

Meteorite Exhibition





About the Exhibition

Meteorites

This exhibition presents meteorites from the private collection of Marc Gordon, an amateur astronomer.

Meteorites are objects made of rock or metal that arrived from space to the surface of Earth (or any other planet.) Most meteorites originate in fragments of comets or asteroids, small objects found in the Solar System that vary in size from a single meter up to a diameter of a thousand km.

These objects, while moving in space are referred to as meteoroids. Upon entrance of a meteoroid into the atmosphere of Earth or another planet, it is referred to as a meteor (some refer to meteors as "shooting stars".)

The illuminated trail behind it is a result of the fast entrance into the atmosphere, which creates intense friction, heating up and burning. Meteoroids that hit the ground are named "Meteorites".

Meteorites are classified by the substances they are made of they are normally divided into three main groups:

- **Stony meteorites**
- **Stony-iron meteorites**
- **Iron meteorites**

Most meteorites found on Earth's surface (over 80%) are Chondrites, of the stony meteorite





group. The Chondrites are meteorites that originated in early asteroids. They are made of rock and contain spherical grains named Chondrules.

Another group of stony meteorites is the Achondrite group - stony meteorites that do not contain Chondrules. It is estimated that no more than 8% of the meteorites found on Earth's surface are Achondrites. This group includes meteorites that arrived from the Moon and Mars.

Stony-Iron meteorites are those with an almost equal content of Iron and Silicates. This is a rather rare group of meteorites, which is divided into two sub-groups: Mesosiderite and Pallasites. The Pallasites are meteorites in which the silicates are embedded into the Iron (mainly Olivine) and the Mesosiderites are meteorites that were consolidated with local rocks in a process referred to as Breccia.

Iron meteorites are those with a high concentration of iron and nickel compounds. The Iron in these meteorites originates in asteroids from the earliest days of the Solar System, some five billion years ago.

In slices taken from iron meteorites, we can observe symmetrical patterns named Widmanstätten patterns. These symmetrical patterns are a result of iron-nickel solidification and can be found in iron meteorites and stony-iron meteorites (Pallasites.)





A short biography of Marc Gordon

Marc Gordon was born in Chicago on August 10, 1951. He graduated his high school studies in Los Angeles in 1969, and between 1970 and 1971 he studied astronomy in UCLA.

From 1971 to 1975 he studied at the Newark School of Engineering in New Jersey, and for a few years after graduation, taught courses at the Hayden Planetarium in New York, one of the world's most famous astronomy centers.

In 1978, Marc returned to Los Angeles and began working in the Griffith Observatory. At first, he worked selling books at the observatory's shop and after three months, he was given a position of general inspector in the observatory. As part of his work as the observatory's general inspector, he taught NASA astronauts the astronomy that was needed prior to their departure for missions on space shuttles.

In addition, he was the first person to meet with the astronauts for debriefing, after their landing in the Mojave Desert landing site. During this time, he got a few meteorites from a colleague who was a meteorite collector himself, thus the idea to begin a collection was born.

In 1983 he made Aliyah and served as a veterinarian's assistant in Kibbutz Shomrat in the Western Galilee. In 2003, Marc moved to Jerusalem where he met his wife, Malka.

Marc is a member of the Israeli Astronomical Association and for years he has been a member of the American Meteor Association and The Astronomical League.



1

Chondrites from Western Sahara

These are chondrites with a low iron content that were found in the Western Sahara. So far, 290 meteorites were discovered in the area, many of them are varied chondrites. In the one before us, the outer layer may be darker from the intense heat upon entry into the atmosphere. When taking a closer look, iron shards and rounded chondrules can be seen.

2-6

Items and artifacts that were engraved out of a meteorite from Aletai, China

This meteorite was discovered in 1888 in Aletai province in North China, close to its border with Mongolia. This is an iron meteorite with an overall mass of about 74 tons. It is unclear when the meteorite fell to Earth, but it is known that it did not fall directly, but skipped on the atmosphere until it finally crumbled in a similar way to skipping a pebble over a deep pond. In the course of these skips that stretched over more than 400 kms, pieces of the meteorite broke off and fell onto various places over the land.

The putative assessment is that the meteorite fell during the last 2.58 million years.

Items 2 to 5 were carved, following Marc's request, from pieces of the meteorite: a fish skeleton, the "Ten Commandments", an axe and a dagger.

The dagger is a copy of the one found in the tomb of Tutankhamen, an Egyptian Pharaoh from the 14th century BCE. The original dagger was forged from iron originating in an ancient meteorite.

Items number 6 are pieces that were sliced off a larger chunk of the meteorite. In these slices, we can observe Widmanstätten patterns.



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Pieces of the Sericho meteorite in Kenya

This meteorite is a Pallasite. It was discovered in 2016 by two brothers who were looking for their camel herd in the sand dunes of Sericho in Isiolo County in East Kenya.

Since then, locals keep finding chunks of different sizes from the meteorite. At this point, the estimation of the meteorite's mass is approximately 2,800 kg. This meteorite contains Olivine, a group of minerals rich in magnesium and iron, colored green or orange.

Apparently, the meteorite originates from a shell of a rocky planet that was located between Jupiter and Mars. Another possibility is that this was an asteroid that was large enough to develop an internal structure constituting a rocky shell and a metallic core.

8-11

Tektites, Moldavites

The Tektites and Moldavites are shards of glass naturally formed by melting sand after meteors explode in the air. Number 8, the Tektites, also referred to as "Libyan Desert Glass". They originate from sand in rocky area; hence they are black.

The Moldavites originate from sandy areas and their colors are determined by the composition of substances in the sand. Items No. 9 were found in the area of the Czech Republic, item No. 10 was found in China and item No. 11 was discovered in Russia.



12-13

Diablo Canyon in Arizona

The fragments before you are remnants of an octahedrite iron meteorite with an evaluated mass of thirty tons, which fell on Earth some 50,000 years ago. Its fall left a colossal crater at the center of present-day Arizona. Most of the meteorite got vaporized due to the impact, but a few remnants were left around the crater. Only in 1891, was it conjectured that the crater might be a result of an impact of a meteorite. Since then to this very day, remnants of the meteorite keep being discovered within the crater. The items before you were gathered in 1978, by Marc Gordon, the collection's owner.

Item No. 13 is a (reduced) model of the Barringer or meteor crater. The diameter of this crater is 1.2 km and it is 180-meter deep.

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Iron meteorites

Campo del Cielo (Field of sky), Argentina

The meteorites here are iron meteorites, siderites, that were found in Argentina, about a thousand km northwest of Buenos Aires. The first items were discovered in 1576. The Spanish name is a translation from the language of the indigenous people who told that the iron chunks in the area fell from the sky.

The entire area has 26 craters of different sizes, resulting from the meteorite exploding mid-air into smaller fragments.

Researchers estimate that the meteorite's original mass was approximately 50 tons. Carbon dating tests reveal that the meteorite fell 4,200 to 4,700 years ago (between 2,200 to 2,700 BCE.). Its age is estimated at 4.5 billion years, placing the creation of this meteorite at the same time our Solar System was formed.



15

Nantan Meteorite, China

This nickel-rich iron meteorite was discovered in 1958. Some believe that this is a meteorite that was recorded falling in 1516, but scientists find it hard to establish a connection between the remnants that were found and the recorded event. This meteorite exploded mid-air and its remnants got scattered over an area 28 km long and 8 km wide around the Chinese city of Nantan.

The full meteorite's mass is approximately 9.5 tons.

16-17

Breccia

The items on this shelf are rocks that are referred to as Breccia, a rock that is formed from fractures of minerals or rocks that underwent a process of consolidation as a result of a traumatic event.

The origins of the items under the number 16 is the moon. A meteorite hitting the moon's surface caused rocks and soil from the moon to detach from its surface. Since the moon's escape velocity, (namely the velocity an object requires to exit the moon's gravity) is just 2.38 km per second, the fragments that were thrown off due to the meteorite's impact on the moon got chucked into space, got caught in Earth's gravity and were thrown forcefully at its surface. This throwing led to formation of breccia, consolidation of the moon's rock fragments and minerals with Earth's rocks and minerals.

Item 17 is breccia that was generated as a result of a meteorite hitting Earth.



18

Meteorite from Mars, Amgala, Western Sahara

Item 18 is the the most recent meteorite in the collection. It was discovered in 2022, and only on July 2023 it was approved as a meteorite by the Meteoritical Society. The meteorite comes from planet Mars and it is scientifically classified as Shergottite. Estimations are that Shergottites were crystalized not before 180 million years ago. The complete meteorite's mass was about 34.67 kg and it contained rare olivine compounds. As for the present, there hadn't been researches to estimate the age of this meteorite.

19

Fragments from the Chelyabinsk Meteorite, Russia

On February 15 2013, a big fireball was observed over the Chelyabinsk, Tyumen, Kurgan and Yekaterinburg Oblasts in the Ural Mountains area located at the center of the Russian Federation.

The fireball entered the Earth's atmosphere at an immense velocity of 65,000 km/h and exploded while in flight over the town of Chelyabinsk. As a result of the explosion, many windows were shattered in Chelyabinsk and nearby towns and hundreds of people were injured by the blast. Multiple meteorite fragments fell in the area, ranging from shards to chunks weighing over a hundred kg. The meteorite was a Chondrite at a diameter of almost 19 meters and weighed over 12 tons.



20

A fossil Chondrite from Algiers

The chondrite, NWA 2965 was discovered in the Algerian desert in 2005. Its estimated weight was around 3 tons, and its fragments are spread across the regions of Algeria, Morocco, and Western Sahara. Its uniqueness is not visible to the naked eye and was revealed through precise laboratory tests. These tests confirmed that the components of this meteorite have not undergone the expected geological processes found in chondrites with similar characteristics. In other words, it is a pristine meteorite that preserves very ancient characteristics. Most likely, this meteorite fell to Earth approximately 23,000 years ago.

21

The meteorite from Abu Moharek, Egypt

This small Chondrite is distinctive by being the only one to be found (relatively) close to the Israel. The meteorite was found in the area of Abu Moharek, some hundred km west of the Nile in 1997. The full meteorite's mass is approximated at 4.5 kg.

Marc Gordon, the collection's owner, ordered this meteorite especially for this exhibition.



22

The meteorite from Fukang, China

This meteorite was found in the year 2000 in the town of Fukang, China. It is a pallasite (a stony-iron meteorite) that contains large quantities of the mineral olivine. Its estimated weight was one ton.

23

The Muonionalusta meteorite (Finland - Sweden)

This is one of the oldest meteorites to have ever been found on the Earth's surface. The meteorite's name is derived from the name of the place where it landed some 800,000 years ago, south of the nowadays village of Muonio, located on the border between Finland and Sweden.

This is a 230-kg mass iron meteorite that also contains Nickel and three elements that are rare on Earth: Germanium, Iridium and Gallium.

24

North Africa

Mesosiderite from north Africa

This item, number NWA 14867, is a Mesosiderite, that was bought from a meteorite dealer in January 2022. Mesosiderites are iron-stone meteorites that became Breccia. This item is composed of about 60% silicate and 40% metallic portions. The estimated mass of the meteorite was 1530 grams.



25

Agoudal, Morocco

This is an iron meteorite that was found in Morocco between the villages of Agoudal and Imilchill in the Atlas Mountains in the year 2000. The estimation of the meteorite's overall mass is approximately 100 kg.

During the scanning of the area, a large chunk of 60 kg was found with hundreds of small fragments that were scattered over an extensive area.

26

Gebel Kamil, Egypt

A nickel-rich iron meteorite that was found in the Kamil crater in Egypt on its border with Sudan. The Kamil crater is an impact crater that was discovered in 2008 by a team of Italian and Egyptian researchers. Fragments of the meteorite kept being discovered for the next couple of years and its overall mass is estimated at 1,600 kg. This meteorite seems to have hit Earth approximately 5,000 years ago.

27

A chondrite from Morocco

NWA 1958 is a low-iron content chondrite found in Morocco in 2003. Its estimated total weight was 244 grams.