

# Martian Meteorites: Fascinating Rocks from Mars!

## What are Martian meteorites?

The Martian meteorites are pieces of the surface of Mars. Each of the Martian meteorites is an igneous rock formed by magma erupted onto or intruded into the surface of Mars. Martian meteorites are ejected from Mars when an asteroid or comet impacts the Martian surface with sufficient energy. Some of these ejected rocks travel for millions of years before they reach the Earth, where they fall to the Earth's surface. Some of the Martian meteorites were discovered as they fell from the sky; most, however, were only discovered many years after they fell. Out of more than 32,000 meteorites in collections around the world, only 44 are Martian in origin.

Mars as viewed by NASA's Hubble Space Telescope



Recent Impact Crater on Mars

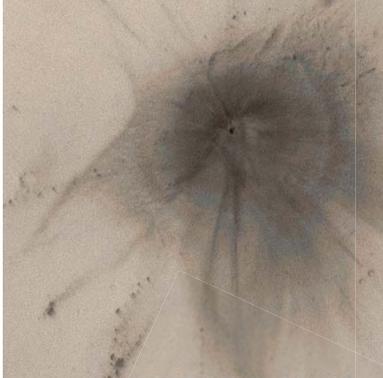


Image Credit: NASA/JPL/MSSS

## How old are the Martian meteorites?

Unlike the meteorites that come from the asteroid belt, most of the Martian meteorites are widely believed to be geologically young (175 million to 1.3 billion years old).

A single Martian meteorite, however, appears to date back to the formation of Mars (~4.5 billion years ago). The meteorites themselves are thought to be ejected from Mars by as many as seven separate impacts over the last 20 million years. Those that were not found immediately sat on Earth from a few thousand to a few hundred thousand years before being found.

## How do we know these meteorites came from Mars?

- 1) The young ages of Martian meteorites imply they come from a planet (not an asteroid) because only planets are large enough to retain their heat to fuel volcanic activity up until a few hundred million years ago.
- 2) Gases trapped in the meteorites match those found in the Martian atmosphere as analyzed by the Viking missions of the 1970's. These gases are a unique "fingerprint" of Mars.

Los Angeles



Photo by D. Ball, ASU

## Why are Martian meteorites important?

- Martian meteorites are the only rocks from Mars that are available for detailed study here on Earth!
- They are crucial to our understanding of the formation and geologic history of Mars. They indicate that Mars has been geologically active throughout most of its history.
- Most of the Martian meteorites show evidence of interaction with water on Mars. They suggest that Mars is generally drier than Earth, but some environments could be suitable for life.

## Life on Mars?

Maybe...

In 1996, a team of scientists proposed that the Martian meteorite ALH 84001 contained fossil-like shapes inside carbonate globules (at right) and other potential biosignatures, suggesting that past life once existed on Mars. After years of intensive study, the scientific community has refuted most of the lines of evidence of biosignatures. The lack of evidence for Martian life in ALH84001 does not mean that Mars as a whole never supported life. Sophisticated instruments on future Martian landers and rovers or samples returned from Mars will be required to settle the question.



Photo by M. Grady, British Museum of Natural History

Carbonate globules (100 microns in diameter) in ALH 84001 thought to hold evidence of past life on Mars.