luckily, Earth has an atmosphere that shields our planet. When a meteor **collides** with Earth's atmosphere, the fast-moving rock pushes air out of its way. As air **particles** move past the surface of a meteor at high speed, they cause the meteor to heat up and break into pieces. As those pieces burn up, the meteor glows in brilliant, fiery streaks of light. Then it vanishes as quickly as it appeared.



## Fireballs and Micrometeorites

On February 2, 2012, residents of Amarillo, Texas, heard a loud boom at around 8:00 P.M. When people looked up, they saw a blazing meteor light up the sky.

What people saw was a special type of meteor that scientists call a *fireball*. Because some meteoroids are huge, they grow extremely bright when striking the atmosphere. In fact, some get as bright as the Moon for a short time.



This fireball, seen over California's Mojave Desert in 2009, was caused by a meteor that was once part of a comet.



A U.S. Navy fighter jet breaks the sound barrier, causing water droplets to form clouds in the shape of shock waves.

What was the blast that everyone heard? The fireball was moving faster than the speed of sound, which is roughly 760 miles (1,223 km) per hour. As the object raced through the atmosphere, it shattered the sound barrier. *Kaboom!* The noise that shook Amarillo was a sonic boom. Sonic booms can be low, rumbling sounds or ear-splitting explosions. The noise can shake the ground and even break windows.

Fireballs are rare. Micrometeorites are not. Most of these tiny meteors are smaller than a freckle. Tons of micrometeorites pass through the air and fall to Earth every year.



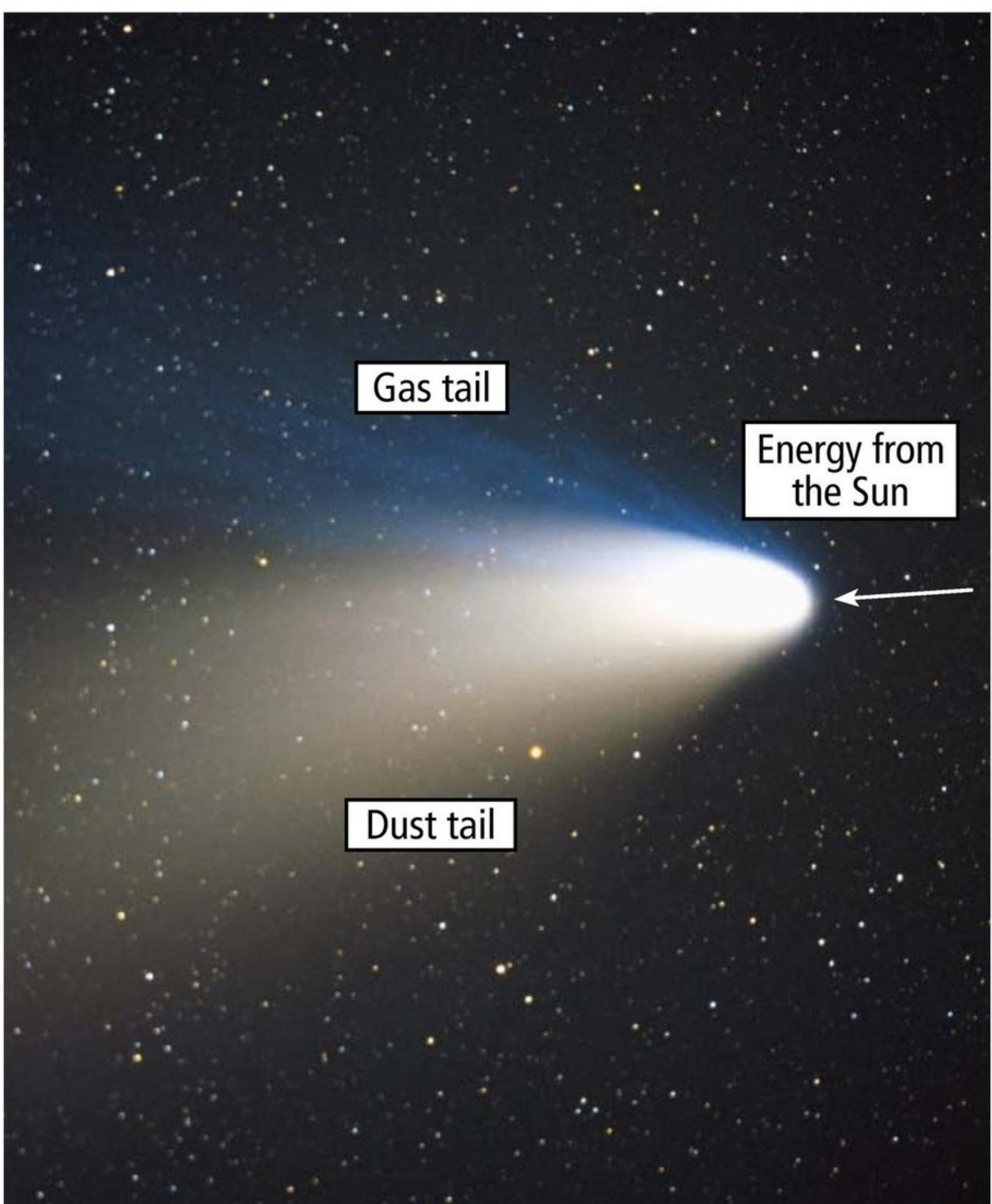
Some meteor showers produce more than one meteor per minute.

## Meteor Showers

What type of shower won't get you wet? A meteor shower, of course! Meteor showers are brief periods of heavy meteor activity. They are fun to watch, and you don't need an umbrella.

Most meteor showers happen at the same time every year. They are often named after the **constellation** in which they seem to appear. For example, every November the Leonid meteor shower appears in the same area of the sky as the constellation Leo. Hundreds, sometimes thousands, of meteors can streak across the sky every hour.

Scientists know when meteor showers will happen because they begin each time Earth passes behind a comet. As the comet closes in on the Sun, it leaves a “tail” of dust and melting ice behind it in space. When Earth passes through the comet’s tail, the dust burns up in the atmosphere, creating a natural fireworks show.



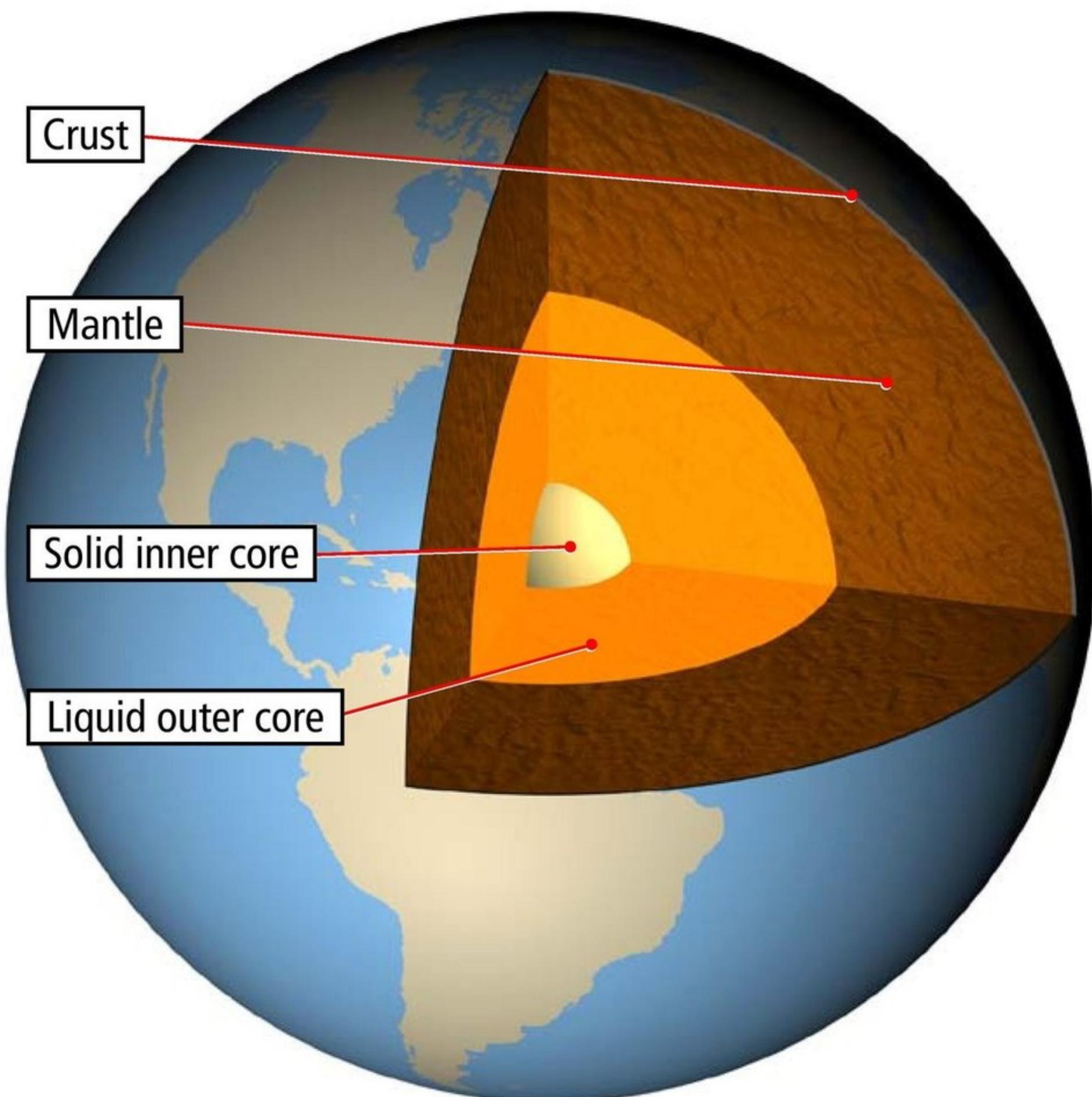
A comet leaves behind a tail of dust and gas as it moves through space.

## Space Gold

Scientists say an ancient meteor shower is the reason gold can be found in the rocks near Earth's surface.

Why do they say that?

When Earth began forming around 4.5 billion years ago, it was a big ball of molten rock. As Earth cooled, iron sank to the center of the planet, forming Earth's core. Some other metals, including gold, sank with the iron.





Did these gold nuggets journey to Earth from space?

If all the gold sank, scientists wondered, where do we find the gold to make watches, bracelets, and other items? About 650 million years after Earth formed, a firestorm of meteorites rained down. That meteor shower forever changed the makeup of Earth's crust. Scientists say that so many meteorites slammed into our planet that if you put them all together, they would weigh about one-fourth as much as Earth's moon. Most of the gold we use for jewelry and coins came from those meteorites.

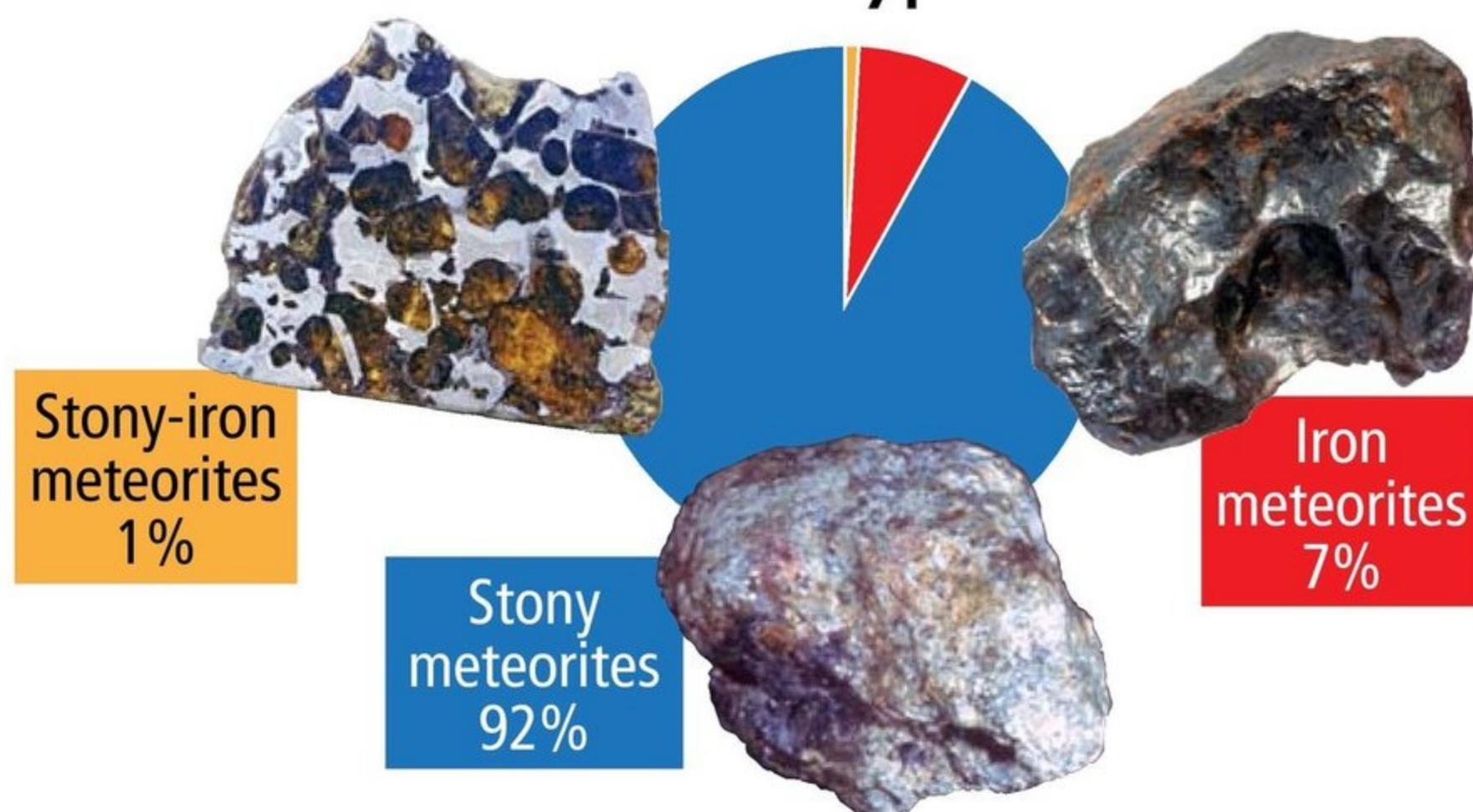
## Types of Meteorites

Meteorites can give us clues as to how our solar system formed. Yet, not all meteorites are the same. Meteorites come in three main types.

Nearly all meteorites are stone. Some stony meteorites come from the Moon or Mars. A few contain small, glassy beads, which formed under high heat at the time the solar system began to form.

Iron meteorites come from the core of a long-vanished asteroid or planet. These meteorites are dark and look as if they are rusting. Iron meteorites are very heavy and sometimes have surfaces that look the way a lump of clay looks after being pressed all over with fingertips. Early humans made tools and weapons out of the iron meteorites they found.

### How Common Is Each Type of Meteorite?





Arizona's Barringer Crater was created by an iron meteorite approximately 50,000 years ago.

Stony-iron are the last type of meteorites. If you find one, you're lucky. Stony-iron meteorites are rare. As their name suggests, these space rocks are a mix of stone and iron.

Meteorite impacts can be devastating. On land, a meteorite strike can create a gigantic explosion and powerful shock waves. Fortunately, the most destructive meteorite impacts happened long ago. Not only does Earth's atmosphere protect the planet, but the pull of the Moon's **gravity** steers some meteoroids away from us.

## Dying Dinos

Scientists say, however, that some 65 million years ago, one very large meteorite got through. At the time, Earth was home to many kinds of dinosaurs.

After the large meteorite struck Earth, the dinosaurs vanished. Earth turned into a wasteland. Although scientists aren't completely sure, they believe a massive meteorite or asteroid strike blasted the dinosaurs into extinction. Scientists say the impact threw huge amounts of dust, gas, and rock into the air. The blast changed Earth's climate, killing almost everything.



The meteorite that most likely caused the extinction of the dinosaurs is thought to have been about 12.4 miles (20 km) wide. That's about 1,770 times the length of a school bus.



Scientists have found a giant meteorite crater on the edge of the Yucatán (yoo-cuh-TAN) Peninsula in Mexico. It may be connected to the extinction of the dinosaurs.

Why do scientists say a meteorite was the cause? One possible answer comes from scientists who study layers of rock on Earth's surface. They noticed that at the same time the dinosaurs disappeared, the amount of iridium (ih-RIH-dee-um) on the planet went up dramatically. Iridium is a metal that is rare on Earth but is common elsewhere in our solar system. The sudden increase of iridium in Earth's rock layers made scientists suspect that a large meteorite slammed into Earth, bringing a huge amount of iridium with it.



This computer-generated image shows how Planetary Resources plans to use a spacecraft to capture an asteroid for mining.

## Asteroid Mining

While some people see giant rocks in space as a threat, others see them as an opportunity. A company called Planetary Resources wants to send spacecraft to mine asteroids in space. According to the company, more than 1,500 asteroids orbit near Earth and could be easily reached using today's technology. Asteroids contain many valuable resources including precious metals and rare minerals. Asteroids may also contain a resource that's particularly valuable in space—water.

## Target Earth?

The chances of another giant meteorite coming our way are slim. In 1908, a meteorite blew apart over the Tunguska River in Siberia. The blast leveled 400 square miles (1,000 sq km) of forest. Had the meteorite struck a city, the destruction would have been massive. However, we shouldn't worry too much. Scientists say chances are that a large meteorite will hit a major city only about once every 10,000 years.



Yet, meteorites continue to fall and always will. If you look up in the sky tonight, you might see a meteor streak across the horizon as it ends its journey through space and time in a blazing show of light.

## Glossary

<b>atmosphere</b> (n.)	a layer of gases surrounding a planet, star, or moon (p. 7)
<b>collides</b> (v.)	impacts something violently or forcefully (p. 10)
<b>comets</b> (n.)	space objects made of ice and dust that develop long, bright tails as they near the star they orbit (p. 6)
<b>constellation</b> (n.)	a group of stars that form a shape and are named (p. 13)
<b>craters</b> (n.)	holes in the ground caused by explosions or impacts (p. 9)
<b>gravity</b> (n.)	the natural force that tends to pull objects toward each other, such as objects pulled toward the center of Earth (p. 18)
<b>meteor</b> (n.)	a meteoroid that burns up after entering Earth's atmosphere, causing a bright streak of light in the sky (p. 5)
<b>meteorites</b> (n.)	a meteoroid that has landed on Earth from outer space (p. 5)
<b>meteoroids</b> (n.)	comets, asteroids, or dust particles in space (p. 6)

<b>orbit</b> ( <i>v.</i> )	to revolve around another object (p. 6)
<b>particles</b> ( <i>n.</i> )	tiny pieces of matter (p. 10)
<b>solar system</b> ( <i>n.</i> )	a group of objects in space that orbit a star (p. 5)

## Index

- Antarctica, 8
- asteroid(s), 6–9, 17, 19, 21  
mining, 21
- Asteroid Belt, 6
- atmosphere, 7, 9–12, 14, 18
- California meteor, 4–6
- comet(s), 6–9, 11, 14
- constellation, 13
- crater(s),
  - Barringer, 18
  - Hoba meteorite, 2
  - Moon, 9
  - Yucatán, 20
- dinosaur extinction, 19, 20
- fireball(s), 11, 12
- gold, 15, 16
- gravity, 7, 18
- iridium, 20
- Kuiper Belt, 6
- Mars, 6, 8, 17
- meteor(s), 2, 4–7, 9–13, 22
- meteor shower(s), 2, 13–16
  - Leonid, 13
- meteorite(s), 2, 3, 5–9, 16–22
  - iron, 17
  - stony, 17
  - stony-iron, 17, 18
- meteoroid(s), 6, 7, 9, 11, 18
- micrometeorite(s), 11, 12
- Moon, 9–11, 16–18
- shooting star(s), 7, 9
- solar system, 5–7, 17, 20
- sonic boom, 12
- sound barrier, 12
- Tunguska River, 21
- Yucatán, 20

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Front cover: A meteor streaks through the night sky over Barringer Crater in Arizona.

Back cover: Computer artwork shows how a meteor shower seems to come from a particular area in the night sky.

Title page: Children sit in the pits on the surface of the Willamette Meteorite in 1939. The meteorite is the largest ever found in North America.

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